**Thesis for the Degree of Doctor of Medicine**

# Is there a Need for a Standardized Thesaurus of Terms in Anaesthesia ? Can Such a Thesaurus be Created, and Introduced into the National Health Service ?

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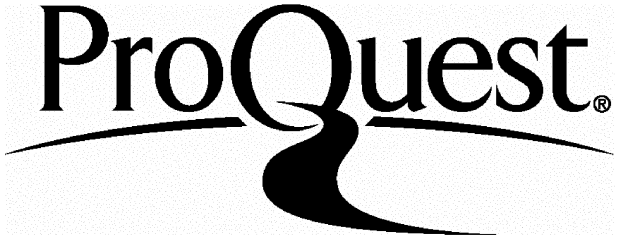

**Abstract**

Health care can be provided more efficiently if clinical and administrative decisions can be made easily. Good quality, accurate information is essential as a basis for these decisions. This applies throughout the National Health Service, and specifically to the specialty of anaesthesia. The thesis illustrates the instances in the Health Service, and in anaesthesia, where accurate data are required.

If information is collected in the form of a common language,then it is more readily understood. The aim of the thesis is to assess the need for a common, or standard language for anaesthesia, whether such a language can be written, and then to examine the means for introducing the language into the National Health Service, after suitable testing.

If the standard language can be used by computers, the language can be written in the form of terms. The use of computers also allows the development of a coding system for the terms. A review of existing classifications and nomenclatures demonstrates that there is no existing standard thesaurus of terms suitable for anaesthesia, and so one needs to be created.

The way in which terms can be used to express relevant concepts in anaesthesia is discussed. The style in which terms need to be written for easy use, and the ways in which terms can be used to express grammatical idioms, and add contextual information is reviewed. The required content of such a thesaurus of terms, such as terms for procedures, history and examination terms, measurements and the like is examined.

Once assembled, the thesaurus needs to be checked and tested. The means of quality assurance already used are reviewed, and methods for further examination

of terms are suggested. The ways of introducing and using the terms within the National Health Service are illustrated.

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The terms given as examples in Section 4 are the property of the Anaesthetic Working Group, and have been reproduced by permission of Dr. R. Tackley.

**Statement of Contribution**

This thesis draws upon the work done by the author whilst in the post of Research Worker to the Anaesthetic Specialty Working Group (SWG), Clinical Terms Project. This project was organised by the NHS Centre for Coding and Classification, part of the NHS Executive. The author was involved in the creation of terms by the SWG by writing the terms, and co-ordinating the work of the SWG with similar groups from other medical specialties. The terms discussed in Section 2 of the thesis, and illustrated in Section 4, were written primarily by the author, supervised by the chairman of the Anaesthetic SWG, Dr. R. Tackley. Terms written were commented on by the SWG before submission to the NHS Centre for Coding and Classification.

The collective body of the Clinical Terms Project, the User Forum, agreed that the main authors of terms from each SWG should be credited with the authorship of the terms. Although the terms collected in the Clinical Terms Project have only been released in an electronic format, the User Forum and the Anaesthetic SWG agreed that the citation for terms submitted on behalf of the Anaesthetic SWG should read as follows:

Banks IC, Tackley RM. Anaesthetic chapter. In: *Read Clinical Classification*, Version 3. Loughborough, NHS Centre for Coding and Classification, 1995.

A review of standard classifications and nomenclatures has failed to reveal any significant standardized terminology for anaesthesia. The work of the author represents the only published thesaurus of terms for use in the specialty of

anaesthesia. These terms, as part of the Clinical Terms Project, can therefore be considered as original work.

This thesis highlights the need for a standardized thesaurus of terms in anaesthesia. As there is previously a lack of such a thesaurus, the author considers that the thesaurus of terms written for the Clinical Terms Project to be an original contribution to the specialty of anaesthesia.

**Is There a Need for a Standardized Thesaurus of Terms in Anaesthesia ?**

**Can Such a Thesarus be Created, and Introduced into the National Health Service ?**

## Introduction

The use of information technology has been growing over a number of years in many organizations. The National Health Service (NHS) is no exception. The NHS has a separate group, the Information Management Group which controls information technology and management. This group is part of the NHS Executive.

The acceleration in the growth of information technology has resulted from the increased use of computers. The increasing capacities of the computer world, and the ease with which a computer can perform large and complicated tasks now means that computers are a standard tool in the management and administration of businesses and organizations. The NHS, being a large but diffuse organization could benefit from more of its administrative tasks being performed by a computer system.

As is often pointed out, the NHS is primarily concerned with the care of patients; the management aspects of the NHS do not always sit easily with the clinical side. It would surely be of benefit to everyone concerned with the NHS if clinical work and management could be integrated more effectively. It has been suggested that information technology may assist in this matter.

Computers can perform large tasks quickly, and can store great quantities of information. If a computer-based system can be devised to handle the needs of both clinicians and management staff, then some headway may be made in improving the efficiency and ease of performing tasks in the NHS. To create a common computer system to be used by such a large group of

people, each with different ideas and each with emphasis on different aspects of their work would be no small task.

The specialty of anaesthesia would need to be included in the creation of such a system. In some ways, anaesthesia may be considered an ideal specialty for such a computer system. Anaesthetists collect data on every patient they anaesthetize, and record this data as an anaesthetic record. Much of this data is collected by machines such as pulse oximeters, or gas analysers, and in technical terms, it becomes easier for a computer to collect this information automatically. Many, but by no means all, anaesthetists are technically-minded, and adapt well to the use of new machines and equipment.

To enable a NHS computer system to be of use to all, communication of facts, ideas, and concepts has to be achieved. Communication depends upon a reliable means of sending the information, and the successful interpretation of the information that has been sent. We achieve this intuitively in every day life through speech, writing, or gestures. For these methods of communication to be of use, the sender of the information, and the recipient, need to have some sort of *common language*. The written and spoken languages that we use have evolved over centuries, and can express thousands of ideas. These languages can be used very subtly, and different meanings can result using the same words by using expression, inflection and emphasis.

The purpose of this thesis is to examine whether or not a common or standard language can be developed for anaesthetists, and to see if it would be of use. This language would need to be able to at least match, and hopefully improve upon the present methods of information recording and transfer.

An additional aim of the thesis is to discuss the practicalities of the use of such a language. A

language on its own is no use: it needs a suitable vehicle. This vehicle will need to be easy to use, for it will have to compete with speech, and paper and pen. The potential users of such a language are busy people, whose prime responsibilty is to the patients in their care, not to a computer system.

The thesis is arranged in five parts. The first part is concerned primarily with the review of the present methods of recording information by anaesthetists, whether there are shortcomings with these methods, and the implications of using these methods. The second part of the thesis examines the possibilty of creating a standard language, based around the use of "terms". The third section of the thesis examines the means whereby a standard language can be presented to anaesthetists in a universally acceptable form. The next section, Section 4, gives examples of terms written according to methods proposed in the second section. Finally, the fifth section is the conclusion to the thesis.

# Section 1

## Evaluation of the Need for a Standard Set of Terms for Anaesthesia

## Section 1: Evaluation of the Need for a Standard Set of Terms for Anaesthesia

The aim of this section of the thesis is to examine whether a standard set of terms would be of use to the specialty of anaesthesia. The existing methods of recording information are reviewed.

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## Section 1:1

### The Role of Information Technology within the National Health Service

The moving force behind the increase in information technology in the National Health Service (NHS) was identified by the Chief Executive of the NHS in 1992 as a demand for "improved quality (of patient care), greater volume of service and more effective use of resources" [1]. Information services are expected to help meet these demands by helping to improve care, and increase efficiency. These information systems will be electronic in nature i.e. in the form of computers. If this improved quality of patient care could be achieved, it would be no mean feat. The NHS Executive, (formerly the NHS Management Executive) has put forward the Information Management and Technology (IM&T) Strategy to oversee the efforts towards these goals.

The NHS Executive, in its booklet, "IM&T Strategy Overview" [2] gives the reasoning behind this strategy by suggesting that there will be:

a) Benefits to patients and populations by: supporting seamless care; mimimising the number of investigative procedures; allowing the better distribution of funds, and improving information regarding waiting times for patients.

b) Benefits to clinical staff by: improving the quality and availability of information; easing the transfer of information between primary, secondary and tertiary health care sites, and allowing more effective distribution of funds necessary for clinical work.

c) Benefits to management and administration by increasing the availability of reliable information upon which decisions can be made regarding the quality and quantity of services provided. It will also become easier to assess the training required to support these services.

It would seem then that the driving force behind the increased use of information technology is to improve patient care, via management and clinicians. Increased efficiency can result from having more and / or better quality information available. This strategy is therefore based upon *information*.

Information is defined by the dictionary as follows: "knowledge of specific or timely events or situations" [3]. It is collected in some form, and then either analysed, stored and possibly later retrieved, or discarded. It can take many forms; for example as words, letters, numbers, shapes, codes, colours, or sounds. For clinical purposes, information comes from sources such as history, examination, and measurements and investigations. It is usually transferred as spoken or written words, or numbers; people tend to be more familiar with words, but computers can handle numbers more readily than the human mind. [See under "Coding", Section 1:3]

At the heart of the IM&T Strategy is the improved use of information. This will not be possible if the information that is collected cannot not be understood by the person charged with interpreting the information and then making decisions based on the information received. It is clear that the information must be in a format which the recipient can understand. As there are many senders and many recipients of information in an organisation as large as the NHS, it would be of great help if all information was in the same format; i.e. in the form of a *common language*.

Thus a common language would be of benefit to the transfer of information. Can this common language then be accepted as a standard language? The answer will depend on whether the language is written in an acceptable form, whether the content is correct, and whether the language can do the job required of it. At this point it is worth examining the uses of a common or standard language.

The NHS is a vast and complex organisation. It is required to administer the health care to a population greater than 56 million people. To function, it needs to be able to manage not only patient care and all that entails, but also to administer its personnel, its buildings and the purchases which are made on its behalf. This problem is compounded by the fact that the NHS is spread out geographically across the whole of the United Kingdom. The co-ordination of all these facets of the NHS requires data to be obtained from a multitude of sources, and the total amount of information that can be obtained is enormous. Computers, if used correctly, can store, analyse and retrieve enormous amounts of data.

What are the uses of this data?

1. Transfer of information

If information is collected in a standard format, it becomes much simpler to transfer information within hospitals, between hospitals, and to sites of primary health care. The recipient of the information will be able to use the information more readily, as the language in which the information is written will be recognisable.

2. Clinical review

Audit requires the retrospective review of clinical practice, and the data collected needs to be of good quality in order to make valid judgements. The same applies to cases used for teaching purposes.

3. Research

Whether for retrospective or prospective research, no valid conclusions can be reached unless there is sufficient accurate data.

4. Workload planning

This can apply to either matching staffing levels to workload, or workload to staffing levels. Casemix management systems are computer programs which allow analysis of hospital workload by clinical specialty, their case load and type. They help check the use of resources, and can be used to predict any changes in workload. The NHS Executive has a National Casemix Office to administer these systems.

5. Finance

Accurate control of finances is required, as the NHS has a finite budget derived from taxpayers. Information is required to be able to manage these funds properly.

6. Central returns

In response to a report from a Department of Health and Social Security steering group [4], chaired by Mrs. Edith Körner, returns are submitted by hospitals, as "Körner returns", to the Office of Population Censuses and Surveys, in London. Information regarding the reason for a patient's admission to hospital (e.g. diagnosis), and any operative procedures carried out are sent in these returns. Their purpose is to improve the information available for health service management. They are used to look at the prevalence and incidence of disease, and information about the number of operative procedures is collated.

The data collected therefore have many essential uses. Will having a standard language for information help? Given that there are a great number of sources of information in the NHS, data can only be used easily and accurately if it can be readily understood. This process can be much simplified if a common, recognisable language is used. If the information is also in electronic form, then its collation, transfer, retrieval and analysis will be simplified. The NHS will function more efficiently if good quality information is available, ready for use. A standard language is therefore *essential*. This language needs to be written in a fashion which can be of use in all the above situations, and it needs to be comprehensive in its content.

## 1:2 The application of a standard language to anaesthesia

The uses of information and data within the specialty of anaesthesia need now to be examined. Anaesthetists record their activities in the patient's notes e.g. the pre-operative assessment, or on special forms (anaesthetic record sheets). The information recorded is a mixture of history and examination findings, recordings of procedures, measurements and incidents, and instructions to others. (These are examined in more detail in Section 2:8) How can all this information, collected routinely, be used?

1. A record of the anaesthetic

The primary reason for recording is to provide a record of the anaesthetist's treatment of the patient. It also aids the anaesthetist in his management of the patient, as it charts trends in physiological parameters. This record may or may not be reviewed at a later stage, but a record is deemed to be a common law requirement [5]. In the immediate post-operative period, the anaesthetic record can give instructions for further treatment of the patient. It also gives an

anaesthetist, who may be required to anaesthetise the patient on a subsequent occasion, some idea as to the behaviour of the patient under an anaesthetic, and of any potential problems. It will permit the second anaesthetist to know which drugs have been used in the first anaesthetic, and to avoid the problems of the repeated use of certain drugs.

There is no standardization of anaesthetic record, although "minimum datasets" have been recommended, and these data sets form the basis for consideration of the content of a future standardized record sheet [6,7]. These datasets are constucted in a way that information necessary for reviewing anaesthetic activity is included, and that the information is recorded in a standard fashion to aid this review. The dataset recommended by Lack, Stuart-Taylor and Tecklenburg [7] requires information to be recorded concerning patient details, the time and place of the operation, the operation itself, the anaesthetist and surgeon concerned with the operation, and any critical incidents that may have occurred during the anaesthetic.

2. Clinical review

Difficult cases, along with complications and critical incidents of anaesthesia, can be reviewed. They can be used for teaching purposes and discussion. Review of complications and incidents can be used to highlight shortcomings in departments, which can then be corrected. This forms part of clinical audit, which is now compulsory in hospitals.

3. Trainee supervision

If information about the activities of trainee anaesthetists can be easily collated, then deficiencies in training can be detected more readily. Improved data collection sytems may assist the trainee anaesthetist in the collation of their Royal College of Anaesthetists' Logbook. Compliance with recording in logbooks is at

present variable, but computer logging systems produced a better response rate when used by trainees [8].

4. Research

The collection of accurate information is essential for good quality research. As much of the research in the field of anaesthesia is based on measurements, then standardized recording of this information would be beneficial.

5. Management of anaesthetic departments

The recent changes in the structure of the NHS have created a more "business-like" approach to the management of anaesthetic departments, and to the formation of Clinical Directorates. Anaesthetic departments are now cast in the role of "providers" in that they now provide anaesthetic services to departments of surgery, radiology, cardiology, dentistry and intensive care, at a cost, and also act as "purchasers" of equipment, drugs etc. Within the department, management also involves the optimal use of staff to cover service and training commitments whilst at the same time maintaining good clinical care. Departments have large budgets for which clinical directors are responsible, and it is in the best interests of anaesthetists that these budgets are well managed, in order to maintain adequate freedom of practice. Lack, in an editorial in *Anaesthesia* [9] has outlined the increased "need for information systems to support the new culture (of controlling health care delivery)". He also points out the need for anaesthetic departments to collect and control this data themselves, so that an accurate picture of clinical practice can be made through clinical audit.

Data collected by anaesthetists during the course of their work can be of use then not only to the anaesthetists themselves, but also to the management of the anaesthetic department and the hospital itself. If the information is collected, analysed and stored in a common format or language, then the task of reviewing

the information is much simpler, and better decisions are likely if an accurate picture can be presented to those making the decisions.

6. Central returns

As mentioned above hospitals submit information about their activity to a central source. Data submitted are based upon the Office of Population Censuses and Surveys Tabular List of the Classification of Surgical Operations and Procedures, 4th Revision (OPCS-4) [10], and the International Classification of Diseases (ICD-9)[11]. As will be seen later, these classifications do not contain much detail about anaesthestic practice, and so there is minimal information submitted about anaesthetic-related activity. These central returns are used in the assessment of Governmental health policies, and in planning future changes in the NHS. As Tackley points out [12], the paucity of information relating to anaesthesia does not help the specialty, as there is a danger of exclusion from centrally-based planning decisions.

7. Information transfer

It would be an advantage to be able to transfer information between hospitals. There are occasions when a patient will disclose that a previous anaesthetic at another hospital was problematical, but may not be able to give more information than that. The previous hospital may be able to send a copy of the notes in some form. This process could be enhanced if the information was sent electronically, and the interpretation of the information improved, especially if a common language was used between the two sites.

It can be seen that there are a number of ways in which the collection, storage, transfer and analysis of information can be of use to the NHS, and to anaesthetists in particular. This process would be enhanced by the use of a common language,

and this enhancement would apply to both handwritten and electronic records. Doctors, including anaesthetists, tend to write in *note* form for speed and, hopefully clarity. (The way in which anaesthetists record their data at present is reviewed later in section 1:5.) This is an accepted method of writing, which is taught at medical schools. As a result, a standard language, to be of greatest use, must be compatible with this form of writing. (Anaesthetists do have a common language of sorts, as an anaesthetic record written by one anaesthetist can *usually* be understood by another. However, this is not always the case.) Hence, a standard language may better be thought of as a collection of note-like *terms*, rather than being prose-like in its syntax. This step from prose to note-like terms is important in the construction of a standard language, and it is upon this premise that the methods for building the standard language, outlined in section 2, are based.

## 1:3 The Coding of a Standard Language

Tackley, Stuart-Taylor and Hurrell have reported upon the desirability for anaesthetists to have electronic data collection systems available, and suggest that the information contained in these systems is stored in coded fashion [13]. They put forward the following reasons why information should be stored as codes:

1. Computers can recognise codes more readily than words ("text-strings"), which may be misspelt, abbreviated incorrectly, or written using the wrong mixture of upper and lower case letters.

2. Codes are more compact and take up less storage space on a computer than words. Codes are not bound by spelling rules as words are, and so all combinations of letters and numbers can be used in a code. Hence a code of five

numbers (using digits 0 - 9) and letters (24 upper and 24 lower case, not using "i/I" and "o/O" which can be confused with "one" and "zero") can have $5^{58}$ possible values. This is far greater than the number of recognisable words with 5 or fewer letters which are available.

3. Codes, if of fixed length, can be computed faster than understandable word sequences, as word sequences or sentences are usually of variable length.

4. Codes express a single medical concept, along with its synonyms. It may take several words to express a concept e.g. *acute myocardial infarction*, but this concept can be encapsulated by just one code.

5. The use of codes encourages consistency in definition of a term.

6. A code can be a central point of convergence between different languages, and can therefore be used internationally.

Tackley and colleagues also point out, in the same paper [13] the disadvantages of a coding system:

1. Once an item of information is coded, the meaning of the information is lost, unless a decoding system is available. If the information is incorrectly coded, then the original information cannot be retrieved.

2. Coding systems have problems in coding continuous variables, such as numbers of heart beats per minute. To have a pure coding system, numbers need codes i.e. *75* beats per minute. This is not possible, as there are a finite number of codes, and an infinite number of numbers. Theoretically, a range of numbers can be coded, for example integers from 0 - 100. The optimum range of numbers

would be difficult to define for practical purposes. In addition, decimals would need to be coded as well. Thus, it is not practicable to code numbers.

It is easier to attach codes to language if the language is based upon unique concepts i.e. one concept = one code. Thus if terms describe single medical concepts (see Section 2:1), terms lend themselves to being coded.

Central to the strategy of the use of information in the NHS is computerisation, as large amounts of information can be handled more efficiently by computer than by the human brain. Given that a standard medical terminology would enhance the overall processing of the information, and that computers can handle codes more readily than words, then it would seem appropriate to develop a coding system alongside the standard set of terms.

The NHS has adopted Read Codes [14] as its preferred clinical coding system. This system is a five character code, the code being built up in hierarchial fashion. For example, using fictitious codes;

| Level | Term | Code |
|---|---|---|
| 1 | Non-operative procedure | H..... |
| 2 | Administration of general anaesthetic | H2... |
| 3 | Induction of general anaesthesia | H24.. |
| 4 | Intravenous induction | H24f. |
| 5 | Rapid sequence induction | H24f7 |

The hierarchical structure upon which the terms are built up is described fully in Section 2:8:1, and this structure is mirrored in the construction of the Read Codes. (The Read Clinical Classification is discussed in Section 1:4.) Thus the codes are built up in a logical fashion, so that all general anaesthesia terms have

codes beginning with H2.... and all terms referring to the intravenous induction of general anaesthesia have codes beginning with H24f. .

Discussion of the use of coding systems in computerised record-keeping systems with some anaesthetic colleagues has produced a look of horror, and the question "Does this mean that we will have to learn lots of codes?" [Personal observation]. The "anaesthetist / computer interface" is discussed in section 3 of this thesis, but this mistrust of computers by many anaesthetists should be borne in mind when marrying a set of terms to computer codes. Ideally the codes should be for the use of the computer system, and not be presented to the practising clinician, to whom they will be totally unfamiliar.

## 1:4 Existing terms and classifications for anaesthesia

Do standard terms already exist for use in anaesthesia? As mentioned previously, classifications which contain terms already exist, and are used at present for central statistical returns. These are the Office of Population Censuses and Surveys Tabular List of the Classification of Surgical Operations and procedures, 4th Revision (OPCS-4)[10], and the International Classification of Diseases (ICD). The version of ICD in current use is Version 9[11], but this will be superceded by the Tenth Revision, Volume 1 of which was published in 1992 [15].(The use of ICD-10 has been delayed by the as-yet non-publication of Volumes 2 and 3, which are the instructon manual and the alphabetical index.) These are classifications, and a classification is " a list of all the concepts belonging to a well defined group (e.g. of diagnoses etc.) compiled in accordance with criteria enabling them to be arranged systematically, and permitting the establishment of a hierarchy based on the natural or logical relationship between them." Furthermore, "a classification should not be confused with a nomenclature.

Whereas the latter is simply a list of names, a classification is an attempt to establish a logical hierarchy between the concepts themselves" [16]. Classifications need more organisation in their creation in their content than nomenclatures, but their hierarchical stucture does permit easier coding of their contents.

The distinction between a nomenclature and a classification has relevance for a standard set of terms for anaesthesia. A list of names is certainly required for many aspects of a standard thesaurus, for example for drugs and equipment. However, it is also an advantage to arrange terms in groups based on concepts, as this makes creating the terms easier, and is necessary for coding these terms in a logical manner. A standard set of terms for anaesthesia will therefore combine characteristics of both a classification and a nomenclature.

Nomenclatures do exist already in medicine. Since 1970, the Council for International Organisations of Medical Sciences (CIOMS) has been producing the International Nomenclature of Diseases (IND)[17]. The purpose of the IND is to provide a "single recommended name for every disease entity". To date, however, only names of diseases of the lower respiratory tract, cardiovascular diseases and infectious diseases have been tabulated. It is not yet comprehensive. The Royal College of Physicians in London, also had a similar nomenclature, but this has not been updated since 1960 [18].

Both OPCS-4 and ICD are designed for the collection of statistical data, and their language reflects this.

For example, from ICD 10

Under *Acute myocarditis*:

*Infective myocarditis*

*Isolated myocarditis*

*Other acute myocarditis*

*Acute myocarditis, unspecified*

Thus all aspects of acute myocarditis, apart from infective and isolated, are covered for coding for statistical purposes by the catch-all terms *other* and *unspecifed*. OPCS-4 uses *not elsewhere classified* or *not otherwise specified* in a similar manner. "*Other*" is used for a specific type of myocarditis which is neither infective, nor isolated. "*Unspecified*" is used if all that is known about the disease is that it is acute myocarditis, but nothing more than that.

e.g. Under *Excision of pharynx*

*Total pharyngectomy*

*Partial pharyngectomy*

*Other specified excision of pharynx*

*Unspecified excision of pharynx*

These sort of terms are not used clinically. No-one would record that a patient had *Acute myocarditis, unspecified*. These terms, it must be remembered, are

designed for the collection of statistics. The "*other specified*" and "*not otherwise specified*" suffixes were included so that all diseases and operations could be coded in some way. It is not then practicable to copy terms straight from these classifications into a standard set of terms, although some of the terms may be useful e.g. *Infective myocarditis*. However, at present these terms still form the basis of central statistical returns. Although anaesthesia does not have many such terms, it is an advantage if terms in a standard thesaurus have some way of cross-referring to OPCS-4 or ICD-10. This would help in "bridging the gap" between existing classification terms and a new set of terms which can be used for use in medical notes as well as statistical returns. This could be achieved through matching codes i.e. a new term code could have a corresponding ICD code. For example, a new term could be

*rupture of pulmonary artery catheter balloon*.(Code e.g XYZ)

The nearest ICD term to that is

*other complications of procedures, not elsewhere classified* (Code T81.8)

If the new term is coded primarily as XYZ, but also as nearest ICD T81.8 as a cross-reference code, then it becomes possible, through codes, to cross-refer from a new standard set of terms to existing classifications. This also has the advantage of freeing the writer of the new standard set of terms from the syntax of OPCS and ICD terminology. (See also Section 2:6:1)

Similarly for a new term

*insertion of pulmonary artery catheter* (Code e.g. ABC),

the nearest OPCS-4 term and code for a cross-referral is

*Other specified transluminal operation on pulmonary artery* (Code L13.8)

The contents of these, and other relevant classifications with respect to anaesthesia are examined below:

a) OPCS-4

The earliest classifications of surgical operations were developed in the 1940s, and were first amalgamated in 1950 by the General Register Office [19]. This was updated in 1956, this revision containing a small series of codes for anaesthesia. Subsequent revisions took place in 1969, and 1975, the latter being under the auspices of the Office of Population Censuses and Surveys. (The 1975 revision, the third, became known as OPCS-3, but the previous revisions are not OPCS-1 and OPCS-2, as they were produced by the General Register Office, not OPCS.) The present revision, OPCS-4, was published in 1990. Before this edition was produced, other existing classifications for medical procedures were considered. These were the International Classification of Procedures in Medicine (ICPM; 1978)[20], the Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures (1978)[21], and the International Classification of Diseases, 9th revision: Clinical Modification (ICD-CM, 1980)[22]. None of these classifications was considered up-to-date, and neither were they considered to be comprehensive. ICPM was released for trial purposes only, and the World Health Organisation has no plans to update this work. Thus OPCS-4 is the most modern classification of procedures.

The purpose of the OPCS classification is to provide an "instrument which will provide the best possible basis...for data on surgical operations"[23]. Most

anaesthetists would not think of their activities as being an operation, but there are some areas of work where there is common ground with surgeons. These are as follows;

Respiratory tract; laryngoscopy, tracheostomy procedures, fibreoptic endoscopic procedures in the respiratory tract, irrigation and aspiration of the respiratory tract
Arteries and veins; cannulation
Neurosurgery: evoked potential recording, many pain procedures involving nerves

Apart from the tortuous language used (e.g. *percutaneous transluminal cannulation of vein*), certain terms may have different meanings to different specialties. To use the example of laryngoscopy, a direct laryngoscopy to an ENT surgeon has a different application than a direct laryngoscopy by an anaesthetist. This is important, especially when reviewing theatre activities and costings.

There are a few terms specifically for anaesthesia. These terms are not meant to be used in their own right, but merely as an adjunct to the code for the surgical operation. These are divided into terms for *general anaesthetic*, *spinal* (including epidural) *anaesthetic*, *local anaesthetic* and *other anaesthetic*. The terms are:

*General anaesthetic*

*Inhalation anaesthetic using muscle relaxant*

*Inhalation anaesthetic using endotracheal intubation not elsewhere classified*

*Inhalation anaesthetic not elsewhere classified*

*Other specified (general anaesthetic)*

*Unspecified (general anaesthetic)*

*Spinal anaesthetic*

*Epidural anaestheic using lumbar approach*

*Epidural anaesthetic using sacral approach*

*Other specified (spinal anaesthetic)*

*Unspecified (spinal anaesthetic)*

*Local anaesthetic*

*Local anaesthetic nerve block*

*Injection of local anaesthetic not elsewhere classified*

*Application of local anaesthetic*

*Other specifed (local anaesthetic)*

*Unspecified (local anaesthetic)*

*Other anaesthetic*

*Gas and air in labour*

*Other specified (other anaesthetic)*

*Unspecifed (other anaesthetic)*

These are inadequate for use by anaesthetists.

There is at present discussion regarding a further revsion of OPCS, OPCS-5 [Dr. J. Read, personal communication]. It is unclear at present whether a future revision will contain terms relevant to anaesthesia.

b) ICD

This statistical classification of diseases began in the 19th century as the International Causes of Death written by Dr. Jacques Bertillon, for the International Statistical Institute, in 1893 [24]. This was reviewed five times before being taken over by the World Health Organisation in 1946. It was only

concerned with fatal disease classification until 1948, when, as ICD-6 [25], causes of morbidity were added. The current version is the 9th revision, ICD-9, published in 1979. The 10th revision, ICD-10 is nearly completed; Volume 1, which contains the classification itself, has been published, but the publication of the instruction manual, Volume 2, and the alphabetical index, Volume 3, have been delayed. It differs from ICD-9 significantly in that the coding structure has been expanded, to allow expansion of the numbers of terms and chapters.

There are many terms in ICD-10 which are of relevance to the anaesthetist. (ICD-10 has been used for this review. Although not in general use yet, the terms of ICD-10 are available in Volume 1. As the full release of ICD-10 is expected, ICD-10 is reviewed in preference to ICD-9.) These terms are diagnostic in nature, and relate especially to the respiratory and cardiovascular systems.

e.g. *Essential hypertension* (I20), *Adult respiratory distress syndrome* (J80), *Asthma* (J45)

There are a number of terms which relate to anaesthesia during pregancy, labour and childbirth. This reflects the historical nature of medical information gathering. These are

- *pulmonary complications due to anaesthesia during pregnancy* (also *aspiration pneumonitis*)
- *cardiac complications due to anaesthesia during pregnancy*
- *central nervous system complications due to anaesthesia during pregnancy*
- *toxic reactions to local anaesthesia during pregnancy*
- *spinal and epidural anaesthesia-induced headache during pregnancy*
- *other complications of spinal and epidural anaesthesia during pregnancy*
- *failed or difficult intubation during pregnancy*
- *other complications of anaesthesia during pregnancy*

- *pulmonary complications due to anaesthesia during labour and delivery* (also *aspiration pneumonitis*)
- *cardiac complications due to anaesthesia during labour and delivery*
- *central nervous system complications due to anaesthesia during labour and delivery*
- *toxic reactions to local anaesthesia during labour and delivery*
- *spinal and epidural anaesthesia-induced headache during labour and delivery*
- *other complications of spinal and epidural anaesthesia during labour and delivery*
- *failed or difficult intubation during labour and delivery*
- *other complications of anaesthesia during labour and delivery*

- *pulmonary complication of anaesthesia during the puerperium*
- *cardiac complications of anaesthesia during the puerperium*
- *central nervous system complications of anaesthesia during the puerperium*
- *toxic reaction to local anaesthesia during puerperium*
- *spinal and epidural anaesthesia-induced headache during the puerperium*
- *Other complications of spinal and epidural anaesthesia during the puerperium*
- *failed or difficult intubation during the puerperium*
- *other complications of anaesthesia during the puerperium*

Some of these terms are useful, but there are no terms available, for example for *post-dural puncture headache* (a more accurate term) in any other context other than related to obstetric anaesthesia.

In addition, there are chapters devoted to external causes of morbidity and mortality, and complications of anaesthesia come under this section. There are few terms relating specifically to anaesthesia. These are

- *Poisoning by inhaled anaesthetics*
- *Poisoning by intravenous anaesthetics*
- *Poisoning by local anaesthetics*
- *Poisoning by other and unspecified general anaesthetics*
- *Poisoning by therapeutic gases*
- *Shock due to anaesthesia*
- *Malignant hyperthermia due to anaesthesia*
- *Failed or difficult intubation*
- *Other complications of anaesthesia*

These terms are clearly not comprehensive, and some terms are not of use e.g. *shock due to anaesthesia.*

Although ICD-10 has many diagnostic terms which may be of use to anaesthetists, terms for complications are not very useful, as they are neither comprehensive, nor are they useful outside narrow situations (see Section 2;5, under "Contextual Information").

c) Read Clinical Classification Version 2 [26]

This classification has been designed by Dr. James Read, formerly a general practitioner in Loughborough, Leicestershire. It was developed for use in general practice, and is a classification of medical terminology. It was expanded from its initial G.P. based terms in the mid-1980s into version 2. (Version 1 was designed and used by Dr. Read within his general practice surgery as an experiment.) This

includes terms for signs and symptoms, diagnostic, operative, and non-operative procedures, medical administration, drugs and appliances, occupations and social information.

It differs from ICD and OPCS in that it is designed primarily for use with medical records, for the recording and retrieval of information, and not for purely statistical purposes. Thus the "catch-all" suffixes "other" and "not otherwise specified" are not used. The terms are accompanied by codes ("Read Codes"), for use in computer systems. These are illustrated in section 1:3. The Read Clinical Classification was adopted by the Royal College of General Practitioners, and then by the NHS Management Executive as a standard classification in 1990.[27]

There are few terms of specific relevance to anaesthesia, although there are many diagnostic terms. The terms

*general anaesthesia*

*local anaesthesia*

*endotracheal intubation*

exist, but there is no further detail for each category than this.

There are also terms for measurement of parameters, although these are limited to blood-based (e.g. haematological) and non-invasive measurements. For example, there is a term for *blood pressure measurement*, but further detail such as *mean*, or *invasive* is not available. Thus Read Version 2 is not sufficient for the needs of anaesthesia.

Version 3 of the Read Clinical Classification was released in 1995.[28] The terms in this version have been created as part of the Clinical Terms Project, organised through the NHS Centre for Coding and Classification. All medical specialties have been involved in the creation of terms, leading to a huge expansion in the

number of terms in Version 3 compared to Version 2. There are many anaesthetic-related terms included in this version, and these have been created by the Anaesthetic Specialty Working Group, Clinical Terms Project. The author was Reasearch Worker for this group [29]. These terms were not fully comprehensive in 1995, at the time of initial realease, as more anaesthetic-related terms relating to drugs, equipment, context, and administration are due for release at a later date.

As section 2 of this thesis is a discussion and demonstration of anaesthetic terms for Version 3 of the Read Clinical Classification, Version 3 will not be discussed further in this section.

d) SNOMED

The Systematised NOmenclature of MEDicine was published in 1979, by the College of American Pathologists [30]. It is a multi-axial system, the axes being topography, morphology, aetiology, function (signs and symptoms), disease, procedure and occupation. The theory behind this system is that a series of codes can describe a medical event, based around the disease diagnosis. Not all axes have to used. For example, appendicectomy for acute appendicitis would be coded along the following lines:

topography: *operation site*
procedure: *appendicectomy*
morphology: *acute inflammation*
function: *abdominal pain*
aetiology: *?*
diagnosis: *acute appendictitis.*

Each axis would carry a code, and the result would be a string of at least five codes.

The use of SNOMED is declining in the United Kingdom, as it can only cope with neatly circumscribed episodes [31]. SNOMED does however, contain 36 terms for anaesthetic procedures, including local anaesthetic procedures. These are as follows:

- *Anaesthesia, not otherwise specified*
- *General anaesthesia, not otherwise specified*
- *Inhalational anaesthesia, machine system, closed, rebreathing primary agent*
- *Inhalational anaesthesia, machine system, closed, no rebreathing primary agent*
- *Inhalational anaesthesia, machine system, semi-closed, rebreathing primary agent*
- *Inhalational anaesthesia, machine system, semi-closed, no rebreathing primary agent*
- *Inhalational anaesthesia, machine system, semi-closed, circulation primary agent and gases*
- *Intravenous anaesthesia, not otherwise specified*
- *Regional anaesthesia, not otherwise specified*
- *Spinal anaesthesia*
- *Epidural anaesthesia*
- *Nerve block anaesthesia*
- *Central block anaesthesia*
- *Stellate ganglion anaesthesia*
- *Paracervical anaesthesia*
- *Paravertebral anaesthesia*
- *Peripheral anaesthesia*
- *Therapeutic anaesthesia*
- *Diagnostic block anaesthesia*
- *Operative anaesthesia*

- *Local anaesthesia, not otherwise specified*
- *Local anaesthesia, surface, topical*
- *Local anaesthesia, surface, by refridgerant*
- *Local anaesthesia, by infiltration*
- *Supplementary measure, anaesthetic*
- *Supplementary agent, anaesthetic*
- *Relaxant, induction and maintenance* (but not reversal)
- *Hypotension, induction and maintenance*
- *Hypothermia, regional, induction and maintenance*
- *Hypothermia, total body, induction and maintenance*
- *Acupuncture, not otherwise specified*
- *Resuscitation from anaesthesia*

These terms are neither comprehensive, nor, as with OPCS-4 and ICD-10, is the language that which would normally be used. These terms cannot be recommended for inclusion into a standard thesaurus. SNOMED does have three terms which are not normally seen in procedure classifications, although anaesthetists recognise them as procedures, and these are:

- *pre-operative evaluation, anaesthesia*
- *post-operative follow-up, anaesthesia*
- *recovery room monitoring* (but no intra-operative monitoring term)

SNOMED is at present undergoing further revision, in the United States.

e) Terms for critical incidents and complications

A number of anaesthetic departments have produced their own lists of complications and critical incidents e.g King's College Hospital, London [Dr.M.Fisher, personal commmunication]. These vary in their content, and the degree of detail contained therein. They are intended for local use, and they are non-standardized. For example, from the King's College Hospital List:

*Displacement endotracheal tube*

*unintentional extubation*

*unintentional extubation during intentional repostitioning*

*while transporting patient*

*during operation due to traction*

*during operation due to inadequate fixation*

*during operation following surgical manipulation*

*into oesophagus after proven tracheal intubation*

*detached into trachea*

*connector failed*

*connector incorrectly inserted*

*surgical damage to tube or connector*

List of critical incidents are difficult to create, owing to problems with definition.[32] (See section 2:8:7)

The Australian Incident Monitoring Study [33] has, through a questionnaire, created a database of incidents and accidents which occur during anaesthesia. The methods employed during the study involved the analysis of 2000 questionnaires completed by anaesthetists after an incident had occurred during an anaesthetic. The questionnaires gave space for a narrative about the incident, and also included

a specific section relating to equipment problems, airway problems or pharmacological incidents. Twenty seven different categories of incident were identified.

These are as follows:

*System failure*

*Human failure*

*Crisis management*

*Which monitor?*

*Ventilation problems*

*Pulse oximeter*

*Paediatric incidents*

*Endotracheal tube*

*Equipment failure*

*Capnograph*

*Regional anaesthesia*

*Wrong drug*

*Electrocardiograph*

*Recovery ward*

*Blood pressure*

*Cardiac arrests*

*Difficult intubation*

*Stethoscope*

*Vascular access*

*Anaphylaxis*

*Environmental safety*

*Oesophageal tube*

*Pre-induction stage*

*Oxygen analyser*

*Air embolism*

*Pneumothorax*

*Awareness*

The study did not seek to standardize terminology, but has been useful as a framework for creating a full list of terms of complications and untoward events. The author used these categories as a guide to make sure that all types of untoward events had terms written to describe them, during the creation of terms outlined in Section 2:8:7.

f) Equipment

The International Standards Organisation (ISO) is a worldwide federation of national standards bodies. It seeks to agree a common terminology for equipment, and set device standards. The work of the ISO is done by its technical committees, comprised of representatives of interested technical bodies. The relevant British body is the British Standards Instituite. The ISO has a collection of agreed terms for anaesthetic equipment [34]. A second edition of this work is expected to be published in 1995. These are accepted as standards, and often have accompanying definitions. These terms are of use to anaesthetists. For example, (from the forthcoming second edition [35]):

*Tracheal tube*: (Definition given: tube designed for insertion through the larynx into the trachea to convey gases and vapours to and from the trachea.)

Specific items of equipment are not referred to, nor are trade names e.g. *anaesthetic vaporiser* is given, (not isoflurane vaporiser).

Lists of products available within the NHS do exist, based on product names from manufacturers, and is thus not a useful source of generic terms needed by anaesthetists. These lists are voluntary, and are incomplete.

g) Drugs

The accepted classification of available drugs in the United Kingdom is the British National Formulary (BNF) [36]. It lists all medications as generic and if applicable, trade names. In addition, it gives the available preparations. These generic names are standard terms, and can be used in the standard set of terms for anaesthesia. There are some terms which are not in the BNF; these include concentrations of drugs mixed by the anaesthetist e.g. for infusions, and drugs which are no longer sold, but are still used occasionally e.g. cyclopropane. Methods of drug administration are not covered comprehensively, either. The standard classification in the United States of America, The Physicians' Desk Reference [37] contains details of all drugs available in a similar fashion. It too has the same drawbacks as the BNF. In addition, there are differences in the spelling of drug names e.g. *lidocaine / lignocaine*, *thiopental / thiopentone*.

h) Summary of existing classifications

Although there are some sources of useful terms available for a standard thesaurus of terms, these relate more to areas which anaesthesia has in common with other medical specialties e.g. diagnostic terms in ICD. There are few existing terms which are specific to anaesthesia, especially with respect to anaesthetic procedures. Standard anaesthetic textbooks are useful for reviewing subjects, and may provide ideas for terms. They are not, of course, designed for this purpose.

## 1: 5 Present recording of anaesthetic notes

Introduction:

As part of the assessment of the need for standardized terminology in anaesthesia, it was necessary to undertake a study to examine how anaesthetic records are recorded at present. The aim of this study was to see whether the present method of recording of certain parameters on anaesthetic record sheets is clear, concise, and therefore acceptable, or whether the methods of recording used indicate that standardization of terminology would be helpful.

This study has been included in this section of the thesis, as it forms part of the review of current practice.

Method:

160 anaesthetic record sheets were reviewed. The records were collected as follows; names of patients, along with their record numbers were taken in order from theatre records in the months of April / May 1993. The notes were collected from medical records departments, and the anaesthetic record contained therein examined. These records came from two different hospitals, one a teaching hospital (112 records), and the other a district general hospital (48 records).

The methods of recording the following items of information were looked at:

1. The method of ventilation used;
2. The method of recording the measurement of oxygen saturation;
3. The method of recording the procedure of peripheral venous cannulation.

These parameters were selected as they were common to all the anaesthetics recorded i.e. all patients were either allowed to breathe spontaneously or were artificially ventilated, oxygen saturation monitoring was available for all of the anaesthetics, and peripheral venous access was instituted for all cases.

The exact method of recording the parameter under review was noted, and the total numbers for each particular method of recording counted. The number and quality of variations in the method of recording were reviewed after data collection.

Results:

Parameter: Control of ventilation

The methods of recording were as follows;

a) Controlled ventilation

| Recorded as | Number | % |
|---|---|---|
| "IPPV" | 54 | *33.8* |
| "IPPR" | 1 | *0.6* |
| "Controlled" | 2 | *1.3* |

b) Spontaneous respiration

| Recorded as | Number | % |
|---|---|---|
| "Spont resps" | 6 | *3.8* |

| | | |
|---|---|---|
| "Spontaneous breathing" | 2 | *1.3* |
| "SR" | 10 | *6.3* |
| "Spont resp" | 6 | *3.8* |
| "SV" | 8 | *5.0* |
| "Sp vent" | 1 | *0.6* |
| "Spont" | 23 | *14.4* |
| "Spontaneous ventilation" | 10 | *6.3* |
| "Sp" | 5 | *3.1* |
| "S. vent" | 1 | *0.6* |
| "Spont vent" | 1 | *0.6* |
| Others | | |
| Nil recorded | 29 | *18.1* |
| Illegible | 1 | *0.6* |
| Regional technique | 2 | *1.3* |

Oxygen saturation monitoring

| Recorded as | Number | % |
|---|---|---|
| "SO2" | 6 | *3.8* |
| "SaO2" | 58 | *36.3* |
| "SpO2" | 33 | *20.6* |
| "Satn." | 5 | *3.1* |
| "Sat" | 1 | *0.6* |
| "O2 sat" | 1 | *0.6* |
| "PO" | 1 | *0.6* |
| "P. ox" | 6 | *3.8* |
| "Pulse ox." | 2 | *1.3* |

| | | |
|---|---|---|
| "Pulse oximeter" | 5 | *3.1* |
| "Pulse oxim." | 1 | *0.6* |
| "Oximeter" | 5 | *3.1* |
| "Oximetry" | 6 | *3.8* |
| "Oxim." | 1 | *0.6* |
| "%" | 2 | *1.3* |
| Others | | |
| Nil specified | 29 | *18.1* |
| Illegible | 4 | *2.5* |

Peripheral venous cannulation

| Recorded by | Number | % |
|---|---|---|
| Site | 143 | 89.4 |
| Laterality | 143 | 89.4 |
| Size of cannula | 111 | 69.4 |
| Type/ make of cannula | 71 | 44.4 |
| Nil recorded | 17 | 10.6 |

Discussion and conclusion:

These are three examples of the different ways that anaesthetists can record various items that commonly appear on anaesthetic record sheets. It can be seen clearly that there are many different ways of writing relatively simple concepts; for example, 15 different ways of writing oxygen saturation were noted, and 11 different ways of recording spontaneous respiration or equivalent. The use of abbreviations is common, either in the form of shortened words e.g. "spont resps.", complete abbreviations e.g. LMA for laryngeal mask airway, or accepted

symbols e.g SaO2. Synonyms are also used e.g. spontaneous respiration or spontaneous ventilation. For peripheral venous cannulation, no consistency in the method of recording of even a simple, common procedure was achieved.

It is clear that there are many different ways of writing the same thing. In most cases, they are understandable, perhaps to another anaesthetist, but not necessarily to anyone else (for example, a lawyer). This diversity also poses problems in data retrieval. If the data is written in many different forms, it becomes difficult to retrieve, as the person searching has to look for alternatives. If the person searching is not well versed in the meanings of some of the abbreviations, then mistakes will be made, and the resulting data becomes inaccurate. In addition, as these records are all hand written, it is therefore more time-consuming, and sometimes impossible, to extract data from them. Coding clerks, not anaesthetists extract information from medical records. Illegible, ambiguous and inconsistent recording in notes compound coding clerks' problems, and reduce the accuracy of data collection. This inconsistency in annotation of anaesthetic records is therefore unsatisfactory.

Could a standard language improve on this situation? Certainly it would cut down on the number of different recording devices, although the ability to use synonymous terms and abbreviations would be helpful (see Section 2:2 for further information on synonymous terms, and abbreviations). This in turn would make searching for the answers to questions such as " How many patients underwent tracheal intubation ?" more practicable. If standard terms such as *oral tracheal intubation* or *nasal tracheal intubation* existed, then the answer would be easier to find. (This would also be enhanced by the use of a computer, preferably using a coding system.) Hand-written notes vary significantly in the content and style of recording, and therefore are unreliable for information gathering purposes.

Computer-based standard terms will thus improve upon the quality of recorded information.

## 1:6 Conclusions to Section 1

There is an increased requirement in the NHS for better quality information. The specialty of anaesthesia is not remote from the pressures of the financial and administrative side of the NHS. Information is required to help maintain services, improve efficiency, audit clinical practice, improve training and balance budgets. This information is difficult to collect at present, as it is hampered by the lack of anaesthetic-related information, and also because data that is collected arrives in different formats. A common terminology would improve this situation, across the NHS, and would aid comparisons between hospitals, health authorities and health regions.

The era of electronic record-keeping systems and computer-based medical records is drawing closer: this is the aim of the NHS Executive through its Information Management and Technology Strategy. An electronic record-keeping system for anaesthesia would be of greater use if it had a standard terminology, especially if this was allied to a coding system. It would be sensible to have one standard language which could facilitate record-writing and data collection, and at the same time provide a better, more efficient way of providing information necessary for anaesthetists.

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# Section 2

## The Creation of a Standard Set of Terms for Anaesthesia

## Section 2: The Creation of a Standard Set of Terms for Anaesthesia

Contents: Page

## 2:1 The criteria for a term

The thesaurus being created is a list of terms. It is first necessary to define what is meant by the word "term", and to outline the criteria which a term should meet. The dictionary definition of a term, in the context of this subject is "a word or expression used in an understood or specially defined sense." [1]. (Other definitions of the word "term" are discussed as homonyms in Section 2:2:3.) This definition was refined for the purposes of terms-writing in the Clinical Terms Project as a "single, useful medical concept"[2]. This concept is discussed further in Section 2:4.

### 2:1:1 Clarity

Compliance with any thesaurus will depend upon how easy the terms are to recognise and use. Therefore, a term needs to be straight-foward and understandable; e.g "*arterial line inserted*". This in turn is helped by the term being short in length, as "*arterial line inserted into right radial artery using Seldinger technique with aseptic precautions*" is not an easy term to use. Longer terms may add more detail, and possibly precision, but loss of clarity results.(A mechanism for dealing with detail in terms is discussed later in section 2:4.) Clarity is essential, as there are thousands of potential terms.

It may be difficult to condense a recognisable medical occurrence into a succinct term. "*Pre-existing patient morbidity discovered intra-operatively*" is understandable, but tortuous. Similarly, how does one write a term to describe the occasion when a patient is admitted as a day case, but on assessment, day case surgery (and /or anaesthesia) is felt not to be appropriate? This term can be written as follows:

- *Patient not fit for day case surgery*
- *Patient not appropriate for day case surgery*

  (These terms do not express the fact that the patient arrived at the hospital.)
- *Patient admitted, but not suitable for day case surgery.*

  (This does not necessarily suggest that day case surgery was planned.)
- *Patient inappropriately admitted for day case surgery.*

  (The adverb describes the manner of admission, not that the patient was inappropriate.)
- *Patient admitted on inappropriate basis for day case surgery.*

  (There remains some ambiguity; "inappropriate basis" is not a clear phrase.)
- *Patient admitted for day case surgery, but such treatment felt not appropriate.*

  (Correct but long-winded.)
- *Day case patient not suitable for such treatment.*

  (Acceptable, but awkward, and does not mention admission.)

It may not be possible to convert a concept to a single, short perfect term in this manner, but this should be the goal. This will provide easy to use terms with clear meanings.

### 2:1:2 Usefulness

It is possible to create a term whose usefulness is questionable. This may result from a desire to make a term too short and precise. An example of such a term might be "*Patient intubated*". This term is not really useful; an anaesthetist may assume that the term refers to endotracheal intubation, but it could just as easily mean endobronchial intubation. The term is ambiguous. Indeed, there are many other parts of the body which can be intubated. Thus this term, although it may be

part of anaesthetic jargon, is not useful as a term for a comprehensive thesaurus.

The usefulness of a term may also be called into question when it relates to concepts which are used uncommonly in clinical practice. These may relate to methods of measurement or monitoring parameters e.g. for research purposes. "Measurement of anaesthetic gas concentration using mass spectrometer", although it may be practised at some centres, is not a useful term for the vast majority of anaesthetists. It is some times difficult knowing where to "draw the line": many well-known clinical syndromes are exceedingly rare, e.g. some of the inborn errors of metabolism, but they often have recognised anaesthetic complications. It would be difficult not to include these syndromes in a list of terms, but the terms may be infrequently used.

### 2:1:3 Definition

Does the term itself need a fixed definition of its own? This point can be illustrated with an example. The coding system developed by the Office of Population Censuses and Surveys (OPCS) [3], in its small section on anaesthetics, has a category named "*Spinal anaesthetic*". This contains the sub-divisions "*epidural anaesthetic using lumbar approach*" and "*epidural anaesthetic using sacral approach*". This implies that epidural anaesthesia is a type of spinal anaesthesia. Anaesthetists would disagree with this, taking the term "spinal anaesthesia" to mean intrathecal injection, not extradural. (The term *spinal anaesthetic* in OPCS-4 cannot be used for coding, as it is used as a grouping term, but its use in this manner is confusing.)

This problem can be "side-stepped" by the creator of terms. The creator can say that he or she creates the terms, and it is then up to the user to apply them as they

see fit. After all, this is what happens in every day practice at present with the written and spoken word. This "solution" makes life easier for the writer of the terms, but is unsatisfactory if the terms are used for analysis later. Using the above example, if some anaesthetists recorded epidural anaesthesia merely as "spinal anaesthesia", then the true numbers of intrathecal and epidural anaesthetics given will be lost.

Anaesthesia does not have many contentious definition problems which would make term writing difficult. The definition of a critical incident has posed problems, and this is examined further in Section 2:8:7. It would be more acceptable to the specialty if any definitions required came from more influential professional bodies, such as, for example, the Royal College of Anaesthetists, rather than an individual.

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## 2:2 The use of alternative terms

### 2:2:1 Synonymous terms

Synonyms abound in medical terminology, and anaesthesia is no exception. Some examples include:

*Induction of general anaesthesia using inhalational technique / Inhalational induction / Gas induction*

*Blood pressure / Systemic arterial pressure / Systemic blood pressure*

*Neuromuscular blockade / Muscle relaxation / Muscle paralysis / Muscle blockade*

*Orotracheal intubation / Tracheal intubation via oral route / Oral endotracheal intubation*

Each synonymous term will need to be included in a list of terms. (The alternative is for everyone to accept just one term- a very difficult task.) This will greatly increase the length of the list of terms, and make a term more difficult to find. If an anaesthetist, using a list of terms in a computer-based system, cannot easily find the term or phrase to which he or she is accustomed, the system will soon be abandoned altogether. If all synonymous terms are entered separately, then analysis of the data becomes difficult. There may be 3 orotracheal intubations, 4 tracheal intubations via oral route, and 7 oral endotracheal intubations recorded. It may not be obvious that 14 patients have been intubated.

For accurate review, and ease of use, some mechanism needs to be put in place in the list of terms to allow the easy use and identification of synonymous terms. It is possible with computer systems to find terms in a list in more than one way, either by choosing a term from a list ("pick list") or by typing in to the computer the term desired. Usually, the computer can recognise words or sections of words very quickly, and identify the required term. If the synonymous terms are linked together, and the computer recognises that they are grouped, then it is not difficult for the computer to display the synonymous terms simultaneously. Using the example above, if "tracheal intubation" is entered into the computer, then the computer will recognise the sequence of letters, and produce all three synonymous terms (and maybe more). The user will then be able to choose his preference. The computer will be able to record the choice, recognising that the other terms, if chosen instead are equivalent in meaning.

If one particular term is much more common than its synonyms, then it is easy to

present this term in a pick list, and have the other synonyms available, but not cluttering up a visible list. This makes choosing a term from a pick list easier.

Terms are often treated as synonyms (see under eponymous terms below), when strictly speaking they may not be so. This may cause problems in creating lists of synonyms, but it is more practical to reflect common usage, rather than strict definitions.

### 2:2:2 Eponymous terms

Eponyms are common in medical terminology. They are useful in that they encapsulate often complex medical ideas very succinctly. It is much easier to use the term "*Colles' fracture*" than to say "*a fracture within 2.5 cm of the lower end of the radius with a backward tilt, backward displacement and radial deviation of the distal fragment.*"
However, it is not necessarily an advantage to just include the eponymous term into the thesaurus, despite the brevity of the eponym. To use an anaesthetic example, Sellick's manoeuvre can be used as an eponymous term. If someone wishes to see how many times cricoid pressure was required in a given time period, then "*cricoid pressure*" will need to be linked to Sellick's manoeuvre. "Sellick's manoeuvre" and "cricoid pressure" are not strictly speaking true synonyms, but are often treated as such. This illustrates that eponymous terms, although commonly used, and useful for their succinctness, do not necessarily fit easily into the ordered creation of a list of terms.

The eponymous terms cannot be ignored, as they are so commonly used. When creating an ordered, logical list of terms, provision has to be made to allow for these terms. It is also necessary for the eponymous term to have a clear, precise,

accepted definition. If the eponym means different things to different people then it becomes impossible to place correctly in a list.

### 2:2:3 Homonymous terms

These are terms which have more than one acceptable meaning for the same term. The word "term" is a good example: as well as being a word or phrase, it can refer to a part of the school year, a prison sentence, and a pregnancy of 40 weeks gestation. To give a medical example, "cervical" applies both to the vertebral column and to the uterus. Common usage prevents abandoning one use of the term in favour of the other: both uses have to be included in a list of terms. These anomalies have to be borne in mind if searching for "cervical collar", and gynaecological terms appear on a screen.

### 2:2:4 Abbreviations and acronyms

Abbreviations are a very useful tool in the speeding up of recording data. It is much easier to write "*COETT*" than "*cuffed oral endotracheal tube*". Some abbreviations are well-recognised e.g. IPPV, PEEP. Some are more idiosyncratic, and may not be acceptable to all e.g. BF (butterfly needle).

Most abbreviations can be accommodated into lists with relative ease, as they can be treated in a similar fashion to synonyms. It should be borne in mind, however, that one abbreviation can apply to more than one term. For example, ABG can mean both arterial blood gases and aortic-bifemoral graft. This may cause problems when using a computer program; both terms should be linked to ABG so that the user can choose which term is required.

A number of abbreviations use symbols which may not appear on a standard

computer keyboard e.g Greek letters; β HCG. Some use superscripts e.g. milligramme per kilogramme (body weight); "per kilogramme" is often expressed as "$kg^{-1}$", with the -1 as a superscript. Subscripts are also used, especially in chemical symbols e.g. $O_2$, with the "2" as a subscript. These may be lost, or be impossible to use, depending on the computer software system available.

## 2:3 Uniformity of style

It is helpful if terms are written in a consistent style. This makes them easier to arrange in a logical fashion for use by a computer. It may also clarify the meaning of the term. It will, in addition, help to reduce errors of omission in the creation of terms in the first place. This uniformity of style may not be easy to achieve. It takes time to assemble a list of terms, and the author may change his manner of expression of terms, consciously or sub-consciously over that period of time. In addition, a certain way of expressing a term may be very appropriate for one set of terms but not for another.

It is certainly easier to read terms if they are written in the word order of natural language; i.e. they are written as they are said in normal speech. Medical records are often written more in note form, and so it is acceptable to create terms which reflect this. For example, "*blood pressure - normal*" is just as acceptable as "*the blood pressure is normal*".

If there are a number of terms which are variations on a common theme, then it may be easier to have the common section as the "stem" of the term e.g.

*blood pressure - normal*
*blood pressure - raised*

*blood pressure - low*

However, the result may be ungainly e.g.

*induction of general anaesthesia - intravenous*
*induction of general anaesthesia - inhalational*
etc.

Here "*inhalational induction*" is more appropriate. Although a consistent style may be logical, it is not always ideal.

The NHS Centre for Coding and Classification outlined some errors in the creation of terms in a booklet "Some Pitfalls in Creating Terms and Hierarchies" [4].(This booklet was produced to help research workers, including the author, during the Clinical Terms Project.) They identified the following, together with some crude examples:

a) The tendency to mix concepts within one term

e.g. *central venous line insertion for assessment of fluid balance*
*central venous line insertion for fluid administration*
*central venous line insertion for drug administration*
etc.

The concepts mixed here are the act of line insertion, and the reason for the line insertion.

b) Putting too much into the term

e.g. *tracheal intubation via the mouth with cuffed tube with the patient under general anaesthetic*

*tracheal intubation via the mouth with cuffed tube with the patient awake*

*tracheal intubation via the mouth with uncuffed tube with the patient under general anaesthetic*

*tracheal intubation via the mouth with uncuffed tube with the patient awake*

*tracheal intubation via the mouth with armoured tube with the patient under general anaesthetic*

*tracheal intubation via the mouth with armoured tube with the patient awake*

etc.

This problem, too, is dealt with under the section "Qualifying terms"(Section 2:4). Qualifying terms are a means of adding additional information (e.g. *cuffed*, *uncuffed* or *armoured tube*) to a basic or "core" term (e.g. *orotracheal intubation*), thus shortening the length of the basic term.

c) The tendency for the term to be meaningless

e.g. For the term

*artery cannulated*

The following add further detail

*percutaneously* }

*open technique* }

*over guide wire* }

However these three bracketed terms do not mean anything on their own. They need to be attached to the higher term to make sense i.e.

*artery cannulated percutaneously* etc.

In otherwords, the basic term *artery cannulated* is qualified by the technique used for cannulation. This method of adding additional or qualifying information to basic terms is discussed in Section 2:4. It allows essential extra detail to be added to basic terms.

d) Avoiding the styles of previous classifications

Some classifications have their own style of writing terms. It is easy to slip into that style inappropriately. The styles peculiar to the OPCS Classification of Surgical Operations and Procedures [3] and the International Classification of Diseases [5] are discussed more fully in Section 1:4, but terms such as "*Intravenous anaesthetic, not elsewhere classified*" and "*Other complications following infusion, transfusion and therapeutic injection*" are not clinically-useful terms.

## 2:4 The length of terms: the use of qualifying terms

How much information should be contained within a term ? If long terms are created, then more information can be carried within that term. If terms are too long, then they become difficult to read, to understand and to decipher. If terms are to be displayed on a computer screen, then there may be physical limits to the length of term. If a term is too short, then its meaning may be lost, and become

too imprecise.

The other consideration which needs to be taken into account is the number of extra terms generated by placing restrictions on the length of terms.
Consider the term "*Insertion of 22 gauge cannula (Venflon) into dorsum of left hand*". This term can be subdivided:

| | |
|---|---|
| Procedure: | *Insertion of cannula* |
| Size of cannula: | *22 gauge* |
| Type of cannula: | *Venflon* |
| Position of insertion: | *Dorsum hand* |
| Laterality: | *Left* |

Further information may still be required; for example, it may be considered desirable to record who inserted the cannula, where the procedure was carried out, or if the procedure was successful. The resultant term to include all this desired information would then be:
*" Successful insertion of 22 gauge cannula into dorsum of left hand by Dr. Smith in the anaesthetic room of Theatre 2."*

There would then need to be a term for
*" Successful insertion of 20 gauge cannula into dorsum of left hand by Dr. Smith in the anaesthetic room of Theatre 2."*
and
*" Successful insertion of 22 gauge cannula into dorsum of right hand by Dr. Smith in the anaesthetic room of Theatre 2."*
and
*" Successful insertion of 22 gauge cannula into dorsum of left hand by Dr. Jones in the anaesthetic room of Theatre 2."*

and so on, additional terms being required for degree of success, anatomical site, personnel involved, and place. For this example, with say, 5 different sizes of cannula, 2 hands, 10 anaesthetists, 6 theatres and 2 degrees of success, there are 5 x 2 x 10 x 6 x 2 =1200 possible combinations!

It readily becomes apparent that such an approach generates huge numbers of terms, most of which are long, and difficult to read. The compliance with such a system would be small. If the system of terms was to be computer-based, it would consume an enormous amount of computer memory.

An alternative approach must be considered.

It is useful to examine at this point exactly what constitutes a "term". (This has already been broached in Section 2:1.) The definition used by the Clinical Terms Project (CTP) is "a single useful medical concept" [2]. The CTP's definition has made an important step in that it specifies that the concept is *singular*, and that therefore concepts should not be mixed in one term. What implications does this have for the writing of terms? To use the above example, the basic term then becomes *"Insertion of cannula"*. This is a single concept, and fulfils the CTP definition.

This shortened term, however does not convey much information, and so, further information would be considered not only desirable, but essential; in this case, the size, position, type of cannula etc. The extra information *qualifies* the basic term. Examination of other terms in this way identifies some common types of qualifying information. For example, common qualifiers would include:

equipment used
anatomical position

outcome

personnel involved

site of procedure (e.g. hospital, ward, community)

time scale (e.g. acute, chronic)

However, some qualifying information may be very specific, and not fall easily into a category. e.g. *"Maintenance of general anaesthesia"* could have qualifying information in the form of *"Control of maintenance"* i.e. manual control, open-loop control, closed-loop control.

During the Clinical Terms Project the basic central term or terms were called the "core term", and the extra information terms "qualifiers".

Having established the principle that a term can have qualifying information, it is necessary to verify that it is possible to construct anaesthetic-related terms using this framework. An example is given below.

Core term: *Tracheal intubation*

Qualifiers:

| Attribute: | Value: |
|---|---|
| patient's level of consciousness | *awake, sedated, under general anaesthesia* |
| tracheal tube size | *8.0, 8.5, 9.0 etc.* |
| tracheal tube type | *cuffed, uncuffed* |
| route of intubation | *oral, nasal* |

Each set of qualifiers can be grouped together e.g. 8.0, 8.5, 9.0 - tracheal tube

size. The size of the tube is an *attribute* of the core term, and the attribute has *values*. This means that a qualifier consists of an attribute with its values; an "attribute / value pair". The attribute acts to group values together, and so the attribute cannot exist without values. Similarly, the values cannot exist without an attribute e.g. *8.0* is meaningless without the attribute "tracheal tube size" to explain it. Thus attributes and vaules are always paired.

i.e. qualifier = attribute + value of that attribute

Using the core term as a base, it is possible to build up a large amount of extra information to supplement the core term. There are advantages to using this method. One advantage is that the basic core term tends to be short, concise and therefore easy to recognise and understand. The desirability of these qualities has already been noted. The condensation of longer terms into short terms with qualifiers also allows the total number of terms to be reduced. This makes selection of the term easier, especially when choosing off a "pick list" on a screen. In addition, the user is free to add as much extra information as he or she wants.

This system is more complex in its organisation, as it creates a second tier of information, and makes the lists "three-dimensional". This may make lists of terms more difficult to organise and use. If terms were being used on paper, then a core term could easily be selected. Selecting the useful qualifiers may be more difficult as they may not appear next to the core term. (If they did, it may make a list of core terms difficult to interpret.) If used in a computer system, the organisation and presentation may be easier, as qualifiers could, for instance, be found in a separate "window" which would be easily accessible.

If a system of terms is to be used in a coding system, then the coding system will need to have the same degree of flexibility as the terms / qualifiers system. If a

core term has say, five attributes, and each attribute has three values, then there are 5 x 3 = 15 possible attribute / value pairs. If each core term / attribute / value combination has a unique code, then the total number of codes will be enormous. As some qualifiers recur e.g. laterality / left, right, then it should be possible to have a separate code for the core term and the qualifier. To use an example:

core term: tracheal intubation (code = 1)

qualifier:

attribute: level of consciousness

value: patient awake (code = a)

patient under general anaesthesia (code = b)

attribute: route of intubation

value: oral (code = A)

nasal (code = B)

Hence *"awake oral tracheal intubation"* codes as 1,a,A

*"nasal tracheal intubation, under general anaesthesia"* codes as 1, b, B.

Thought has to be given to the form of the core term, as it forms the base on which so much extra information is placed. It should, as stated previously, be clear and concise. It should avoid overlap with other core terms to avoid confusion, but at the same time reflect the natural term used in every day speech and writing. Using the above example;

core term tracheal intubation

qualifier value awake

This reads as *"tracheal intubation, awake"*, whereas the commonly used phrase is *"awake intubation"*. The phrase *"awake intubation"* is therefore lost in this proposed system of qualifiers. (This may also happen with the term *"blind nasal intubation"*.) A complex computer system may be able to have the ability to apply some qualifiers to certain terms in a group, but not to others, but this may be too difficult to design at present. We found that there were few occasions where this occurred, but that it was more likely to occur if the core term was very short (or "atomic"). For the example of "*awake intubation*", it was necessary to use the synonym "*awake intubation*" for both the terms

*oral tracheal intubation* (core term), + *awake* (qualifier)

and

*nasal tracheal intubation* (core term), + *awake* (qualifier)

to avoid losing the expression "*awake intubation*" completely.

Also the term "*oxygen saturation*" can have the following qualifiers:

*arterial*

*venous*

*mixed venous*

*peripheral*

If the term is created as such i.e. *oxygen saturation* + qualifier, then it is difficult to put in the abbreviations which anaesthetists may use to record such a parameter e.g. $SaO_2$. If the core terms become

*arterial oxygen saturation*

*venous oxygen saturation*

*mixed venous oxygen saturation*

*peripheral oxygen saturation*

then the abbreviations become simple to add in to the thesaurus. This method is not "pure", in that the core terms are not as short as they could possibly be, but the result is more useful to anaesthetists. A balance has to be struck between the usefulness of terms and the length of terms in a core term / qualifier structure.

The distillation of terms into core terms and qualifiers is not straightforward. The advantages with respect to ease of use of the core terms / qualifiers, especially in a computer-based thesaurus outweigh the disadvantages. If this system is not adopted, then terms become too long and unwieldy. The number of terms becomes too great to be used quickly and accurately. However, the terms which act as the foundations of this system need careful consideration and thought in their creation.

## 2:5 The Use of Contextual Information

Contextual information is that which allows the recipient of the information to create a fuller picture of what is being described. This is especially necessary for the recording of medical notes, including anaesthetic records. The addition of contextual information is second nature in written and spoken language, and is often done without thought. Written and spoken language is also very flexible and subtle; different meanings can be conveyed merely by the position of words in a sentence. To use an example with just two words, "possible" and "hypoparathyroidism".

*"Possible hypoparathyroidism"* means that a diagnosis is being suggested.

*"Hypoparathyroidism possible"* may refer to the likelihood of post-thyroidectomy

complications occurring.

Using this example, it is difficult to design a system using terms to overcome this problem. If a system of qualifiers is to be contemplated, then the above would be recorded as *"Hypoparathyroidism, [degree of certainty: possible]"*, and this would not differentiate between the two meanings mentioned above. If however, additional items of information can be added i.e. contextual information, then the intended meaning will become clearer.

Hence the alternatives are

*"Possible hypoparathyroidism"*, context : diagnosis (i.e. current situation)

*"Possible hypoparathyroidism"*, or *"Hypoparathyroidism possible"* context : post-operative complication (i.e. still a diagnosis but predicted in the future.)

There are two areas in an anaesthetic record where the use of contextual information would be particularly useful: these are the concepts of measurement vs. monitoring, and critical incident recording.

2:5:1 Measurement and monitoring

Anaesthetists monitor their patients during and after an anaesthetic to check on the patient's well-being. By doing so, the anaesthetist may get some warning that problems may be developing. The anaesthetist may use various measured paramters e.g. oxygen saturation, and use these measured parameters to help him or her monitor. Monitoring can therefore be considered to be a separate procedure to measurement, although making measurements may play a part in the

monitoring process.

During an anaesthetic, a patient may have the peripheral oxygen saturation measured, and the result recorded. The anaesthetist may then wish to request that the patient have peripheral oxygen saturation monitoring post-operatively. The same parameter *peripheral oxygen saturation* is being used, but in a different context. Thus contextual information is required to differentiate between the measurement and the monitoring of a parameter.

It may be necessary to have a series of terms which say
*"ECG monitoring", "blood pressure monitoring", "Inspired oxygen concentration monitoring"* etc., and also a series of terms for measurement *"ECG measurement [rate]"*, or *"Blood pressure measurement [120/80 mmHg]"*. Alternatively, the addition of contextual information to a more basic parameter term may suffice. For example

parameter: *end-tidal carbon dioxide*
context: *measurement* or *monitoring*

Either way, the facility to differentiate between measurement and monitoring is required.

### 2:5:2 Critical incidents

It is necessary for anaesthetists to be able to record untoward events during an anaesthetic. Some of these events may be interpreted as "critical incidents". These events may have a significant morbidity. It may be possible to learn from these incidents. They may also be subject to medico-legal review. It is imperative then, that as much information as possible is recorded about such an incident.

An example can be used to illustrate this point: during a general anaesthetic, the catheter mount may become disconnected from the breathing system. This may be automatically recorded by the measurement / monitoring system as a sudden loss of both the airways pressure trace and the capnograph tracing. This will then appear on the anaesthetic record as a breathing system disconnection. For subsequent accurate analysis of this event, additional information is required: the disconnection may have been either accidental or deliberate; the disconnection may have been spotted immediately or may not; there may have been a contributing factor, such as movementof the patient by the surgeon; there may be related sequelae of the event, such as hypoxia. All these additional items of information put the event into context, and so the facility must be available to qualify any term in the thesaurus with contextual information. (A fuller description of the types of contextual information that can be added can be found in section 2:8:7 "Events and complications".)

## 2:6 The use of pre-existing standard terms

Anaesthesia is a subject which touches upon many other medical specialties. An anaesthetic has effects upon every system in the body. It is not surprising then that any standard set of terms will use terms which would be of use to other specialties. The areas of overlap are apparent from the discussion into the content of a thesaurus later in this section (section 2:8).

Although it is possible to attempt to write a thesaurus of terms which are purely of use to anaesthetists, the use of the terms would be enhanced by incorporating the terms into a larger set of terms which could be used by other, and possibly all medical specialties. The wider the scope of a set of terms, the easier it would be to introduce the terms in a computer system throughout a hospital, and throughout a health service. As anaesthesia is moving towards an electronic

patient record, then it is conceivable that the rest of the medical record may also be electronic / computer-based in the future. To create a set of terms for the whole of medicine is no small undertaking, and to avoid inconsistencies in term-writing, and term-structure, then close co-operation is required between specialties. Just as anaesthesia draws on terminology which may be normally part of another specialty, then other speciaities may use terms more associated with anaesthesia.

It is possible to question whether overlap between specialties' terms matters: so long as the terms required for anaesthetists are present in a set named "Anaesthesia terms", then that is all that is necessary. This approach is easier to organise, but it does remove one of the advantges of having a computerised system in the first place. One of the strengths of a computer is that it can store and retrieve large amounts of information quickly. This information can be used for many purposes, such as audit, costings, administration of stores etc. This process is enhanced by computer coding of these terms. As anaesthetic departments do not exist in a vacuum, but are part of a hospital management and finance structure, it would be very short-sighted to create a set of terms exclusively for anaesthetists in a form which would not be compatible for use by other medical, nursing and administrative staff.

If two or more specialties simultaneously are creating sets of terms for a thesaurus, then to avoid repetition of work, certain topics can be delegated to one or other specific specialty group i.e. "areas of prime responsibility". The delegated specialty can then produce suitable terms, and pass them onto the other group for approval and/or criticism, so that each group has its own needs addressed. This can be difficult to administer, but is possible.

Different medical specialties look upon the same medical concept in different

ways. For example, the examination of an open mouth has different connotations for an ENT surgeon or a dental surgeon than an anaesthetist. So for terms concerning the examination of the mouth, written probably by the dental surgeons, terms will need to be added to ensure that the anaesthetist's view point is catered for e.g
*"examination of open mouth - difficult intubation predicted"*. There are cases where other specialties will use terms normally in the province of anaesthesia. For example, airway maintenace is most commonly performed by anaesthetists, but the doctor in an Accident and Emergency department will want access to these terms. The same may apply to surgeons who use sedative techniques.

On occasion different groups may use the same term in different contexts. This may or may not matter. A cardiac surgeon may see the cannulation of the superior vena cava in a different light to the anaesthetist, but the use of qualifiers for the method of cannulation or the approach used, should differentiate between the two concepts. Contextual information is especially useful here i.e.

core term: *cannulation (of superior vena cava)*

context: *for monitoring* or *for cardiopulmonary bypass*

A problem may arise when the number of procedures performed is analysed e.g. for costing, or audit. If only one term *"Direct laryngoscopy"* exists, and is shared between anaesthetists and ENT surgeons, then confusion may arise. It may become impossible to decide whether, out of 50 direct laryngoscopies performed, the ENT surgeons had done 10 direct laryngoscopies and the anaesthetists 40. Such inaccuracies now have great implications in the funding of departments in today's Health Service. Again, contextual information is required.

If a standard set of terms for anaesthesia is to be incorporated into a larger set of terms, then the anaesthetic terms required by another specialty may not need to be as specific. For example, a surgeon may merely wish to record that the operation he has just performed was carried out under a general anaesthetic, and require no more anaesthetic information than that. Consequently, when constructing a standard set of terms, then very basic terms are required to satisfy the needs of the "generalist" as well as the "specialist".

### 2:6:1 The use of existing classifications

There are in existence already a number of nationally accepted sets of terminology. These have already been been reviewed earlier in Section 1: for example, The Office of Population Censuses and Surveys Tabular List of the Classification of Surgical Operations and Procedures [Fourth Revsion] [OPCS 4] [3], the International Classification of Diseases and Health Related Problems [ICD] [5], and the British National Formulary[6].

As some of these systems are already used for statistical purposes, it would be advantageous to use these systems and incorporate them into a thesaurus for anaesthesia. Then any new system of terms to be used will be able to be "slotted in" alongside the existing system. However, there are problems associated with this approach. These are:

1. The lack of anaesthetic-specific terms or sections in these classifications;
The lack of anaesthetic terms in some of these classifications is to some extent an advantage. It liberates the writer of anaesthetic terms from having to adapt terms to fit in with other lists. If there are few terms, it becomes difficult to match the classification terms with the new terms, as the way that the existing term is

written may bear little resemblance to the structure of the new terms.

2. The inappropriateness of some of the anaesthetic-related terms present;
For example, the latest revision of ICD, ICD 10 [7], reflects the historical connection with data collection for pregnancy-related problems, but there are no terms for complications of anaesthesia at other specified times. It is therefore difficult to write terms for a new thesaurus in a logical manner and take into account the sporadic nature of these existing terms.

3. The language and wording used in these classifications.
The language in which the existing terms are written may be extremely stylised, and intended only for use in such a classification. For example, the terms for general anaesthesia in OPCS 4 read as follows:

*General anaesthetic*

> *Inhalation anaesthetic using muscle relaxant*
> *Inhalation anaesthetic using endotracheal intubation, not elsewhere classified*
> *Inhalation anaesthetic, not elsewhere classified*
> *Intravenous anaesthetic, not elsewhere classified*
> *Other specified general anaesthetic*
> *Unspecified general anaesthetic*

Most of these terms would not be used normally in medical or anaesthetic records. They are non-specific, and do not allow the addition of essential extra information.

There remains the problem of how to resolve the incompatibility of these existing

OPCS 4 and ICD 10 terms, and a proposed new standard set of anaesthetic terms. Fortunately, there are few terms to worry about, and because of this, it is justifed to omit these terms altogether. To allow statistical returns to be made, it is necessary to say which of the new terms matches most closely with an existing term. (The mechanism of cross-referring codes is discussed in Section 1:4.)This means that the nearest cross-reference of new term will be to the general "other specifed" - type terms. For example, a general anaesthetic with an intravenous induction, and inhalational maintenance would cross-refer to the OPCS term *"other specified general anaesthetic"*. It is therefore more sensible to restrict any new thesaurus of terms to clinically-useful terms only.

## 2:7 The Updating and Editing of Terms

Anaesthesia, along with the rest of medicine, is a constantly evolving subject. It follows then, that as new techniques evolve, new terms will become necessary. Similarly, new drugs and new items of equipment will appear. These too will need new terms.

It is impossible for the author of a standard thesaurus of terms to have included every single possible term that may be used by the anaesthetist, despite quality assurance tests [see section 3:1]. There are so many terms. Also, after a period of use, it may become apparent, for example, that the wording of a term is not correct, and a more suitable version may be suggested. The meaning of a term may also eventually change with time.

For the continued successful use of a standard set of terms, there will need to be a mechanism for correcting terms, updating terms and adding or deleting terms. Also some terms will become obsolete. There will also need to be a mechanism for the collection of users' opinions i.e. "feedback", perhaps using a reporting

system similar to the "Yellow card" system used by the Committee on Safety of Medicines [8]. This will require a central, responsible co-ordinating body, with the necessary authority and financial support.

It is very important that the mechanism for updating and editing terms is in place even as the thesaurus is created and published. Confusion will occur if there is undue delay between comments and criticism being received, and action taken to correct any errors and omissions.

## 2:8 The Content of the thesaurus

Probably the easiest starting point for consideration of the content of a thesaurus of terms is to examine exactly what anaesthetists record at present. This varies from anaesthetist to anaesthetist, and also from hospital to hospital. Each hospital has a different anaesthetic record sheet. These anaesthetic sheets influence what is recorded, as they guide the recording of information by having areas on the sheet specific to certain topics. For example, if a record sheet has an area or box for the recording of ventilator parameters, then the box acts as a reminder to the anaesthetist. If the area for recording of ventilator parameters is sub-divided e.g. tidal volume, then this too will influence what is recorded.

There is no such thing as an "average" anaesthetic record sheet; there is as yet no standard. What is recorded is this section is very variable in its content, although the Royal College of Anaesthetists has accepted a minimum dataset [9]. (See also Section 1:2:1.) An anaesthetic sheet may have areas to record such details as:

- patient information e.g name, age, date of birth, ward, hospital number
  date of operation
  personnel involved in theatre procedure e.g. anaesthetist, surgeon

operation performed

[These could be considered as "organizational", or "administrative" details.]

- There is usually a space to record pre-operative assessment.This may involve recording details concerning

    history

        general

        anaesthetic, including previous complications

    examination

    investigations

- There are often areas on an anaesthetic record sheet to describe common anaesthetic procedures e.g. endotracheal intubation, cannulation, general and local anaesthetic techniques. Equipment terminology, and drug names are often used in these sections.

- Drugs, and drug administration, including intravenous fluids often have sections to themselves on anaesthetic record sheets.

- Much of the information recorded on an anaesthetic record sheet involves patient physiological parameters, the "vital signs"; e.g. blood pressure, heart rate, oxygen saturation. These can be thought of as measurements. These measurements may also be derived from equipment e.g ventilator rate.

- The position of the patient is often recorded. These positions are often anatomical terms e.g. supine, prone.

- There is often a space on the anaesthetic record sheet for the recording of events or complications which the anaesthetist sees fit to include.

Anaesthetists do not only write on anaesthetic record sheets. Pre-operative and post-operative assessments and instructions may be written in conventional medical notes instead of on anaesthetic record sheets. On occasion, details of an anaesthetic or sedative procedure may be written in the notes. Information from the Pain Clinic may be written in the patient's notes. Similarly, the record of a patient's stay in intensive care may be made in the medical notes, and not on a separate special sheet.

This is an outline of the way that anaesthetists record information. It gives an idea of how terms for a standard thesaurus may be grouped together. Grouping terms allows a more logical and consistent approach in the creation of terms by providing a framework. Following on from the examples given above, the following headings or groups of terms can now be considered:

Procedures (including equipment)
History terms; symptoms and diagnoses
Examination terms; clinical signs; anatomical terms
Drugs and drug administration
Measurements and investigations
Administration terms
Events and complications
Equipment terms

### 2:8:1 Procedure terms

Anaesthetists perform many procedures during the course of the administration of an anaesthetic. Some of them are performed so frequently that they do not normally warrant a mention on an anaesthetic record sheet. For example, the endotracheal tube is normally secured after insertion into the patient; this procedure is not normally recorded. If later some mishap occurs and the tube is dislodged, then the method of securing may need to be recorded. This illustrates that a list of procedure terms needs to be comprehensive. The resulting list of terms may then be "dry" and pedantic, and a literal-minded approach to the creation of terms becomes necessary.

The administration of an anaesthetic involves many procedures. These may include

Administration of general anaesthetic [induction, maintenance, reversal]
Airway control and maintenance
Monitoring
Positioning

The way that terms can be created to cover the needs of anaesthetic records can now be examined, with reference to the subheadings outlined above.

i) <u>General anaesthesia - related terms</u>

These are commonly used core terms, and are often subject to abbreviation and short-hand terminology. The required terms can be built up in a hierarchical, logical fashion.
Although each term produced can be used on its own, it is easier to create terms if

they are fashioned in some sort of order. There will also be fewer omissions.

For each category, there needs to be a base term. In this case, the term will be

*General anaesthesia*. This term needs to have an abbreviation as it is commonly written as *GA*.

This term may not be used by anaesthetists themselves, but is commonly used by other medical and theatre staff; for example, in theatre records. It also makes recovery of data easier, if for example, the total number of general anaesthetics given in a time period is required.

The next "level" of term which can be produced relates to the common sub-divisions of general anaesthesia i.e. induction, maintenance and reversal.

For the example of induction:
It is possible to merely have a term which says *Induction of general anaesthesia*. This is itself a useful term. If it is recorded, along with the time of induction, it marks the beginning of the anaesthetic. Further information could then be added as qualifiers to show the route of induction ;

Hence

*Induction of anaesthesia* Route: *Intravenous*
*Intramuscular*
*Inhalational*

However, this approach does not allow for commonly used synonymous terms, such as *gas induction*, or for further subdivisions of these terms e.g. *rapid*

*sequence induction* as a variant of intravenous induction. In addition, terms such as *Inhalational induction* are commonly used.

A series of core terms can now be built up and arranged as a hierarchy. So, a proposed hierarchy of core terms could be

*General anaesthesia*

*Induction of general anaesthesia*

*Intravenous induction of general anaesthesia*

*Rapid sequence induction*

*Intramuscular induction of general anaesthesia*

*Inhalational induction of general anaesthesia*

*Single breath inhalational induction*

*Multiple breath inhalational induction*

As already mentioned, the use of synonyms and abbreviations greatly increases the usefulness and acceptability of terms. It is much simpler for a user of terms to type onto a computer *iv induction*,or *RSI* instead of rapid sequence induction. Similarly, *gas induction* may be preferred by some anaesthetists. It is not possible for the author of terms such as these to enforce on all anaesthetists certain prescribed terms when alternatives are very much in use in everyday practice.

Some balance must be struck in the number of levels of hierarchies. If too few are used, terms will be lost. If too many are used, then terms may become difficult to find. It must be kept in mind that terms must be clinically-useful, and that qualifying terms may be useful.

For all the terms relating to induction above, the drug and dose of the drug used in the induction could be qualifying information e.g.

*Intravenous induction* Qualified by: *Propofol, 200mg*

Many anaesthetists do not routinely record "induction" as such, and rely on the recording of the administration of a drug or drugs to signify induction. This is common practice at present, but if electronic continous anaesthetic record keeping systems are used, then it is more practical to press a button at the allotted time to record "induction", and then add details about drugs at a later, more convenient time.

Many anaesthetic procedures involve the injection of drugs and other therapeutic substances by various means. [Regional and local anaesthesia is a good example of this.] A functional system of terms for anaesthetists cannot be created without terms to describe drugs, drug dosages and means of drug administration (see Section 2:8:4).

Terms for maintenance, and reversal /cessation of anaesthesia can be created in a similar fashion as for induction. Sedation procedures are similar in nature to general anaesthesia terms, and can be created in a similar way.

ii) Airway procedures

Anaesthetists specialize in procedures associated with the airway, although it is not their exclusive preserve, unlike general anaesthesia. This should be borne in mind, as non-anaesthetists may want to use some of these terms.

Unlike terms for general anaesthesia, airway procedures are not as amenable to following branching hierarchies. They tend to be a set of separate procedures, which although they are related to the airway, do not necessarily follow on from each other. It becomes easier to think in a more "chronological" fashion in deciding the type of terms to create. For example, after the induction of a general anaesthetic, the anaesthetist maintains the airway manually e.g. by lifting the chin, or extending the head on the neck. The anaesthetist may consider then inserting an airway of some description, or performing a direct laryngoscopy and intubating the trachea. This leads to terms such as;

*Chin lift*
*Jaw thrust*
*Airway insertion*
*Tracheal intubation*

Care must be taken not to stray from the original theme of airway procedures; attaching a capnograph monitor may be the next step in normal practice, but it is not an airway procedure.

Again, qualifying terms are useful: e.g.

Core term: *Laryngeal mask airway insertion* Qualified by: *Size 3*

Tracheal intubation has the scope for many qualifying terms to be added. The route of intubation can be added, such as nasotracheal intubation, the type of tube can be recorded, and whether or not an introducer is used during the intubation. Thus very important information can be carried as qualifying terms.

Just as much information about a general anaesthetic is written in terms of drugs and drug administration, many procedures around the airway are written in terms of equipment. For example, an anaesthetist may not actually record that a *tracheal intubation was performed*, but may write *8.0 cuffed armoured oral endotracheal tube*. This is of course not a record of a procedure when written in this way. As for induction of anaesthesia, electronic records will require a near-simultaneous recording of the procedure, and so a term for tracheal intubation will be required. Detail about tube size can always be added later. Cannulation of arteries and veins is also often recorded in terms of equipment e.g. *16G Venflon inserted.*

It can be seen now that drug-related and equipment-related terms are of great importance to the creation of useful anaesthetic terms.

When a large number of qualifiers can be assigned to a single core term, care must be taken that inappropriate qualifers are not connected to terms. For example, a tracheal intubation via the nose, cannot have *Introducer: rigid bronchoscope*, whereas tracheal intubation via the mouth can.

Other topics can be considered under airway procedures. These include:

Endobronchial intubation
Insertion of devices such as throat packs, mouth guards
Intentional lung collapse and expansion

Toilet and suction of all parts of the airway

Removal of devices from the airway, including tracheal extubation.

iii) Monitoring

There is some debate as to whether or not monitoring is actually a procedure that is recorded, or whether it is merely the context in which a measurement is made (see Section 2:5:1). However, monitoring terms are used by anaesthetists, and therefore should be included in some form in the thesaurus e.g patient requires *continuous ECG monitoring*. It becomes difficult to decide how many monitoring terms to create. Blood pressure monitoring is a useful term, as blood pressure is commonly monitored. There are many other parameters that can be measured during an anaesthetic: the expired fraction of oxygen can easily be measured by anaesthetic gas monitors, but is not usually recorded as being "monitored". To avoid inconsistencies, however, it is better to provide terms for even the less-commonly used parameters.

iv) Positioning of the patient

Terms to describe the position of a patient during an anaesthetic procedure can take two forms. The patient can be described as being *head up*, or having their *arm out* or *arm abducted*. Alternatively, it is possible to describe the act of positioning the patient i.e. *patient positioned in lithotomy position*. To describe a position of a patient requires either standard anatomical terms, or specific surgical/anaesthetic terms e.g. *knee-chest position*. Creating a list of all possible anatomical terms is a huge task, as there is a great array of possible positions. For anaesthetic purposes, the positions needed to be described are fortunately not as many as some other specialities e.g.orthopaedics, although there are some areas

of overlap.

If purely anatomical terms are used, however, it becomes more difficult to record complications of a patient having been positioned in a certain way e.g lithotomy position. This may be circumvented by having a term saying *patient injured during positioning procedure*, and then having the position as a qualifying term if required.

Another use of anatomical terms in anaesthesia involves the positioning of cannulae. These need a mixture of specific terms e.g. *internal jugular vein*, and less specific terms e.g. *vein on dorsum of hand.*

Terms for procedures form a large and important part of a thesaurus of terms. However, it must be emphasised that their usefulness for recording information is often reliant on other terms especially those relating to drugs and equipment.

The procedure terms illustrated above were written by the Anaesthetic Specialty Working Group. There are other procedures involved in the administration of an anaesthetic. These include:

cannulation
ventilation of the patient
administration of drugs and fluids
the care of the unconscious patient
the administration of local and regional anaesthesia
miscellaneous procedures e.g. insertion of nasogastric tube.

Terms to cover these procedures were considered by the Anaesthetic SWG, but the group did not have prime responsibilty for these terms (see section 2:6).

Terms for cannulation and drug administration were written by the NHSCCC, taking into account suggestions from various SWGs. The terms for the care of the unconscious patient were created by Nursing groups, and the terms for local and regional anaesthesia were written by the Intensive Care SWG. Terms to describe miscellaneous procedures were forwarded to the most appropriate group e.g. nasogastric tube insertion was dealt with by the Gastrointestinal SWG. Suggestions were made by the Anaesthetic SWG to all these groups, so that the terms would be suitable for use by anaesthetists.

### 2:8:2 History Terms; Symptoms and Diagnoses

Anaesthesia has very few, if any "diseases" of its own. [Pain-related disorders may be seen by anaesthetists in a Pain clinic, but they are not anaesthetic in the way that a lung tumour is a respiratory disease.] There are a number of disorders which do not usually manifest themseleves except under anaesthesia, e.g. malignant hyperpyrexia, but they are really primarily disorders of various body systems.

This poses a problem to the creator of a standard set of terms for anaesthesia. A patient may have any one of thousands of medical disorders, and these diseases will need to be noted at the time of pre-operative assessment. Whether or not the disorder has direct relevance to anaesthetic practice is really a matter for the anaesthetist assessing the patient to decide, and so the facility to record all disorders should really be available. This is a enormous list, and may not be practicable for an author to write. The alternative is for only the commonly encountered, and important disorders to be included in a thesaurus. The decision as to which disorders to include and which to omit would be very difficult, and the result would not be comprehensive.

Are there alternative approaches ? There appear to be two other approaches. One is to allow other specialties to create similar lists of disorders of particular relevance to their specialty. The anaesthetist could then pick terms from these lists as required. The lists of terms from other specialties would need to be in the same format as the anaesthetic terms thesaurus. In addition this makes the total number of terms grow considerably, and requires a computer system to be able to handle all the terms at a reasonable speed.

Also, the emphasis placed on different disorders by specialities varies, and so "general" as well as specific terms will be required. It may be possible to simplify such large lists of terms by having a "sub-set" of anaesthetically-useful terms extracted from larger lists. These could then be placed in an anaesthetic record keeping software system, but at the same time, still have access to the large lists for less-commonly used terms for rarer disorders. The content of such a subset would be decided from analysis of which terms are commonly used.

Another approach is to use existing terms from classifications of diseases. The internationally-accepted classification is the International Classification of Diseases [ICD] [5], published by the World Health Organisation. This has terms which cover many of the diagnostic terms relevant to anaesthesia, and these terms could be used. However, there are problems with the language that ICD uses, and these are outlined elsewhere (Section 2:6:1). In addition, history terms of direct relevance to anaesthesia such as *Severe post-operative nausea and vomiting*, or *Post-dural puncture headache* are not included. The ICD documents can form a basis of a series of terms for use in creating a thesaurus of terms, but they are not enough on their own. The former approach, (the anaesthesia subset within a large set of terms) is the most practicable and the most comprehensive. It is the approach that has been adopted by the Anaesthetic SWG.

The subject of context is discussed more fully in Section 2:5, but it is worth pointing out here that "history" could be either past-history [e.g. *past history of anaphylactic reaction to thiopentone*], or "present" history [ *one hour history of sudden onset chest pain* i.e. still present]. Both are considered as history terms, although their context in terms of time are different.

### 2:8:3 Examination terms

As with history terms, examination terms derive from different specialties, as the examination technique and diagnosis tends to be centred around different body systems. The recording of the pre-operative examination may be either generalised, based on a diagnosis e.g. *evidence of hyperthyroidism*, or it may be more specific, such as *tachycardia, tremor, sweaty palms* etc.

The method of recording examination findings is formalised already, as this is the method taught at medical schools e.g. *fine bilateral basal inspiratory crackles heard*, rather than *crackles were heard at the bases of both lungs; these crackles were fine in intensity, and were heard in inspiration.* This formalisation does make standard term writing easier, and creates shorter terms.

Examination terms also make use of anatomical language. Anatomical positions are standardised: this makes the creation of terms to describe the position of limbs during anaesthesia for example, easier. The system of "qualifiers" is especially useful here, e.g for adding the number of degrees an arm was abducted during anaesthesia.

So, it it is relatively easy to create a standard set of terms for examination findings, as the same method of examination, and recording exists for the whole

of clinical practice. (It may be easier to have "method" and "findings" terms in separate hierarchies for ease of use.) There are however some instances where the interpretation of the findings carries more weight, particularly for anaesthesia. It is the method of assigning interpretation to findings that is more difficult. If the findings on examination may be summed up as a diagnosis; this is relatively simple to create terms for e.g. *evidence of congestive cardiac failure*. The recording of an interpretation of findings is more difficult, and more specific. For example, the recording by an anaesthetist of the findings of open mouth examination may say *poor mouth opening*, or *Malampatti grade 4*, or *difficult intubation predicted*. It is these interpretations of findings, which are not diagnoses per se, but which are recorded by anaesthetists, that are more difficult to write. Again, contextual information is required to distinguish between the interpretation of for example, dilated pupil during a general anaesthetic, after a head injury, or after a cardiac arrest.

### 2:8:4 Drugs and drug administration

This topic has already been mentioned under "Procedures" (Section 2:8).

The following need to be considered for inclusion in a set ot terms:

i) The name of the drug

It is not difficult to collect a set of drug names, as these already exist in the British National Formulary [6]. It may be necessary to include some drugs which are not available generally. These may include such drugs as cyclopropane, which are still used on occasion. In addition, if the terms were to be used outside of the United Kingdom, the drugs available for use, or their names may be different.

ii) The amount of the drug given

This can be expressed in different ways, and so this needs to be taken into account; e.g. 200 mg, 10 ml of 0.5% solution, 10 ml of 1 in 10,000 solution. Some anaesthetists create solution strengths by mixing or diluting drugs e.g. 0.375% bupivacaine. These concentrations do not appear in the British National Formulary.

iii). The route of administration

Abbreviations are especially common e.g. *i.m. injection*

iv) The anatomical site of the administration.

v) The control of administration

It may be necessary to have terms to describe the method or control of the drug administration. This may include such terms as *slow [intravenous injection], under X-ray control*, or *under closed-loop control.*

The facility to add new terms is especially important, in the ever-changing world of pharmacology.

### 2:8:5 Measurement terms

During the course of an anaesthetic, many measurements are made, by automated machines, and by the anaesthetist. Some of these measurements are recorded onto

the anaesthetic record sheet, and some not. At present, most recordings are made manually, the frequency of recording depending on the individual anaesthetist. Automated anaesthetic recording devices tend to make more frequent recordings, and also to record more variables. The measuring device is often connected electronically to the recording machine.

The measurements of variables is also of interest to anaesthetists in the pre-operative and post-operative care of patients e.g. blood results, post-operative observations.

To create terms to allow measurements to be recorded by an electronic record system, the following types of terms need to be considered.

1. Variable to be measured

Not surprisingly, there are many variables that can be measured by anaesthetists before during and after an anaesthetic. These tend to be self-explanatory e.g. *systolic blood pressure*, *cardiac output*, *inspired fraction of oxygen*. This list also includes analytes from the chemical pathology and haematology laboratories. Synonyms and abbreviations in particular are commonly used, and need to be included.

2. The value measured

This is the value of the variable measured, and is usually expressed as a number. As there are an infinite number of numbers, this poses a slight problem for the creation of terms, in that there needs to be some means of attaching a parameter to a value. If not then there will have to be a whole series of terms which say *systolic blood pressure of 120 [mmHg]*, *systolic blood pressure of 121 [mmHg]*,

etc. It is obviously better to have a single term which says *systolic blood pressure*, and then attach a number to it.

3. The units of the value measured

This is the ability to add, for example, *millimetres of mercury* or *kiloPascals* to the parameter and its value. The system of qualifiers is especially useful in the field of measurement recording terms as it allows the progressive build up of important information based around the parameter term. Standard terms are already available for units.

4. Additional information

Further qualifying information is often of use. This may include the time of recording, the method of recording [e.g. *by non-invasive cuff*, *direct measurement* etc.], and the position of the measuring device [e.g. *on the arm*, *on the leg*, *in the radial artery* etc.] It may be necessary to record the measuring device as the source of the information, and this will require equipment terms.

5. The interpretation of the measurement

It is important to be able to comment on results of measurements. An example in the field of anaesthetic records is the artefactual or erroneous reading. These measurements are common, and are often caused by interference e.g. from the diathermy current. As these readings are automatically recorded by electronic record systems, a parameter with its value needs to be able to be qualified by "*artefact*" if neccesary. General qualifying terms such as *high*, *low*, *abnormal* etc. are also useful.

6. The relationship between examination and measurement

In terms of writing standard terms, it does not matter whether the measurement of blood pressure is considered to be part of physical examination or as a separate measurement. It does become more important if the author of the terms is trying to design a general framework in which parameters can be easily attached to their qualifiers. If some parameters are scattered into different sections of the thesaurus, they become more difficult to organise. This especially applies if the terms are to be coded in a logical manner.

7. The relationship between measurements and monitoring

This is discussed under "Contextual information", section 2:5.

### 2:8:6 Administration terms

These terms are commonly used already, in theatre management systems. There is also a place for their use in anaesthetic records. Examples are given below:

1. Patient details; to allow recording of patient identity, and the addition of demographic details.

2. Operation proposed and/or performed

3. Personnel involved e.g. the anaesthetist giving the anaesthetic, or who assessed the patient pre-operatively. Anaesthetic assistance can also be recorded.

4. The place where a procedure took place e.g. in theatre, on the ward etc.

5. The time at which a procedure or event took place. It may be neccessary to record retrospectively, as it may not be practicable to record at the time that an event took place. There needs to be the facility for this to be done.

6. Miscellaneous e.g. whether the procedure was elective or urgent. This could be based on the NCEPOD classification [10].

### 2:8:7 Events and Complications

It is necessary to record incidents or events which deviate from the norm. It is also necessary to record events that are part of the normal process, but have special significance e.g. *aortic cross-clamp on*. This record gives useful information to medical personnel who may treat the patient subsequently. In addition, accurate recording of complications and events is vital from the medico-legal standpoint.

There appear to be four different categories of events [11];

i) Significant events which are part of normal practice e.g. *primary incision* or *knife to skin.*

ii) Minor events:

These events show deviation from the expected normal, but are not considered significant in either their severity or outcome. They are often transient in nature, and may be predictable. An example of such an event could be the transient

hypotension which occurs after the injection of protamine; the arterial blood pressure may dip and thus be recorded. The anaesthetist may wish to record this blood pressure drop as being related to the injection. If the hypotension readily corrects itself, and no patient harm is anticipated, then the event is deemed to be minor, but may be worthy of note.

iii) Critical Incident:

The concept of the critical incident has been applied to anaesthesia since Cooper and colleagues [12] adapted the Critical Incident Reporting Technique [13]. It is readily accepted as being part of the recording of anaesthetic practice, and warrants a separate chapter in the Royal College of Anaesthetists' Log Book [14]. However, there is no universally-accepted definition of a "critical incident", and the consequences of this are discussed below.

iv) Complication:

This can be considered as an undesirable condition or diagnosis which results from medical care, or of another medical condition.

These categories have "blurred edges", and separating event terms into one of these categories may be difficult. It can be questioned if it matters whether an untoward event needs to be labelled into any particular category; however the concept of the critical incident is so fixed in anaesthesia, that the ability to record any event as such is required.

Many untoward events which occur in practice are closely related to each other in that they follow in a sequence. It may be desirable to analyse such a sequence of events retrospectively, e.g. for teaching purposes, and to identify critical incidents,

factors which contribute to critical incidents, and complications which may have resulted. The anaesthetist present at the time of the event is the person who can interpret these events most accurately.

The need to record untoward events in patient care is accepted by anaesthetists. Consequently, any attempt to create a standard thesaurus of terms to be used by anaesthetists must contain terms to be able to record these events. The content of such a list can now be considered.

A suitable starting point for consideration of the content of such a list of terms is to examine the defintions of the categories already mentioned. To decide what sort of terms should be created, then the writer needs to know his terms of reference. The original definition of a Critical Incident, given by Cooper and colleagues [12] is as follows: "A mishap was labelled a critical incident when it was clearly an occurrence that could have led (if not discovered or corrected in time) or did lead to an undesirable outcome, ranging from increased length of hospital stay to death or permament disability." The event also had to have the following characteristics:

i) "it involved an error by a member of the anaesthesia team or a failure of the anaesthetist's equipment to function properly;

ii) it occurred at a time when the patient was under the care of an anaesthetist;

iii) it was described in clear detail by a person who either observed or was involved in the incident;

iv) it was clearly preventable."

Upon closer examination of this definition, the phrase "*clearly an occurrence that could have led*" creates problems for the would-be term writer. There are many instances in anaesthetic practice where a complication or event takes place, and the majority of these events do the patient no harm at all. To use an example, a

blood vessel puncture whilst inserting an epidural rarely causes harm, and most anaesthetists would not consider this to be a critical incident. However, as an epidural haematoma may possibly, albeit rarely, ensue, should all epidural blood vessel punctures be classified as critical incidents? (The word "clearly" is too imprecise.)

Other definitions have been put forward. The Royal College of Anaesthetists minimum dataset has the following definition, put forward by the Society for Computing and Technology in Anaesthesia, such that an event is a critical incident when the event is "one which does not necessarily lead to harm, but which would or could do so if left to progress." [11] This definition is simpler, but open to much wider interpretation.

This confusion as to what is or is not a critical incident does not help the writer of terms who is trying to decide which terms need to be included in a standard set of terms. The same problem occurs when trying to decide what are minor events. Very often, it is the same underlying problem which may be either a more minor event or a critical incident, depending upon the degree of severity. For example, a term saying "*hypotension*" is of little help in the recording of untoward events: further information to qualify the terms is needed, to give some idea of severity or duration.

A solution to this problem can be found in the use of qualifying terms. (This mechanism has already been outlined, in Section 2:4) The proposal of the Anaesthetic Specialty Working Group, Clinical Terms Project has been outlined by Banks and Tackley [11] . They proposed a single list of terms, headed "Untoward Events in Patient Care", and suggested that the terms in this list have qualifying terms available to add further information. This list would contain terms which can be categorised into critical incident, complication or contributing

factor, as the recorder of the event felt fit. Other additional and useful information could also be recorded. The qualifying [attribute / value pairs] terms which they suggest are as follows:

| ATTRIBUTE | VALUE |
|---|---|
| Timing of event | *Pre-operative* |
| | *At induction* |
| | *Intra-operative* |
| | *During recovery* |
| | *Post operative* |
| | *Actual time* |
| Time to recognition of event | *Immediate recognition* |
| | *Delayed recognition* |
| Type of event | *Complication* |
| | *Critical incident* |
| | *Contributing factor to other event* |
| Severity of event | *Grade 1- transient abnormality unnoticed by patient* |
| | *Grade 2 - transient damage with full recovery* |
| | *Grade 3 - potentially permanent but not disabling damage* |
| | *Grade 4 - potentially disabling damage* |
| | *Grade 5 - death* |
| Duration of event | Time value |

Onset of event *Acute*

*Acute on chronic*

To give an example, a term, such as "*dislodgement of tracheal tube*", as a consequence of positioning a patient, could have the following qualifying terms:

Time: *intra-operative, actual time*

Time to recognition: *immediate*

Type of event: *complication* [result of positioning]

*critical incident*

Severity: e.g. *Grade 1*

In this way, a picture of the event is built up. This additional information makes the event more amenable for accurate review for teaching, audit or medico-legal purposes. The following definitions are used in this system:

Critical incident: an event which does not necessarily lead to an undesirable outcome, but which could or would do so if left to progress.

Complication: an undesirable condition or diagnosis of the patient which has resulted from medical care. It may have any grade or severity. It may or may not follow a critical incident.

Contributing factor: a situation, event or condition of the patient which has led, or

could have led to a critical incident or complication in a patient.

The severity scoring system is one devised by Lack [15], and is repeated here:

| | |
|---|---|
| Severity of event | *Grade 1- transient abnormality unnoticed by patient* |
| | *Grade 2 - transient damage with full recovery* |
| | *Grade 3 - potentially permanent but not disabling damage* |
| | *Grade 4 - potentially disabling damage* |
| | *Grade 5 - death* |

The advantage of using this system is that it removes the need for the writer of terms to decide which term should be assigned to a list headed "Critical Incident", which should be simply an "event", and which should be a "Complication". It allows the anaesthetist present at the time to make the judgement as to the grading and severity of the event.

The combination of all possible event terms into one list results in a large list of terms, and these can conveniently be subdivided into sections. The section headings proposed by Banks and Tackley [11] are:

| EVENT HEADINGS | EXAMPLE OF CORE TERM |
|---|---|
| Cardiovascular | *Myocardial infarction* |
| Respiratory | *Tension pneumothorax* |
| Unintended tissue damage | *Tooth knocked out* |
| Musculoskeletal | *Masseter spasm* |
| Neurological | *Recurarisation of patient* |

| | |
|---|---|
| Local anaesthetic | *Total spinal blockade* |
| Haematological | *Transfusion reaction* |
| Metabolic | *Malignant hyperthermia* |
| Gastrointestinal | *Regurgitation of stomach contents* |
| Renal | *Low urine output* |
| Infective | *Transmission of infection from unsterile equipment* |
| Pharmacological | *Wrong drug given* |
| Equipment | *Equipment failure* |
| Pre-operative preparation | *Wrong operation on consent form* |
| Staff problems | *Anaesthetic assistance not available* |
| Hospital problems | *Inadequate post-operative facilities available* |
| Patient problems | *Pre-existing morbidity discovered intra-operatively* |
| Patient positioning | *Patient dropped onto floor during transfer* |
| Anaesthetic | *Inadequate depth of anaesthesia* |

Many of these core term examples use diagnostic terms e.g. *myocardial infarction*, or examination terms e.g. *masseter spasm*. It is necessary to have access to a full thesaurus of terms when recording untoward events.

There are a number of existing lists of terms, such as the Australian Incident Monitoring Study (AIMS)[16], or The International Classification of Diseases [5], but these are not comprehensive, and in the case of ICD, are often specific towards anaesthetic complications of anaesthesia during pregnancy or labour. AIMS, as mentioned in Section 1:4, has only grouping terms e.g. *equipment*

*failure*, *ventilation problems*. ICD has few terms specifically for anaesthesia outside those relating to pregnancy, relying on more non-specific terms such as *poisoning by intravenous anaesthetics*.

In conclusion, it is very difficult to write a standard set of terms for "Critical Incidents" or "complications" alone. The use of suitable qualifying terms may allow one set of terms to be created, and then used in a flexible manner, allowing appropriate recording by the anaesthetist of untoward events.

### 2:8:8 Equipment terms

Equipment terms are commonly used, as already mentioned. Often, these are as qualifying terms e.g. as a source of measurement data, or as an adjunct to a procedure e.g. *insertion cannula; triple lumen*. Both specific terms e.g *Portex tracheal tube* (Portex Ltd., Hythe, Kent), and less-specific terms e.g. *pulmonary artery floatation catheter* need to be included. Specific terms may be needed to specify product liability. Clear organisation of hierarchies of terms is required to make terms easily accessible to the user. As with drugs, the facility for updating terms is especially useful here.

## 2:9 Conclusion for section 2

This section has examined the content of a thesaurus of terms, and the way in which these terms can be written. Can any conclusions be drawn?

A number of points have been raised.

1. The total number of terms which will need to be created is very large. It will not be possible to have standard terms accepted unless they are used in a computerized system. There are far too many terms to be looked up for use in a hand-written system. Only a computer can handle and present such a large number of terms quickly enough to be of practical use. As has been suggested earlier, the standard set of terms then should be designed for use in computers and electronic record keeping systems.

2. The variations in techniques for procedures, the different drugs available, and the vast array of equipment means that the amount of information that can be recorded for each general anaesthetic is also great. The only way of organising this information usefully is via the use of the core term/qualifier system. This requires a certain degree of computer sophistication to be able to present this system to the user anaesthetist.

3. Only terms used in clinical records should be included in the thesaurus. This will often mean abandoning terms presently accepted for central statistical returns.

4. Terms are often meaningless, or open to misinterpretation unless contextual information can be added at the same time to an anaesthetic record. This is vital, especially with respect to the medicolegal aspects of record keeping.

5. Anaesthesia is not a specialty which operates in isolation of other specialties, and of hospital management. Terms should be designed so that they integrate with the needs of other specialties for the benefit of all interested parties. This will enhance the long-term acceptability of a set of terms.

6. The standard system of terms will be much easier to use, and more likely to be acceptable, if synonyms and abbreviations can be easily incorporated into the

system.

7. The difficulty in writing standard terms to cover complications and critical incidents cannot be resolved fully until a suitable definition for critical incident is universally accepted.

It is possible to create a standard set of terms for anaesthesia. There is an enormous amount of work involved in attempting to do so.

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# Section 3

## Further Development of the Standard Set of Terms for Anaesthesia

## Section 3 : Further Development of the Standard Set of Terms for Anaesthesia

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## Section 3:1 Quality Assurance

For the most benefit to be gained from a standardized thesaurus of terms, the terms must be acceptable to the people using them. The quality of the terms must be assessed to check that the terms are correct i.e. the process known as *quality assurance*.

When reviewing terms for their quality, what attributes of the terms should be tested?

a) The term itself.
Does the term make sense? Is its message clear and unambiguous? Is the term easily recognisable, or is the term tortuous in its syntax? Does it have appropriate, correct synonyms and abbreviations? Are its qualifiers correctly assembled?

b) The thesaurus of terms.
Are all the necessary terms included in the thesaurus? Are there any unneccessary terms, which would not be used, in the list? Are there any terms which are repeated elsewhere?

c) The overall structure of the terms.
Does the combination of terms and their attribute / value (qualifier) make sense? Does it make the system difficult or easy to understand and to use?

The terms created as part of this Project [1] have been subjected to examination in a number of ways. These methods of checking are outlined below.

### 3:1:1 **Review by members of the Anaesthetic Specialty Working Group (SWG).**

Most of the terms were written in the first instance by a small number of members of the Working Group, namely the Research Worker (the author) and the Chairman (Dr. R. Tackley), along with members of the group with a special interest in a particular area of terms. These terms were then circulated around to other members of the SWG for discussion and comment at regular meetings of the SWG. At these meetings, lists of terms were reviewed, and comments and criticisms made about the presented material. Omissions were pointed out and corrections made where appropriate. This stage was the first level of quality control, and as everyone in the group was either an anaesthetist or an anaesthetic assistant, this was useful as a initial review of content. A representative from the NHS Centre for Coding and Classification was also present at the meetings, to give advice on the structuring of terms, and to give some idea as to how anaesthetic terms would fit alongside terms created by other specialty working groups.

This level of quality assurance is not necessarily sensitive, as the people reviewing the terms are closely involved with the creation of the terms themselves. In addition, the members' enthusiasm for the project, or for specific parts of the project, may not make them the most objective of critics. However, the familiarity of the members of the group with the structure of the thesaurus allowed them to be able to concentrate more readily on the terms themselves. The author considers that this stage of quality assurance was very valuable. No anaesthetist can single-handedly create a term for every situation that may need recording; the insight and experiences of a number of anaesthetists are needed.

### 3:1:2 **Review by a panel of independent assessors.**

The NHS Centre for Coding and Classification (NHSCCC) appointed a panel of assessors for each specialty working group, to review the work being produced by each group. These panels, known as Specialty Assurance Teams, or SATs, each consisted of three people. One member of the team held an academic post, one was a hospital consultant, and one a general practitioner. The idea behind having this particular selection of people was to ensure that the terms produced by an SWG were appropriate for use by people across the full spectrum of the medical profession (i.e. both the "specialist" and the "generalist"). None of the people in the SAT were part of the specialty working groups, and so were not directly involved in the creation of terms. The members of the SAT groups were nominated by the NHSCCC.

Members of the SATs were introduced to the Clinical Terms project initially by letter, and then by attendance at a "Briefing Day". Thus the ideas behind the Project were explained before the SAT members reviewed the work of the SWG. Members of the SAT were permitted and encouraged to discuss matters relating to the work of the relevant SWG with members of the working group if they so desired. The members of the Anaesthetic Specialty Assurance Team were as follows:

| | |
|---|---|
| Professor Sir Keith Sykes (Oxford) | Academic member |
| Dr. Eleri Edwards, (Wrexham) | NHS Consultant member, recommended by the Association of Anaesthetists, Great Britain and Ireland |

Dr. G. Roberts, (Poole, Dorset) General practitioner member

The members of the Anaesthetic SAT were sent copies of the lists of terms produced by the Anaesthetic SWG. These lists were of terms for the analysis of patients' charts, measurement terms, procedures related to general anaesthesia, procedures relating to patients' airways, equipment procedures, patient monitoring and abbreviations.

The comments received by the NHSCCC from the SAT members were of the following types;

a) Improvement of existing terms: e.g. the original term *wake-up test performed during anaesthesia* was considered ambiguous, and should be changed. (It was changed to *intra-operative wake-up test performed.*)

b) Lack of specific terms within a list: e.g. the terms *carbon dioxide absorber in use* and *carbon dioxide absorber not in use* were added to the equipment procedures list.

c) Lack of sections of terms. One disadvantage of the approach whereby only one SWG creates terms for certain set topic ("areas of prime responsibility") is that other groups do not initially have access to the other group's terms, even though they may be of importance. For example, in the Clinical Terms Project, terms for measurement of oxygen saturation were the responsibilty of the Chemical Pathology SWG, and so such terms did not appear in lists presented to the Anaesthetic SAT. It was therefore unclear to the SAT member whether this term was missing altogether or whether it did exist, but in a separate part of the classification. There are many such examples, and it makes the assessment of terms by a SAT difficult. In addition, whole sections of vitally important terms,

regarding drugs, drug administration, and equipment have not been part of the initial creation of terms by the Clinical Terms Project. Similarly, the means of putting terms into some sort of context were not present, and this was commented upon by SAT members.

The method of assessment of terms by "three wise men" is useful as they are members of the medical profession who can assess terms in different ways, according to their background. However, there are some disadvantages to this approach. The number of assessors is small, and they cannot be exected to spot every error and omission. The relatively narrow range of the terms given to the SAT members has been mentioned above, but if every term is given to the SAT member, then the total number of terms to check becomes too large. The quality assessment by this method is thus limited.

The method of presentation of terms, in this case on paper, has implications to the review of terms, and this is discussed later.

### 3:1:3 **Piloting of terms to a wider range of anaesthetists.**

The Anaesthetic SWG, in conjunction with the NHSCCC, arranged for a "pilot" of terms to be presented to volunteers at various sites through out the United Kingdom. Volunteers were recruited by direct request, by asking for volunteers at a meeting of the Society for Technology and Computing in Anaesthesia, and through an article in *Anaesthesia News* [2]. In total, 31 anaesthetists volunteered for the pilot. The pilot volunteers were sent computer floppy disks with terms on them in the form of a browser. The disks contained terms created by the Anaesthetic SWG, and also terms from the Pain, Intensive Care, Cardiology, Renal, and Respiratory Medicine SWGs, and consumed 33 megabytes of computer storage space. In addition, a separate disk with just Anaesthetic and

Intensive Care SWG terms was sent, for those pilot volunteers who did not have sufficient space on their personal computer, or who did not want to review terms from other groups. Covering letters were sent to explain the contents of the disks, sections that were not covered by the disks, and instructions on how to use the browser to find terms. The volunteers were asked to look for a term of their choice in the browser. They were then asked to comment on the following:

a) the method of searching for the term in the browser (either using a keyword, or by looking through hierarchies of terms);

b) the ease with which a term was found;

c) how well the term selected from the browser matched what the anaesthetist wished to record;

d) whether the synonyms were appropriate;

e) whether any qualifying terms were inaccurate, missing or inappropriate.

The method of commenting was by filling in a "feedback form", which had spaces and boxes for replying to the above questions.

14 (45%) of the anaesthetists who volunteered for the pilot replied. The comments are as shown:

| Pilot volunteer comment type | number of comments | (% of total) |
|---|---|---|
| *Term not found in browser (but actually present)* | *8* | *(5.2)* |
| *Criticism of anaesthetic term* | *3* | *(2.0)* |
| *Inappropriate qualifying term (anaesthetic)* | *2* | *(1.3)* |
| *Absent synonym* | *4* | *(2.6)* |
| *Absent terms:* | | |
| *equipment* | *22* | *(14.4)* |
| *examination* | *5* | *(3.2)* |
| *drug* | *6* | *(3.9)* |
| *measurement* | *3* | *(2.0)* |
| *diagnosis* | *3* | *(2.0)* |
| *monitoring procedure* | *7* | *(4.5)* |
| *non-monitoring procedure* | *4* | *(2.6)* |
| *administrative* | *3* | *(2.0)* |

| | | |
|---|---|---|
| *anatomical* | *9* | *(5.9)* |
| *terms known to be in other SWG's lists* | *31* | *(20.3)* |
| *Comments on terms from Intensive Care SWG* | *12* | *(7.8)* |
| *Comments on terms from Pain SWG* | *31* | *(20.3)* |
| | ---- | ---- |
| *Totals* | *153* | *(100)* |

Points of note on pilot volunteers' responses:

a) 43 (28.1%) of the comments were related to work done by the Pain and Intensive Care SWGs, not to that of the Anaesthetic SWG.

b) Absent terms: 31 (20.3%) of responses related to terms which were known to be in other SWGs' lists. There were 40 (26.1%) replies noting the absence of terms relating to equipment, drugs, anatomy, and adminstration. These categories were not included in the pilot, and this had been explained in a covering letter to the pilot volunteers. All comments were checked, and the terms which were not actually present in other SWGs' lists at the time had already been suggested to the other SWGs concerned. The terms in question were *malignant hyperpyrexia*, *plasma cholinesterase deficiency*, and terms relating to airway assessment.

c) 8 (5.2%) of the replies referred to anaesthetic terms which could not be found, but were in fact present. This reflects either poor browser design, or incorrect usage of the browser.

d) There were some comments that were made by more than more than one person. There were 3 separate comments about the term *reversal of muscle relaxant*, suggesting that *reversal of neuromuscular blockade* was more appropriate.

The usefulness of the pilot was limited by its lack of sensitivity and specificity. The terms were presented to the volunteer on a computer in the form of a browser. The anaesthetist could search for terms either through a keyword (e.g. *Tracheal* if looking for the term *tracheal intubation*), or just by moving up and down (i.e. browsing) through hierarchies. The volunteers were encouraged to look specifically at anaesthetic terms, but as terms from other groups had been included, feedback replies were received relating to terms from these groups. These replies were not useless, as these terms are obviously of use to anaesthetists, but at this stage, the terms from all the different groups had not been formally "spliced" together, nor had they been edited fully by the NHSCCC.

Terms relating to areas of interest to anaesthetists, but not necessarily written by the Anaesthetic SWG, were reviewed. Thus terms regarded as being necessary to anaesthetists were checked by the Research Worker and Chairman of the Anaesthetic SWG, on behalf of the group. This ensured that omissions commented upon by the SAT, and others, were included in the NHSCCC thesaurus of terms.

Both the pilot and the SAT samples were presented to the revievers in an artificial format: the SAT received terms on paper, and the pilot volunteers received their terms on a computer browser. The terms produced by the Anaesthetic SWG will be used in computer form, most likely in electronic record keeping systems, and so these terms were not being tested in an environment in which they will be used. It is difficult to assess easily the contents of the lists printed on paper, which contain hundreds of terms and have qualifiers printed in boxes on separate pages. When faced with a browser, the ease of finding a term depends not only on the term itself, but also on the browser software design and the skill of the operator in using the browser.

### 3:1:4 **Reappraisal of terms after integration of terms from different specialty working groups**

During 1994, the NHSCCC amalgamated the terms produced by the constituent SWGs of the Clinical Terms Project into a single unified list of terms. This was no small task, involving much work [3]. The terms required integration into a common style, concerning both the terms themselves, and also the qualifiers. These terms were collated into a new browser, in "Windows" (Microsoft Corporation) format, for further evaluation. A computer is the only feasible way of storing all these terms, as there are so many. The resulting browser required 156 megabytes of disk space [4].

These browsers were released to members of the SWGs to check the success of the integration of all the terms. This was known as the "Refinement Project". Each participant in the project was asked to check whether the terms produced by their SWG were present, and whether they fitted correctly into the new hierarchy created by the integration. The task of checking the terms from the Anaesthetic SWG was straight-forward, but time-consuming. (This task was performed by

Drs. Ian Banks, Roger Tackley, and Andrew Norton.) Lists of terms, with their qualifiers, produced by the Anaesthetic SWG were cross-checked against the browser. In addition, terms submitted to other SWGs by the Anaesthetic SWG for inclusion in their lists were checked.

A number of errors were identified. These were of the following types:

a) Technical errors; these involved the incorrect translation of terms from the original lists into the integrated set. For example, qualifiers which the Anaesthetic SWG had decided to "switch off" as not being appropriate to a term at a certain hierarchical level had been reinstated in the integrated set. These were not errors in the terms, but had resulted from the misreading of terms and qualifiers by the program which had drawn all the terms together.

b) Omissions of terms and qualifiers; for example, the Anaesthetic SWG produced a term *removal of device from airway*, which had qualifiers to allow the state of the patient to be described (*lightly anaesthetised, deeply anaesthetised, awake*). These qualifers were missing, reducing the value of the core term. Some terms which had been submitted to other SWGs for inclusion in their hierarchies were occasionally missing. For example, terms to describe airway assessment (e.g. Malampatti scores) had been submitted to the Dentistry SWG for inclusion as examination terms, but they were absent in the integrated set.

c) Problems with amalgamation of lists; a term may fit easily into two different hierarchies. For example, the term *percutaneous cricothyroidotomy*, is both an airway procedure, and a laryngeal procedure. *Percutaneous cricothyroidotomy* was originally produced by the Anaesthetic SWG, and had no qualifiers. However, by including the term under laryngeal procedures in the integrated set, the term inherits qualifiers from the "laryngeal" set of terms. In this case, the new

qualifiers include the *use of operating microscope*, and *endoscopic approach*, which are not appropriate for this term.

Errors discovered at this stage were referred back to the NHS Centre for Coding and Classification for further editing.

This method of review was useful from the technical point of view, in that it helped to identify errors not in the lists of terms themselves, but in the amalgamation of the lists of terms.

Summary:

The methods of review above have all been limited in some form. However, they have all been useful in identifying errors and omissions in terms produced for inclusion in a thesaurus of terms. It is easy to criticise the design of these forms of quality assurance, but as they have been carried out simultaneously with the creation of terms and the development of the Read Code hierarchies, more searching review was not possible at the time. Without these reviews, the terms, as they stood at initial release (April 1995) would be of inferior quality.

There is a clear need for further evaluation and structured trials of terms produced. The NHSCCC intends to run a large-scale formal evaluation during 1995 and 1996. In addition, the use of terms in automated anaesthetic record-keeping systems will provide a test for anaesthetic terms "in the field". Such systems are already in use in some anaesthetic departments.

It would be appropriate for any standard set of terms for use in anaesthesia in the U.K. to be approved on a formal basis by a body which is responsible for standards of anaesthetic practice. The Quality of Practice Committee of the Royal

College of Anaesthetists has been kept informed of the progress of the creation of terms by the Anaesthetic SWG by Dr. R. Tackley (Chairman, Anaesthetic SWG). At the time of writing, the standard set of terms for use in anaesthesia in the form of Read Codes Version 3 is incomplete; it lacks terms to cover drug administration and equipment, for example. In addition, the terms need more rigorous testing, as described above. Thus the terms cannot be endorsed formally, at present, although further work and future developments will hopefully result in acceptance of the terms as a standard thesaurus. Work on the missing sections of terms is being carried out by the NHSCCC, and will continue throughout 1995 and 1996. The Anaesthetic SWG will continue to put forward its comments about these areas of work.

## 3:2 The introduction of a standard set of terms for anaesthesia into a hospital setting

There is no use creating such a set of terms if they cannot be put to any practical use; the terms should not be thought of purely as an academic exercise. The first section of this thesis examined the potential uses for a standard set of terms. The aim of this section is to look at the uses of these terms in a hospital setting.

The areas of a hospital where an anaesthetist is likely to use these terms are as follows: in the anaesthetic room and operating theatre, on a ward, and in an office. The application of the standard terms in each of these situations will be examined.

### 3:2:1 In the anaesthetic room and in the operating theatre

This is the situation where an anaesthetist is most likely to use a standard set of terms, in the creation of an anaesthetic record. The keeping of an anaesthetic record is a common law requirement, as it is considered to be part of proper practice and to be in the best interest of the patient [5].

The information which is recorded on an anaesthetic record has already been considered in Section 2:8, as a starting point for consideration of the content of a thesaurus of terms. Thus the set of terms proposed is designed with the anaesthetic record in mind. It would be very difficult to persuade people to use a standard thesaurus with a hand-written record, as people are used to using their own terminology when writing on paper.

Attributes of an automatic record-keeping system have been outlined by Fisher [6], and these include the folllowing:

a) the record should be a complete account of the administration of the anaesthetic.

b) the record should have a facility to record pre-operative evaluation and post-operative events.

c) there should be a hard copy of the record available. This copy should appear complete without blank fields in it.

d) data entry should require minimum effort by the anaesthetist, and the act of data entry should be straight-forward enough to prevent patient care being compromised.

e) information recorded should be easily retrievable for retrospective review, and epidemiological study.

f) the data should only be available to those who "need to know". There should be a framework for security and confidentiality within the record-keeping system.

The terms available for use need to allow the record to conform with these attributes.

How may a standard thesaurus of terms help with data collection and recording ? Data may be collected in two ways on to a record; on-line data entry, where information is automatically recorded as it is produced, and off-line data entry, where information is added to the record in some way, e.g. via keyboard, mouse or pen at a later time than the event [7]. (A mouse in this context is a hand-held device moved across a desktop to move an indicator across the computer screen.)

The author has some practical experience of an automatic anaesthetic record-keeping system. The RECALL system, designed by Informatics PLC, is in use in the Anaesthetic Department, at Manchester Royal Infirmary. Its data capture is both on-line and off-line. For on-line data, the system takes information directly from the monitoring systems attached to the anaesthetic machine, and records such parameters as blood pressure, heart rate, oxygen saturation, and inspired and expired gas measurements. These sorts of measurements can easily be recorded using the standard terms created, e.g.

*systolic blood pressure* (term) + 120 (numerical value) + *mmHg* (qualifier: units) + time

Thus the system can store information, probably in code form, as a term + qualifier pair, attached to a value and the time of recording.

The off-line data-collection with the RECALL system involves entry using a mouse or a keyboard, usually choosing terms from "pick lists". For example, the recording of the administration of a drug involves choosing the drug from a pick list e.g. *thiopentone* from a list of induction agents, then typing in the dose and the time of administration. Similarly, records of procedures e.g. cannulation are recorded from the selection of pre-written terms from a series of picking lists. A standard term or sets of terms can easily fit into this pattern e.g.

*insertion of central venous cannula* (term) + *internal jugular vein* (qualifier: site) + *right* (qualifier: laterality) + *triple lumen cannula* (qualifier: equipment)

Therefore the standard set of terms can easily be used in suitable automated anaesthetic record-keeping systems. The terms created by the Anaesthetic SWG as part of the Clinical Terms Project were designed with this use in mind.

### 3:2:2 **On the wards**

Information gathered by the anaesthetist on a pre-operative visit to a ward may be stored in the anaesthetist's memory and then transcribed onto the anaesthetic record in the operating theatre. This is not ideal, especially if the anaesthetist has a large number of patients to visit pre-operatively. If the anaesthetist wishes to make notes on a post-operative visit, then the task of adding to the anaesthetic record is even more difficult. In addition, many anaesthetists work in intensive care units, where entries are frequently made in patients notes. For an anaesthetist to gain the most use out of a standard set of terms, then there needs to be a facility to make entries in patients' records on the wards. These entries would then

need to be linked in some way to other sites where the anaesthetist would make make use of these entries i.e. a network facility linking computer terminals. The more sites which exist on this network, then the greater the ease with which other people can make entries e.g. laboratory staff adding blood results. This eventually leads to the concept of having an integrated, electronic, computerised medical record based on terms which encompass the whole of medicine. (This is the rationale behind the Clinical Terms Project.) If terms exist to write a medical record, including laboratory results, investigations, nursing observations etc., and the facilities exist to be able to create this record, then an electronic record is possible. Although anaesthetists on the ward may only require a subset of the terms, there is no reason why the system should not be extended to other medical specialties.

To allow such an idea to work, there has to be the facility for the anaesthetist to add information about the patient on the ward. This could be done using a small hand-held computer device, which then can discharge its information into a larger system. Alternatively, there could be suitable computer terminals sited on wards, clinics and laboratories, which would be open for use by all suitable medical, nursing and technical staff. This idea has been called the "Integrated Clinical Workstation" i.e. a computer terminal suitably prepared for hospital staff to make their entries into the patient's medical record. This concept is being developed by the NHS Centre for Coding and Classification, in conjunction with the University of Loughborough. There are many potential problems which may be encountered during the development of such a system, e.g. software design, education, confidentiality, cost and difficulties in installing a system in a hospital [8]. The Integrated Clinical Workstation design has been the subject of much study, but a full discussion of the problems involved is outside the realm of this thesis.

Intensive care units (ITUs) may have the facilities to use these terms at an earlier date than general wards; ITUs are physically more discrete than general wards, and the use of high technology equipment in ITUs is more common, leading to greater staff familiarity with computer equipment. Some ITUs already have automatic on-line data capture for many patient physiological parameters, and could use some standard terms. However, the idea of anaesthetists using terms in a fully integrated electronic patient record is some years off yet.

### 3:2:3 **In offices**

In Section 1 of this thesis, the potential uses of a standard set of terms outside the immediate clinical setting were outlined. These include clinical review and audit, research, workload planning, finance, central returns, and the transfer of information within and between hospitals, clinics and administrative centres. Thus, standard terms for use by anaesthetists can be of use not only to the anaesthetist reviewing work in an anaesthetic department, but may be used in all parts of the hospital. As well as having a networked system for clinical records, as described above, the system could be extended to cover the whole hospital, including administrative and management sites. This hospital-wide system is known as a Hospital Information Support System (HISS). The proposed benefits from having a HISS system are both financial, i.e. cost savings resulting from greater efficiency in administration, and indirectly, clinical, by simplifying the organisational aspect of patient care [9]. A computer-based integrated clinical patient record would form part of such a HISS system. To function efficiently, standard terms from all other medical specialities would be needed.

Medical information can be transferred between computers. This is sometimes known as "messaging". The advantages of having a standard terminology for the

relay of information have already been discussed (see section 1). In addition, a standard syntax for the message transfer, or electronic data exchange (EDI) is needed. The NHS has adopted the international standard syntax, known as UN/EDIFACT [10]. This standard will exist alongside the Read Clinical Classification [11] for use in data transfer.

Terms used by an anaesthetist could therefore be used throughout the hospital setting. Standardisation of terminology is necessary for such large networks to run smoothly, for everyone would then be using the same language. The advantages of using codes attached to these terms becomes more apparent, as they simplify the processing of the vast amounts of information that these networks would be handling. However, large networks which handle confidential information such as medical records need to be secure and have sophisticated safeguards built in to them [12].

The development of systems within hospitals, and the National Health Service as a whole, is part of the Information Management and Technology Strategy of the NHS Executive. A national thesaurus of clinical terms (Read Codes) forms part of this stategy. It is intended that all major NHS organisations will be able to communicate electronically by 1996, and that all hospitals will have integrated systems by the year 2000 [13.]. At present anaesthetists can use standard terms only in the field of automated anaesthetic record keeping systems. Given adequate funding, and using ever-improving computer technology, the goals of the NHS Information Management and Technology Strategy could be reached. A standard language for medicine, of which anaesthesia is an essential part, is a central pillar of this strategy.

## Section 3:3 Conclusion

The terms written for this standard thesaurus for anaesthesia need further evaluation and quality assurance. Some tests have been done, but more formal structured trials are needed. These tests are planned by the NHS Centre for Coding and Classification for 1995/6. Evaluation of terms also needs to be carried out using established anaesthetic record-keeping systems, where possible. Although these terms have been designed for use in a computer, it must be remembered when testing them, that they are to some extent reliant on the computer software package for their easy use.

There is considerable scope for use of terms not only by anaesthetists in anaesthetic rooms, operating theatres and wards, but throughout the hospital by clinicians and non-clinicians alike. Much work needs to be done to bring to fruition many of these ideas, but the use of standardized terms should grow, as computer systems develop throughout hospitals, both in the United Kingdom and abroad.

## Section 3:4 References


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11. *Read Clinical Classification*, Version 3. Loughborough, NHS Centre for Coding and Classification, 1995.

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# Section 4

## Terms Produced for the Clinical Terms Project

## Section 4: Terms Produced

This section contains lists of terms produced for the Clinical Terms Project, in accordance with the methods described in Section 2.

Contents:

## Section 4:1 Introduction

The following lists of terms are included in the thesis as evidence that suitable terms can be produced following the methods outlined in Section 2. The lists of terms reproduced here relate to those topics assigned to the Anaesthetic Specialty Working Group as their "areas of prime responsibility" (see Section 2:6).

The Group also submitted terms to other SWGs for inclusion in their lists, and also to the NHS Centre for Coding and Classification for inclusion in lists for which they had responsibility. For example, terms to describe oxygen saturation measurement were sent to the Chemical Pathology SWG, and terms to describe cannulation were sent to the NHSCCC. These terms are not included in this section, as they are often isolated terms, and may be misinterpreted if they are not seen in the context of a fuller list.

The lists of terms created by the Anaesthetic SWG were submitted to the NHSCCC [1]. They have been amalgamated with other lists into Version 3 of the Read Clinical Classification [2], and thus these lists of terms do not appear in an identical form in the Classification. The Classification is in electronic form only.

The lists reproduced in this section are in the form in which the lists were submitted, and also in the form that they were reviewed by the Specialty Assurance Teams (see Section 3:1:2).

The lists are arranged in a hierarchical fashion. If a term has another term below it, but indented to the right, then the term below is a "child" term of the above term. The example given in Section 2:8:1 is repeated here

*General anaesthesia* (level 1)

*Induction of general anaesthesia* (level 2)

*Intravenous induction of general anaesthesia* (level 3)

*Rapid sequence induction* (level 4)

*Intramuscular induction of general anaesthesia*

*Inhalational induction of general anaesthesia*

*Single breath inhalational induction*

*Multiple breath inhalational induction*

Terms in Section 4 which appear in italics are synonyms of the term immediately above. For example

Pulmonary artery occlusion pressure

*Pulmonary artery wedge pressure*

*PAOP - Pulmonary artery occlusion pressure*

*PCWP- Pulmonary artery wedge pressure*

This example also shows the inclusion of abbreviations, along with their full explanation.

Many terms in the lists have annotations next to them e.g. [ICB1]. This means that the term has qualifying "attribute / value" pairs (see Section 2:4). These qualifying terms are printed at the end of each list, in boxes designed by the NHSCCC. If a "higher level" term in the hierarchy has qualifying terms, then these qualifying terms will apply to all the terms below it in the hierarchy. A low-level term may therefore have qualifying terms from higher level terms as well as its own specific qualifying terms. For example, from the list of monitoring terms;

The high level term "monitoring" has qualifying terms for

frequency of monitoring (continuous, intermittent)

the equipment used for monitoring

time

All lower level terms in this list "inherit" these qualifying terms, so that a lower level term e.g. pulse oximetry can also use these qualifying terms

i.e. *continuous* pulse oximetry or *intermittent* pulse oximetry

These terms are the property of the Anaesthetic Specialty Working Group, and, as mentioned in the Acknowledgement, have been reproduced with the permission of the Chairman of the Anaesthetic SWG, Dr. R. Tackley.

## 4:2 Procedures Related to General Anaesthesia

General anaesthetic [ICB1]

*G.A.*

**Induction of general anaesthesia**[ICB2]

General anaesthesia induction using agent given intravenously[ICB3]

*Intravenous induction*

General anaesthesia induction as a rapid sequence induction technique

*Crash induction*

General anaesthesia induction using agent given intramuscularly

*Intramuscular induction*

General anaesthesia induction using an agent given per rectum

*Rectal induction*

General anaesthesia induction using inhalational technique[ICB4]

*Inhalational induction*

*Gas induction*

General anaesthesia induction using a single-breath technique

General anaesthesia induction using a multiple-breath technique

**Maintenance of general anaesthesia**[ICB5]

General anaesthesia maintenance using inhalational anaesthetic agents only

General anaesthesia maintenance using intravenous anaesthetic agents only

*Total intravenous anaesthesia*

General anaesthesia maintenance using a combination of inhalational and intravenous anaesthetic agents

**Reversal or cessation of anaesthesia**

Cessation of anaesthesia by withdrawal of anaesthetic agent

Reversal of anaesthesia[ICB6]

Reversal of anaesthesia using a stimulant drug

Reversal of anaesthesia using a specific drug reversal agent

Preoperative therapies

**Premedication prescribed[ICB7]**

**Premedication deliberately omitted**

**Anaesthetic procedure explained**

**Postoperative procedure explained**

**Additional preoperative therapy instituted by anaesthetist**

**Pre-existing therapy altered by anaesthetist preoperatively**

Preservation of spontaneous respiration during anaesthesia or sedation

*Spontanous ventilation during anaesthesia or sedation*

*Spontaneous respiration*

Neuromuscular blockade[ICB8]

**Neuromuscular blockade induction**

**Neuromuscular blockade reversal**

Sedation

**Induction/ maintenance of sedation**[ICB9]

Sedation using agents given intravenously

*Intravenous sedation*

Sedation using a neuroleptanalgesic technique

Sedation using agents given intramuscularly

Sedation using agents given by inhalation

Inhalation sedation

*IS*

Relative analgesia

*RA*

Sedation using agent given per rectum

Sedation using a combination of techniques

Sedation with analgesic adjunct

**Reversal / cessation of sedation**

Sedation reversal using a specific sedative drug reversal agent [ICB10]

Sedation reversal by withdrawal of sedative agent

Protection of patient under anaesthetic

**Eye protection during anaesthesia**[ICB11]

Eye protection by taping of eyelids

Eye protection by padding over eyelids

Eye protection by application of lubricant to eyes[ICB12]

Eye protection using goggles/spectacles

**Pressure point protection during anaesthesia**[ICB13]

Pressure point protection by padding

Special anaesthetic procedures

**Preoxygenation**

**Application of cricoid pressure**[ICB14]

*Sellick's manoeuvre*

Application of cricoid pressure using one hand

Application of cricoid pressure using two hands

**Induced hypotensive technique performed**

*Induced hypotension*

**Induced vasodilatation**

**"Wake- up" test performed during anaesthesia**

Patient positioning for anaesthetic procedure[ICB15][ICB16]

**Patient in tracheal intubation position**[ICB17]

*"Sniffing the morning air"position*

Patient positioning for intubation by extension of head

Patient positioning for intubation by flexion of neck

Patient positioning in lateral position for intubation[ICB18]

**Patient in supine position**

**Patient in head-down position**

**Patient in head-up position**

**Patient in lateral position**[ICB19]

**Patient in sitting position**

**Patient in semi-recumbent position**

**Patient in prone position**

**Patient in semi-prone position**

*Patient in "recovery" position*

**Child held on parent's lap for procedure**

**Child held on assistant's lap for procedure**

Tourniquet procedures[ICB20]

**Tourniquet application**

**Tourniquet removal**

**Tourniquet cuff inflation**[ICB21]

Upper tourniquet cuff inflation

Lower tourniquet cuff inflation

**Tourniquet cuff deflation**[ICB22]

Upper tourniquet cuff deflation

Lower tourniquet cuff deflation

Limb exsanguination [ICB23]

**Limb exsanguination using a mechanical exsanguinator**

**Limb exsanguination using gravity**

**Limb exsanguination using arterial occlusion**

Control of patient temperature

**Warming device used to control patient's temperature**[ICB24]

Warming of intravenous fluid

Warming of patient using water mattress

Warming of patient using radiant heater

Warming of patient using electric blanket

Warming of inhaled gases

Warming of patient using infant incubator

Warming of patient using warm air blower

Warming of patient using extra-corporeal circulation

**Cooling device used to control patient's temperature**[ICB25]

Cooling of patient using a water mattress

Cooling of patient using cold liquids

Cooling of patient using ice

Cooling of intravenous fluid

Colling using fan

Cooling of patient using extra-corporeal circulation

**Room temperature increased**

*Ambient temperature increased*

**Room temperature decreased**

*Ambient temperature decreased*

**Patient heat loss reduced by insulation**[ICB26]

Patient insulated against heat loss using padding

Patient insulated against heat loss using wrapping

Patient insulated against heat loss using a hat, socks or gloves

**Induced hypothermia technique**

Oesophageal stethoscope inserted

[ICB1]

| **Object:** General anaesthetic | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Control of general anaesthetic | Manual, Open-loop, Closed-loop | |

[ICB2]

| **Object:** Induction of general anaesthesia | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Route of administration of drug | Intravenous<br>Intramuscular<br>Rectal<br>Inhalational | |
| Drugs used, with amount | Term from Drug Admin. Project | |

[ICB3]

| **Object:** General anaesthesia induction using agent given intravenously | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of induction | Rapid sequence induction | |

[ICB4]

| **Object:** General anaesthesia induction using inhalational technique | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of inhalational induction | Single-breath technique<br>Multiple-breath technique | |

[ICB5]

| **Object:** Maintenance of general anaesthesia | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of maintenance of general anaesthesia | Using inhalational agent,<br>Using intravenous agent,<br>Using a combination of inhalational and intravenous agents | |
| Drugs used and dose | Term from Drug Admin. Project | |

[ICB6]

| **Object:** Reversal of anaesthesia | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Drugs used, and amount | Drug Admin. term | |

[ICB7]

| **Object:** Premedication prescribed | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Drugs prescribed, and amount | Drug Admin. term | |

[ICB8]

| **Object:** Neuromuscular blockade | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Drugs given, with dose | Drug Admin. term | |

[ICB9]

| **Object:** Induction/ maintenance of sedation | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of induction/ maintenance of sedation | Intravenous<br>Intramuscular<br>Inhalation<br>Rectal<br>Combination of techniques | |
| Drugs used, and dose | Drug Admin. Term | |

[ICB10]

| **Object:** Sedation reversal using a specific sedative drug reversal agent | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Drugs given, and dose | Drug Admin. term | |

[ICB11]

| **Object:** Eye protection during anaesthesia |
|---|

| Attribute: | Value: | |
|---|---|---|
| Method of eye protection | Taping<br>Padding<br>Lubrication<br>Goggles/ spectacles | |
| Eye protected [laterality] | Right<br>Left<br>Bilateral | |

[ICB12]

| **Object:** Eye protection by application of lubricant to eyes | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Lubricant used | Drug Admin. term | |

[ICB13]

| **Object:** Pressure point protection during anaesthesia*[ICB13]* | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of protection | Padding<br>Inspection and turning | |
| Pressure point protected | Anatomy qualifier | |

[ICB14]

| **Object:** Application of cricoid pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of application | One handed<br>Two handed | |
| Person applying cricoid pressure | Trained assistant<br>Untrained assistant | |

[ICB15]These have been limited to types of positioning for anaesthesia or in recovery room. There will be other positions for other procedures which may eventually all come under this heading. They may use anatomical terms.
[ICB16]

| **Object:** Patient positioning for procedure | | |
|---|---|---|
| **Attribute:** | **Value:** | |

| | | |
|---|---|---|
| Position patient positioned in | Tracheal intubation position<br>Supine<br>Head-down<br>Head-up<br>Lateral position<br>Sitting position<br>Semi-recumbent position<br>Prone position<br>Semi-prone position<br>On parent's lap<br>On assistant's lap | |

[ICB17]

| **Object:** Patient in tracheal intubation position | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method used for positioning patient in tracheal intubating position | Extension of head<br>Flexion of neck<br>In lateral position | |

[ICB18]

| **Object:** Patient positioning in lateral position for intubation | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Laterality | Right<br>Left | |

[ICB19]

| **Object:** Patient in lateral position | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Laterality | Right<br>Left | |

[ICB20]

| **Object:** Tourniquet procedures | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Site of cuff | Anatomical term | |

[ICB21]

| **Object:** Tourniquet cuff inflation | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Cuff inflated | Upper cuff<br>Lower cuff | |

[ICB22]

| **Object:** Tourniquet cuff deflation | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Cuff deflated | Upper cuff<br>Lower cuff | |

[ICB23]

| **Object:** Limb exsanguination | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of exsanguination | Mechanical exsanguinator<br>Gravity<br>Arterial occlusion | |

[ICB24]

| **Object:** Warming device used to control patient's temperature | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of warming | Warming of intravenous fluid<br>Water mattress<br>Radiant heater<br>Electric blanket<br>Warming of inhaled gases<br>Infant incubator<br>Warm air blower<br>Extra-corporeal circulation | |

[ICB25]

| **Object:** Cooling device used to control patient's temperature | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of cooling used | Water mattress<br>Cold liquids<br>Ice<br>fan<br>Cooling of intravenous fluid<br>Extracorporeal circulation | |

[ICB26]

| **Object:** Patient heat loss reduced by insulation | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of insulation | Padding<br>Wrapping<br>Hat<br>Socks<br>Gloves | |

## 4:3 Airway procedures

Manual establishment of airway[ICB1]

**Airway obtained by jaw thrust**

**Airway obtained by head extension**

*Airway obtained by head tilt*

**Airway obtained by neck flexion**

**Airway obtained by tongue traction**

Laryngoscopy

**Oral laryngoscopy[ICB2]**

Oral diagnostic laryngoscopy

**Nasal laryngoscopy[ICB3]**

Nasal diagnostic laryngoscopy

Airway insertion[ICB4]

**Oropharyngeal airway insertion**

**Nasopharyngeal airway insertion**

**Laryngeal Mask Airway insertion**

**Obturator airway insertion**

Tracheal intubation[ICB5]

*Endotracheal intubation*

**Tracheal intubation via oral route**[ICB6]

*Orotracheal intubation*

Tracheal intubation through a Laryngeal Mask Airway

Tracheal intubation using rigid bronchoscope

Orotracheal fibreoptic intubation

**Tracheal intubation via nasal route**[ICB7]

Tracheal intubation- blind via nasal route

*Blind nasal intubation*

Tracheal intubation via nasal route under direct vision

Nasotracheal fibreopic intubation

**Cricothyroidotomy tube insertion**

**Tracheostomy tube insertion**

Tracheal tube position check[ICB8]

*Endotracheal tube position check*

Tracheal tube fixation[ICB9]

Endobronchial intubation[ICB10] [RMT11]

*Bronchial intubation[ICB12]*

*Endobronchial intubation via oral route*

**Endobronchial intubation using flexible fibreoptic endoscope**

**Endobronchial intubation using rigid bronchoscope**

Endobronchial tube position check [ICB13][ICB14]

*Bronchial tube position check*

Endobronchial tube fixation[ICB15]

Insertion of endobronchial blocker

Cricothyroidotomy

**Percutaneous cricothyroidotomy**

**Percutaneous dilatational cricothyroidotomy**

**Open cricothyroidotomy**

Tracheostomy

Cuff procedures for airway isolation

**Inflation of tube cuff**[ICB16]

Inflation of endotracheal tube cuff

Inflation of endobronchial tube tracheal cuff

Inflation of endobronchial tube bronchial cuff

Inflation of tracheostomy tube cuff

**Deflation of tube cuff**[ICB17]

Deflation of endotracheal tube cuff

Deflation of endobronchial tube tracheal cuff

Deflation of endobronchial tube bronchial cuff

Deflation of tracheostomy tube cuff

Insertion of throat pack[ICB18]

Insertion of bite guard

Insertion of tooth guard

*Gum shield insertion*

Intentional lung collapse and re-expansion[ICB19]

**Intentional temporary unilateral lung collapse**

**Intentional temporary bilateral lung collapse**

**Re-expansion of temporarily collapsed lung**

Airway toilet / clearance

**Oropharyngeal suction**[ICB20]

Oropharyngeal suction under direct vision

Oropharyngeal "blind" suction

**Nasopharyngeal suction**[ICB21]

**Tracheal suction** [ICB22]

Tracheal suction via mouth[ICB23]

*Orotracheal suction*

Tracheal suction via nose[ICB24]

*Nasotracheal suction*

Tracheal suction via tracheostomy[ICB25]

**Tracheobronchial lavage**[ICB26]

Tracheobronchial lavage via tracheal tube

*Tracheobronchial irrigation via tracheal tube*

*Tracheobronchial washing via tracheal tube*

Tracheobronchial lavage via tracheostomy

Tracheobronchial lavage via fibreoptic bronchoscope

Tracheobronchial lavage via rigid bronchoscope

**Bronchial suction[ICB27]**

Bronchial suction via endobronchial tube

Bronchial suction via tracheostomy

Bronchial suction via airway

Bronchial suction via fibreoptic bronchoscope

Bronchial suction via rigid bronchoscope

**Bronchial lavage[ICB28]**

Bronchial lavage via fibreoptic bronchoscope

Bronchial lavage via rigid bronchoscope

**Airway clearance by finger sweep**

**Foreign body removed from airway**[ICB29]

**Mouth care performed**

Removal of device from airway[ICB30]

**Extubation of trachea**

**Extubation of bronchus**

Withdrawal of tube from bronchus into trachea

**Removal of airway**

**Removal of throat pack**

*Removal of tooth guard*

*Removal of gum-shield*

**Removal of bite guard**

**Removal of endobronchial blocker**

**Removal of cricothyroidotomy tube**

Page: 153
[ICB1]

| **Object:** Manual establishment of airway | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of establishment of airway | Jaw thrust<br>Head extension<br>Neck flexion<br>Tongue traction | |

Page: 153
[ICB2]

| **Object:** Oral laryngoscopy | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Instrument used | Anaesthetic laryngoscope<br>Anaesthetic laryngoscope with #1 blade<br>Anaesthetic laryngoscope with #2 blade<br>Anaesthetic laryngoscope with #3 blade<br>Anaesthetic laryngoscope with #4 blade<br>Anaesthetic laryngoscope with straight blade<br>Anaesthetic laryngoscope with intubating prism<br>Anaesthetic laryngoscope with polio blade<br>Anaesthetic laryngoscope with left handed blade<br>Fibrelight anaesthetic laryngoscope<br>Flexible fibreoptic endoscope<br>Rigid endoscope<br>Microscope<br>Pharyngeal mirror | |
| Position of laryngoscope tip | Anterior to epiglottis, Posterior to epiglottis | |

Page: 153
[ICB3]

| **Object:** Nasal laryngoscopy | | |
|---|---|---|
| **Attribute:** | **Value:** | |

| | | |
|---|---|---|
| Instrument used | Flexible fibreoptic endoscope<br>Microscope | |

Page: 153
[ICB4]

| **Object:** Airway insertion | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of airway inserted | Oropharyngeal<br>Nasopharyngeal<br>Laryngeal Mask Airway<br>Obturator | |

Page: 153
[ICB5]

| **Object:** Tracheal intubation | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Patient level of consciousness | Awake, Under general anaesthetic | |
| Tracheal tube type | Equipment term | |
| Route of tracheal intubation | Oral, Nasal, Cricothyroid, Transtracheal | |

Page: 153
[ICB6]

| **Object:** Tracheal intubation via oral route | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Introducer | Flexible fibreoptic endoscope, Rigid bronchoscope, Laryngeal Mask Airway, Anterograde guide, Stylet, Bougie, Retrograde guide, Light wand | |

Page: 153
[ICB7]

| **Object:** Tracheal intubation via nasal route | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| View at intubation | Direct, Blind, Via flexible fibreoptic endoscope | |

| | | |
|---|---|---|
| Introducer | Flexible fibreoptic endoscope, Anterograde guide, Bougie, Retrograde guide, Light wand | |

Page: 154
[ICB8]

| **Object:** Tracheal tube position check | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of checking | Observation of appropriate chest movement<br>Auscultation<br>Capnography<br>Chest X-ray<br>Direct laryngoscopy<br>Flexible fibreoptic endoscopy<br>Oesophageal detector device | |

Page: 154
[ICB9]

| **Object:** Tracheal tube fixation | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of fixation | Adhesive tape<br>Tying<br>Suturing | |

Page: 154
[ICB10]All these endobronchial intubation terms refer to *intentional* endobronchial intubation. Unintentional endobronchial intubation is an "Untoward event".
Page: 154
[RMT11]

| **Object:** Endobronchial intubation | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Patient level of consciousness | Awake, Under general anaesthetic | |
| Endobronchial tube type | Equipment term | |
| Introducer | Flexible fibreoptic endoscope, Rigid bronchoscope, Anterograde guide, Stylet, Bougie, Retrograde guide, Light wand | |

Page: 154
[ICB12]The synonym "bronchial intubation" applies to all the terms for "endobronchial intubation"
Page: 154
[ICB13]Endobronchial tube = bronchial tube
Page: 154
[ICB14]

| Object: Endobronchial tube position check | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of tube position check | Alternate clamping, Auscultation, Chest X-ray, Flexible fibreoptic endoscopy | |

Page: 154
[ICB15]

| **Object:** Endobronchial tube fixation | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of fixation | Adhesive tape<br>Tying<br>Suturing | |

Page: 154
[ICB16]

| **Object:** Inflation of tube cuff | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of cuff inflated | Tracheal tube cuff, Endobronchial tube tracheal cuff, Endobronchial tube bronchial cuff, Tracheostomy tube cuff | |

Page: 155
[ICB17]

| **Object:** Deflation of tube cuff | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of cuff deflated | Tracheal tube cuff, Endobronchial tube tracheal cuff, Endobronchial tube bronchial cuff, Tracheostomy tube cuff | |

Page: 155
[ICB18]

| **Object:** Insertion of throat pack |
|---|

| Attribute: | Value: | |
|---|---|---|
| Method of insertion of throat pack | Manual<br>Instrumental | |
| Type of throat pack | Wet ribbon gauze<br>Dry ribbon gauze<br>Tampon<br>Dental V pack | |

Page: 155
[ICB19]

| **Object:** Intentional lung collapse and re-expansion | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Laterality | Right<br>Left<br>Bilateral | |

Page: 155
[ICB20]

| **Object:** Oropharyngeal suction | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Suction catheter used | Aeroflow, Yankauer, Rubber, Closed-circuit, | |
| Size of suction catheter | 4 - 12 | |
| Approach | Through airway, Direct vision, Blind | |

Page: 155
[ICB21]

| **Object:** Nasopharyngeal suction | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Suction catheter used | Aeroflow, Yankauer, Rubber, Closed-circuit | |
| Size of suction catheter | 4 - 12 | |
| Approach route | Through airway<br>Blind | |

Page: 155
[ICB22]

| **Object:** Tracheal suction | | |
|---|---|---|
| **Attribute:** | **Value:** | |

| | | |
|---|---|---|
| Suction catheter used | Aeroflow, Yankauer, Rubber, Closed-circuit | |
| Size of suction catheter | 4 - 12 | |

Page: 155
[ICB23]

| **Object:** Tracheal suction via mouth | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Approach route | Tracheal tube<br>Flexible fibreoptic bronchoscope<br>Rigid brochoscope<br>Airway | |

Page: 155
[ICB24]

| **Object:** Tracheal suction via nose | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Approach route | Tracheal tube<br>Flexible fibreoptic endoscope | |

Page: 155
[ICB25]

| **Object:** Tracheal suction via tracheostomy | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Approach route | Tracheostomy tube<br>Flexible fibreoptic bronchoscope | |

Page: 155
[ICB26]

| **Object:** Tracheobronchial lavage | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Approach route | Tracheal tube<br>Tracheostomy tube<br>Fibreoptic bronchoscope<br>Rigid bronchoscope | |

Page: 156
[ICB27]

| **Object:** Bronchial suction | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Approach route | Endobronchial tube, Tracheostomy, Tracheostomy tube, Fibreoptic bronchoscope, Rigid bronchoscope, Airway | |
| Suction catheter used | Aeroflow, Yankauer, Rubber, Closed-circuit | |
| Size of suction catheter used | 4 -12 | |

Page: 156
[ICB28]

| **Object:** Bronchial lavage | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Approach route | Fibreoptic bronchoscope<br>Rigid bronchoscope | |

Page: 156
[ICB29]

| **Object:** Foreign body removed from airway | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Position of foreign body | Anatomical term | |
| Type of foreign body | Free text | |

Page: 156
[ICB30]

| **Object:** Removal of airway device | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Patient level of consciousness | Awake<br>Sedated<br>Lightly anaesthetised<br>Deeply anaesthetised | |

## 4:4 Equipment Settings and Procedures[ICB1]

Equipment check

**Anaesthetic equipment check**

Oxygen analyser check

Medical gas supply check

Anaesthetic machine 1 hose test

Pipeline gas supply check

Cylinder gas supply check

Pipeline tug test

Oxygen flush check

Vaporiser check

Breathing system check

Adjustable pressure relief valve check

Breathing system leaks check

Ventilator check

Ventilator disconnect alarm check

Suction check

Airway equipment check

Intubating equipment check

Monitoring equipment check

Equipment switched on

**Equipment set to manual control**

**Equipment set to automatic control**

Equipment switched off

Equipment gain calibration

**Invasive pressure monitor gain calibration**[ICB2]

Equipment zero check

**Invasive pressure monitor zero check**[ICB3]

*Pressure monitor zeroed*

Equipment flush

Equipment replacement

Equipment setting

**Monitor alarm setting**[ICB4]

Monitor alarm enabled

Monitor alarm disabled

Monitor alarm resetting

Monitor alarm limits adjustment

Monitor alarm upper limit setting

Monitor alarm lower limit setting

Monitor alarm time delay setting

**Ventilator setting**[ICB5]

Ventilator mode setting on ventilator,

Mandatory breath rate setting on ventilator[RMT6]

Tidal volume setting on ventilator[RMT7]

Minute volume setting on ventilator[RMT8]

Ventilation rate setting on ventilator[RMT9]

Inspiratory time setting on ventilator[RMT10]

Expiratory time setting on ventilator[RMT11]

Inspiratory/ expiratory ratio setting on ventilator

Inspiratory flow rate setting on ventilator[RMT12]

End inspiratory plateau time setting on ventilator[RMT13]

Cycling mechanism setting on ventilator[RMT14]

Maximum inspiratory pressure setting on ventilator[RMT15]

Positive end-expiratory pressure setting on ventilator[RMT16]

Negative end-expiratory pressure setting on ventilator[RMT17]

Continuous positive airways pressure setting on ventilator[RMT18]

**Defibrillator setting**[ICB19]

Synchronised DC shock mode selected

Asynchronised DC shock mode selected

**Temperature setting**

Equipment temperature setting[ICB20]

Warming device temperature setting

Cooling device temperature setting

Humidifier temperature setting

Ambient temperature setting

**Drug delivery system setting**

Vaporiser setting

Anaesthetic volatile agent concentration setting

Vaporiser temperature setting

Syringe driver rate setting

Intravenous infusion rate setting

Patient-controlled analgesia system setting[ICB21]

Bolus dose setting

Lock-out time setting

Maximum hourly dose setting

Background infusion rate setting

Drug concentration setting

Loading dose setting

Page: 165
[ICB1]

| **Object:** Equipment settings and procedures | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of equipment | Term from equipment list | |

Page: 165
[ICB2]

| **Object:** Invasive pressure monitor calibration | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of pressure | Systemic arterial pressure<br>Pulmonary arterial pressure<br>Central venous pressure<br>Intracranial pressure | |

Page: 166
[ICB3]

| **Object:** Invasive pressure monitor zero check | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of pressure | Systemic arterial pressure, Pulmonary arterial pressure, Central venous pressure, Intracranial pressure | |

Page: 166
[ICB4] Monitor alarm terms will require a qualifier for the parameter monitored, and the value at which the alarm is set.

Page: 166
[ICB5]

| **Object:** Ventilator setting | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Parameter set | Ventilator mode,Mandatory breath rate,Tidal volume,Minute volume,Ventilation rate,Inspiratory time,Expiratory time,Inspiratory/ expiratory ratio,Inspiratory flow rate End inspiratory time plateau time,Cycling mechanism,Maximum inspiratory pressure,Positive end-expiratory pressure,Negative end-expiratory pressure,Continuous positive airways pressure | |

Page: 166
[RMT6]

| **Object:** ,Mandatory breath rate setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Value set | Breaths per minute | |

Page: 166
[RMT7]

| **Object:** Tidal volume setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mls<br>litres | |
| Value set | Units | |

Page: 166
[RMT8]

| **Object:** Minute volume setting on ventilator |
|---|

| **Date:** 8 July 1995 |
|---|

| **Attribute:** | **Value:** | |
|---|---|---|
| Units | mls<br>litres | |
| Value set | Units | |

Page: 166
[RMT9]

| **Object:** Ventilation rate setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Breaths per minute | |

Page: 166
[RMT10]

| **Object:** Inspiratory time setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | seconds<br>% of respiratory cycle | |

Page: 166
[RMT11]

| **Object:** Expiratory time setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | seconds<br>% of respiratory cycle | |

Page: 166
[RMT12]

| **Object:** Inspiratory flow rate setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mls/sec<br>litres/sec | |

Page: 166
[RMT13]

| **Object:** End inspiratory plateau time setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Seconds<br>% of total respiratory cycle | |

Page: 166
[RMT14]

| **Object:** Cycling mechanism setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Cycle trigger | Pressure cycled<br>Time cycled<br>Volume cycled | |

Page: 166
[RMT15]

| **Object:** Maximum inspiratory pressure setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mmHg<br>kPa<br>cmH2O | |
| Value set | Units | |

Page: 167
[RMT16]

| **Object:** Positive end-expiratory pressure setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mmHg<br>kPa<br>cmH2O | |
| Value set | Units | |

Page: 167
[RMT17]

| **Object:** Negative end-expiratory pressure setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mmHg<br>kPa<br>cmH2O | |
| Value set | Units | |

Page: 167
[RMT18]

| **Object:** Continuous positive airways pressure setting on ventilator | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mmHg<br>kPa<br>cmH2O | |
| Value set | Units | |

Page: 167
[ICB19]

| **Object:** Defibrillator setting | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Energy set | Number of joules | |

Page: 167
[ICB20]

| **Object:** Equipment temperature set |
|---|

| Attribute: | Value: | |
|---|---|---|
| Temperature | Degrees Celsius [or Kelvin] | |

Page: 167
[ICB21]

| Object: Patient-controlled analgesia system setting | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Drug mass<br>Drug rate<br>Drug concentration<br>Time | |

## 4:5 Terms for Monitoring[ICB1]

Patient monitoring

**Cardiovascular monitoring**

Continuous ECG monitoring[ICB2]

Continuous ECG ST segment monitoring

Continuous ECG automated dysrhythmia analysis

Heart rate monitoring

Blood pressure monitoring

Non-invasive arterial blood pressure monitoring

Invasive systemic arterial blood pressure monitoring

Central venous pressure monitoring

Pulmonary artery pressure monitoring

Pulmonary capillary wedge pressure monitoring

*Pulmonary artery occlusion pressure monitoring*

Cardiac output monitoring

Air embolism monitoring

Air embolism monitoring with pre-cordial Doppler probe

Air embolism monitoring using capnography

Continuous auscultation monitoring

Continuous auscultation monitoring with pre-cordial stethoscope

Continuous auscultation monitoring with oesophageal stethoscope

**Respiratory monitoring**

Oxygen monitoring

Inspired oxygen concentration monitoring

*Oxygen concentration monitoring using inspired gas analysis*

Continuous intravascular oxygen monitoring

Transcutaneous oxygen monitoring

Carbon dioxide monitoring

Carbon dioxide monitoring using respired gas analysis

*Capnography*

Anaesthetic agent monitoring

Blood gas monitoring

Continuous invasive blood gas monitoring

Oximetry

Invasive oximetry

Pulse oximetry

Respiratory rate monitoring

Respiratory rate monitoring by observation

Respiratory volume monitoring

Airways pressure monitoring

**Patient temperature monitoring**

Core temperature monitoring

Peripheral temperature monitoring

Core-periphery temperature gradient monitoring

**Neuromuscular blockade monitoring**

Neuromuscular blockade monitoring using peripheral nerve stimulator

Neuromuscular blockade monitoring using clinical examination

Neuromuscular blockade monitoring using electromyograph

**Depth of anaesthesia monitoring**

Depth of anaesthesia monitoring using EEG

Depth of anaesthesia monitoring using CFM

Depth of anaesthesia monitoring using CFAM

Depth of anaesthesia monitoring using compressed spectral array

Depth of anaesthesia monitoring using evoked potentials

Depth of anaesthesia monitoring using visual evoked potentials

Depth of anaesthesia monitoring using auditory evoked potentials

Depth of anaesthesia monitoring using isolated arm technique

Depth of anaesthesia monitoring by clinical examination

Depth of anaesthesia monitoring using ECG parameter

Lower oesophageal sphincter pressure monitoring

**Metabolic monitoring**

**Intra-cranial pressure monitoring**

Equipment monitoring

**Fresh gas oxygen concentration monitoring**

*Oxygen concentration monitoring at the common gas outlet*

**Oxygen failure monitoring**

*Oxygen supply failure monitoring*

**Breathing system disconnection monitoring**

*Disconnection alarm*

**Ventilator monitoring**

*Ventilator observations*

**Tourniquet cuff pressure monitoring**

Page: 173
[ICB1]

| **Object:** Monitoring | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Frequency measurement for monitoring | Continous<br>Intermittent | |
| Equipment used for monitoring | Term from equipment list | |
| Time monitoring started | time | |
| Time monitoring ended | time | |

Page: 173
[ICB2]

| **Object:** Continuous ECG monitoring | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Lead configuration | CM5,I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 | |
| Number of leads | 3, 5, 6, 12 | |

## 4:6 Terms for Measurement for Anaesthesia

The terms contained in this list are parameters which can be measured, and have numbers attached, with units where applicable. Also included in this list are terms which allow analysis of measurements.

**Parameters**[ICB1]

Cardiovascular parameters

**Heart rate [ICB2]**

*HR - Heart rate*

**Pulse rate [ICB3]**
**Arterial pressure**

*BP - Blood pressure*

*SAP - Systemic arterial pressure*

*SBP - Systemic blood pressure*

Non-invasive arterial pressure[RMT4]

*Cuff blood pressure*

*NIBP - Non-invasive blood pressure*

Non-invasive systolic arterial pressure

*SAP - Systolic arterial pressure*

*Non-invasive systolic blood pressure*

Non-invasive mean arterial pressure

*MAP - Mean arterial pressure*

*Non-invasive mean blood pressure*

Non -invasive diastolic arterial pressure[ICB5]

*DAP - Diastolic arterial pressure*

*Non -invasive diastolic blood pressure*

Invasive arterial pressure[RMT6]

*Invasive blood pressure*

*IBP - Invasive blood pressure*

*ABP - Arterial blood pressure*

Invasive systolic arterial pressure

*SAP - Systolic arterial pressure*

*Invasive systolic blood pressure*

Invasive mean arterial pressure

*MAP - Mean arterial pressure*

*Invasive mean blood pressure*

Invasive diastolic arterial pressure

*DAP - Diastolic arterial pressure*

*Invasive diastolic blood pressure*

**Central venous pressure**[ICB7]

*CVP - Central venous pressure*

Jugular venous bulb pressure[ICB8]

**Pulmonary artery pressure[ICB9]**

*PAP - Pulmonary artery pressure*

*PA pressure - Pulmonary artery pressure*

Pulmonary artery systolic pressure

Pulmonary artery diastolic pressure

Pulmonary artery mean pressure

**Pulmonary artery occlusion pressure** [ICB10]

*Pulmonary artery wedge pressure*

*PAOP - Pulmonary artery occlusion pressure*

*PCWP - Pulmonary capillary wedge pressure*

**Blood loss [ICB11]**

Respired gas concentration

**Respired oxygen concentration** [ICB12]

*O2 concentration - respired*

*Oxygen concentration - respired*

Inspired oxygen concentration

*Oxygen concentration - inspired*

*FIO2 - Inspired fraction of oxygen*

Expired oxygen concentration

*Oxygen concentration - expired*

*FEO2 - Expired fraction of oxygen*

Mixed expired oxygen concentration

End -tidal oxygen concentration

*Oxygen concentration - end-tidal*

*ETO2 - End-tidal oxygen concentration*

**Respired carbon dioxide concentration[ICB13]**

*CO2 concentration - respired*

*Carbon dioxide concentration - respired*

Inspired carbon dioxide concentration

*Carbon dioxide concentration - inspired*

*FICO2 - Inspired fraction of carbon dioxide*

Expired carbon dioxide concentration

*Carbon dioxide concentration - expired*

*FECO2 - Expired fraction of carbon dioxide*

Mixed expired carbon dioxide concentration

End -tidal carbon dioxide concentration

*Carbon dioxide concentration - end-tidal*

*ETCO2 - End-tidal carbon dioxide concentration*

**Respired carbon dioxide tension[ICB14]**

Inspired carbon dioxide tension

*PICO2 - Inspired partial pressure of carbon dioxide*

Expired carbon dioxide tension

*PECO2 - Expired partial pressure of carbon dioxide*

Mixed expired carbon dioxide tension

End -tidal carbon dioxide tension

*ETCO2 - End-tidal carbon dioxide*

**Respired nitrogen concentration** [ICB15]

*N2 concentration - respired*

*Nitrogen concentration - respired*

Inspired nitrogen concentration

*Nitrogen concentration - inspired*

*FIN2 - Inspired fraction of nitrogen*

Expired nitrogen concentration

*Nitrogen concentration - expired*

*FEN2 - Expired fraction of nitrogen*

End -tidal nitrogen concentration

*Nitrogen concentration - end-tidal*

*ETN2 - End-tidal nitrogen concentration*

**Respired nitrous oxide concentration**[ICB16]

*N2O concentration - respired*

*Nitrous oxide concentration - respired*

Inspired nitrous oxide concentration

*Nitrous oxide concentration - inspired*

*FIN2O - Inspired fraction of nitrous oxide*

Expired nitrous oxide concentration

*Nitrous oxide concentration - expired*

*FEN2O - Expired fraction of nitrous oxide*

End -tidal nitrous oxide concentration

*Nitrous oxide concentration - end-tidal*

*ETN2O - End-tidal nitrous oxide concentration*

**Respired anaesthetic agent concentration** [ICB17]

*AA concentration - respired*

*Anaesthetic agent concentration - respired*

Inspired anaesthetic agent concentration

*Anaesthetic agent concentration - inspired*

*FIAA- Inspired fraction of anaesthetic agent*

Expired anaesthetic agent concentration

*Anaesthetic agent concentration - expired*

*FEAA - Expired fraction of anaesthetic agent*

End -tidal anaesthetic agent concentration

*Anaesthetic agent concentration - end-tidal*

*ETAA - End-tidal fraction of anaesthetic agent*

**Arterio-venous difference[ICB18]**

*A-Vdiff - Arterio-venous difference*

Equipment gas concentration

**Oxygen concentration in equipment[ICB19]**

*O2 concentration in equipment - Oxygen concentration in equipment*

**Carbon dioxide concentration in equipment[ICB20]**

*CO2 concentration in equipment - Carbon dioxide concentration in equipment*

**Nitrous oxide concentration in equipment[ICB21]**

*N2O concentration in equipment - Nitrous oxide concentration in equipment*

**Nitrogen concentration in equipment[ICB22]**

*N2 concentration in equipment - Nitrogen concentration in equipment*

**Anaesthetic agent concentration in equipment[ICB23]**

*AA conentration in equipment - Anaesthetic agent concentration in equipment*

Ventilation parameters

**Breathing rate [ICB24]**

*Respiratory rate*

*RR - Respiratory rate*

Spontaneous breath rate

**Total breath rate**

**Minute volume [ICB25]**

*VMIN - Minute volume*

Total minute volume

Spontaneous minute volume

Triggered minute volume

Mandatory minute volume

**Tidal volume** [ICB26]

*VT - Tidal volume*

*TV - Tidal volume*

Spontaneous tidal volume

Mandatory tidal volume

**Ventilatory time [ICB27]**

Inspiratory time

*TI - Inspiratory time*

Expiratory time

*TE - Expiratory time*

Inspiratory pause time

*Plateau time*

*TP - Pause time*

**Inspiration/expiration time ratio** [ICB28]

*I/E ratio - Inspiration/expiration ratio*

**Total compliance measured dynamically**[ICB29]

*Ct - Total chest compliance*

**Airways resistance measured dynamically**[RMT30]

*Rairw - Airways resistance*

Ventilator parameters

**Ventilator generated pressure** [ICB31]

**Ventilator flow output** [ICB32]

**Ventilator volume output**

Ventilator delivered tidal volume [ICB33]

Ventilator delivered minute volume [ICB34]

**Ventilator rate** [ICB35]

Mandatory breath rate

Triggered breath rate

Patient temperature **[ICB36]**

**Core temperature**

**Peripheral temperature**

Equipment temperature **[ICB37]**

Ambient temperature[ICB38]

Inspired gas temperature[ICB39]

Humidity[ICB40]

**Absolute humidity**[ICB41]

**Relative humidity**[ICB42]

Neuromuscular blockade parameters **[ICB43]**

**Train of four ratio**[ICB44]

*TOF ratio - Train of four ratio*

**Train of four count**[ICB45]

*TOF count - Train of four count*

**Single stimulus depression[RMT46]**

**Post-tetanic count[RMT47]**

*PTC - Post-tetanic count*

**Double burst count**[ICB48]

**Double burst ratio**[ICB49]

**Tetanic fade [RMT50]**

Tetanic fade ratio[ICB51]

Depth of anaesthesia

**Spectral edge frequency[ICB52]**

**Median frequency[ICB53]**

Central nervous system pressures

*CNS pressures - Central nervous system pressures*

**Intra-cranial pressure [ICB54]**

*ICP - Intra-cranial pressure*

**Extra-cranial cerebrospinal fluid pressure** [RMT55]

*Extra-cranial CSF pressure - Extra-cranial cerebrospinal fluid pressure*

*CSF pressure - Cerebrospinal fluid pressure*

Intracerebral vascular parameters

**Cerebral perfusion pressure** [ICB56]

*CPP - Cerebral perfusion pressure*

**Cerebral blood flow** [ICB57]

*CBF - Cerebral blood flow*

Metabolic parameters

**Oxygen delivery**[ICB58]

*Oxygen flux*

*DO2 - Oxygen delivery*

Indexed oxygen delivery[ICB59]

*Indexed oxygen flux*

*DO2i - Indexed oxygen delivery*

**Oxygen consumption**[ICB60]

*VO2 - Oxygen consumption*

Indexed oxygen consumption[ICB61]

*VO2i - Indexed oxygen consumption*

**Oxygen extraction ratio**[ICB62]

*ER - Extraction ratio*

**Oxygen uptake**[ICB63]

*O2 uptake - Oxygen uptake*

**Basal metabolic rate**[ICB64]

*BMR - Basal metabolic rate*

**Respiratory quotient**[ICB65]

*RQ - Respiratory quotient*

**Energy expenditure** [ICB66]

**Nitrogen balance** [ICB67]

*N2 balance - Nitrogen balance*

Gas flow **[ICB68]**

**Fresh gas flow**[ICB69]

*FGF - Fresh gas flow*

Gas pressure

**Gas cylinder pressure** [ICB70]

**Gas pipeline pressure** [ICB71]

**Pressure in the breathing system**[ICB72]

**Airways pressure[ICB73]**

*Pressure in patient's airways*

*Pmth - Mouth pressure*

End -expiratory pressure

Positive end -expiratory pressure[ICB74]

*PEEP - Positive end-expiratory pressure*

Negative end -expiratory pressure[ICB75]

*NEEP - Negative end-expiratory pressure*

Continuous positive airways pressure[ICB76]

*CPAP - Continuous positive airways pressure*

**Airway device cuff pressure** [ICB77]

Tourniquet parameters

**Duration of tourniquet inflation**[ICB78]

*Tourniquet time*

**Tourniquet inflation pressure**[ICB79]

Length of vascular catheter in body[ICB80]

Waveform parameters

**Systemic arterial waveform**

**Pulmonary arterial waveform**

**Capnograph waveform**

**Plethysmograph waveform**

**ECG waveform**

**Airway pressure waveform**

**Flow volume loop**

**Pressure volume loop**

**Examination and analysis of patient charts**[ICB81]

Analysis of value[ICB82]

**Actual value**

**Peak value**

**Trough value**

**Maximum value**

**Minimum value**

**Value high**

**Value low**

**Value normal**

**Value unrecordable**

**Average of sample**

Mean value

Mode value

Median value

**Value greater than other value**

**Value less than other value**

**Value equal to other value**

**Difference between values significant**

**Difference between values non-significant**

**Erroneous value**

Artefact

Analysis of trends[ICB83]

**Stable trend**

**Unstable trend**

Upward trend

Downward trend

Variable trend

**Improving trend**

**Worsening trend**

**No trend**

Analysis using time

**Frequency of data collection**[ICB84]

**Rate of change of value**

Analysis of curves

**Area under curve**

**Analysis of waveform**[ICB85]

Waveform normal

Waveform abnormal

Waveform overdamped

Waveform underdamped

Waveform correctly damped

Interference on waveform

Electrical interference on waveform

**Interference on waveform from physical contact**

Page: 177
[ICB1]

| **Object:** Parameters | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Frequency of measurement | Continuous,Intermittent | |
| Equipment used | Term from equipment list | |

Page: 177
[ICB2]

| **Object:** Heart rate | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of measurement | Palpation of apex<br>ECG<br>Auscultation<br>Ultrasonography<br>Doppler probe | |
| Units | Beats per minute | |

Page: 177
[ICB3]

| **Object:** Pulse rate | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method | Palpation,Finger plethysmography, Oximetry,Non-invasive blood pressure monitoring,Intra-arterial waveform | |
| Units | Beats per minute | |

Page: 177
[RMT4]

| **Object:** Non-invasive arterial pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Site of measurement | Arm,Calf | |
| Laterality | Left, Right | |

Page: 177
[ICB5]

| **Object:** Non-invasive diastolic arterial pressure |
|---|

| Attribute: | Value: | |
|---|---|---|
| Phase | Phase 4,Phase 5 | |

Page: 178
[RMT6]

| Object: Invasive arterial pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Site of measurement | Artery<br>Radial<br>Brachial<br>Femoral<br>Dorsalis pedis<br>Posterior tibial<br>Carotid | |
| Laterality | Left,Right | |

Page: 178
[ICB7]

| Object: Central venous pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of pressure | Peak, Mean, Trough | |
| Site of measurement | Internal jugular vein,External jugular vein,Subclavian vein,Brachiocephalic vein,Superior vena cava,Inferior vena cava | |
| Units | mmHg, kPa,cmH2O | |

Page: 178
[ICB8]

| Object: Jugular venous bulb pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Site of measurement | Jugular venous bulb | |

Page: 178
[ICB9]

| Object: Pulmonary artery pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of measurement | Direct,Indirect | |
| Units | mmHg, kPa, cmH2O | |

Page: 178
[ICB10]

| **Object:** Pulmonary artery occlusion pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mmHg, kPa,cmH2O | |

Page: 178
[ICB11]

| **Object:** Blood loss | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of measurement | Visual estimation,<br>Weighing of swabs,<br>Dilution and colorimetry,<br>Drainage measurement,<br>Volume in drainage bottles,<br>Volume in suction drainage, | |
| Units | mls,litres,units of blood | |

Page: 178
[ICB12]

| **Object:** Respired oxygen concentration | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Sample site | Mouth,Nose,Y connector,Tracheal tube | |
| Units | %,fraction of barometric pressure | |

Page: 179
[ICB13]

| **Object:** Respired carbon dioxide concentration | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Sample site | Mouth,Nose,Y connector,Tracheal tube | |
| Units | %,fraction of barometric pressure | |

Page: 179
[ICB14]

| **Object:** Respired carbon dioxide tension | | |
|---|---|---|
| **Attribute:** | **Value:** | |

| | | |
|---|---|---|
| Sample site | Mouth,Nose,Y connector,Tracheal tube | |
| Units | kPa,mmHg | |

Page: 180
[ICB15]

| **Object:** Respired nitrogen concentration | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Sample site | Mouth,Nose,Y connector,Tracheal tube | |
| Units | %,fraction of barometric pressure | |

Page: 180
[ICB16]

| **Object:** Respired nitrous oxide concentration | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Sample site | Mouth,Nose,Y connector,Tracheal tube | |
| Units | %,fraction of barometric pressure | |

Page: 180
[ICB17]

| **Object:** Respired anaesthetic agent concentration | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Sample site | Mouth,Nose,Y connector,Tracheal tube | |
| Units | % | |
| Anaesthetic agent | Halothane,Enflurane,Isoflurane,Desflurane,Sevoflurane,Ether,Cyclopropane | |

Page: 181
[ICB18]

| **Object:** Arterio-venous difference | |
|---|---|
| **Attribute:** | **Value:** |
| Gas measured | Oxygen,Carbon dioxide |
| Units | mmHg, kPa |

Page: 181
[ICB19]

| **Object:** Oxygen concentration in equipment | | |
|---|---|---|
| **Attribute:** | **Value:** | |

| | | |
|---|---|---|
| Sample site | Breathing circuit inspiratory limb,Breathing circuit expiratory limb,Common gas outlet,Ventilator outlet | |
| Units | % | |

Page: 181
[ICB20]

| **Object:** Carbon dioxide concentration in equipment | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Sample site | Breathing circuit inspiratory limb,Breathing circuit expiratory limb,Common gas outlet,Ventilator outlet | |
| Units | % | |

Page: 181
[ICB21]

| **Object:** Nitrous oxide concentration in equipment | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Sample site | Breathing circuit inspiratory limb,Breathing circuit expiratory limb,Common gas outlet,Ventilator outlet | |
| Units | % | |

Page: 181
[ICB22]

| **Object:** Nitrogen concentration in equipment | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Sample site | Breathing circuit inspiratory limb,Breathing system expiratory limb,Common gas outlet,Ventilator outlet | |
| Units | % | |

Page: 181
[ICB23]

| **Object:** Anaesthetic agent concentration in equipment |
|---|

| Attribute: | Value: | |
|---|---|---|
| Sample site | Breathing circuit inspiratory limb,Breathing circuit expiratory limb,Common gas outlet,Ventilator outlet | |
| Units | % | |
| Anaesthetic agent | Halothane,Enflurane,Isoflurane,Desflurane,Sevoflurane,Ether,Cyclopropane | |

Page: 181
[ICB24]

| **Object:** Breathing rate | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Source of measurement | Examination,Gas analyser,Ventilator,ECG impedance,Spirometer, Chest plethysmograph | |
| Units | Breaths per minute | |

Page: 182
[ICB25]

| **Object:** Minute volume | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | litres/minute | |
| Stage of respiratory cycle | Inspired,Expired | |
| Source of measurement | Wrights spirometer,Electronic spirometer,Pneumotachograph | |

Page: 182
[ICB26]

| **Object:** Tidal volume | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mls,litres | |
| Stage of respiratory cycle | Inspired,Expired | |
| Source of measurement | Wrights spirometer,Electronic spirometer,Pneumotachograph | |

Page: 182
[ICB27]

| **Object:** Ventilatory time | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | seconds,% of respiratory cycle | |

Page: 182
[ICB28]

| **Object:** Inspired/ expired ratio | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Nil | |

Page: 182
[ICB29]

| **Object:** Total compliance measured dynamically | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Source of measurement | Ventilator<br>Respiratory gas monitor | |
| Units | litres per cm H2O | |

Page: 182
[RMT30]

| **Object:** Airways resistance measured dynamically | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Source of measurement | Ventilator<br>Respiratory gas monitor | |
| Units | cm H2O per litres/sec | |

Page: 183
[ICB31]

| **Object:** Ventilator generated pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mmHg,kPa,cmH2O | |

Page: 183
[ICB32]

| **Object:** Ventilator flow output | | |
|---|---|---|
| **Attribute:** | **Value:** | |

| | | |
|---|---|---|
| Units | mls/second, litres/minute | |

Page: 183
[ICB33]

| **Object:** Ventilator delivered tidal volume | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mls,litres | |

Page: 183
[ICB34]

| **Object:** Ventilator delivered minute volume | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | litres/min | |

Page: 183
[ICB35]

| **Object:** Ventilator rate | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Breaths/minute | |

Page: 183
[ICB36]

| **Object:** Patient temperature | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Site of measurement | Skin,<br>Skinfold,<br>Axilla,*axillary<br>Mouth,*oral<br>Nose,*nasal<br>Nasopharynx,*nasopharyngeal<br>Oesophagus,*oesophageal<br>Pulmonary artery,*PA<br>Rectum,*rectal,<br>Tympanic membrane<br>Core<br>Peripheral | |
| Units | Degrees Celsius,Degrees Kelvin | |

Page: 183
[ICB37]

| **Object:** Equipment temperature | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Temperature measured | Intravenous fluid warmer,*iv fluid warmer,<br>Warming/ cooling mattress,Radiant heater,Heat exchanger,Anaesthetic vaporiser | |
| Units | Degrees Celsius,Degrees Kelvin | |

Page: 183
[ICB38]

| **Object:** Ambient temperature | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Degrees Celsius,Degrees Kelvin | |

Page: 183
[ICB39]

| **Object:** Inspired gas temperature | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Degrees Celsius,Degrees Kelvin | |

Page: 183
[ICB40]

| **Object:** Humidity | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Sample type | Ambient gas,Inspired gas | |

Page: 183
[ICB41]

| **Object:** Absolute humidity | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mg/litre,g/cubic metre | |

Page: 183
[ICB42]

| **Object:** Relative humidity | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | % | |

Page: 183
[ICB43]

| **Object:** Neuromuscular blockade | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Nerve stimulated | Ulnar nerve,Facial nerve,Lateral popliteal nerve | |
| Muscle assessed | Adductor pollicis,Temporalis, Muscle | |
| Mode of assessment | Visual, Tactile, Force, Electromyography, Accelerometry | |

Page: 183
[ICB44]

| **Object:** Train of four ratio | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Nil | |

Page: 183
[ICB45]

| **Object:** Train of four count | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Nil | |

Page: 183
[RMT46]

| **Object:** Single stimulus depression | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | % | |

Page: 183
[RMT47]

| **Object:** Post-tetanic count | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of stimulation | Post-tetanic count stimulation,Post-tetanic count pattern | |

| | | |
|---|---|---|
| Units | Nil | |

Page: 183
[ICB48]

| **Object:** Double burst count | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Nil | |

Page: 183
[ICB49]

| **Object:** Double burst ratio | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Nil | |

Page: 183
[RMT50]

| **Object:** Tetanic fade | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Method of stimulation | Tetanic burst stimulation,Single tetany | |

Page: 184
[ICB51]

| **Object:** Tetanic fade ratio | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Nil | |

Page: 184
[ICB52]

| **Object:** Spectral edge frequency | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Hz | |

Page: 184
[ICB53]

| **Object:** Median frequency | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Hz | |

Page: 184
[ICB54]

| **Object:** Intra-cranial pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Site of measurement | Brain tissue<br>Frontal lobe,Temporal lobe,Parietal lobe,Occipital lobe<br>Ventricle<br>Lateral ventricle,Third venticle,Fourth ventricle<br>Subarachnoid space of brain<br>Frontal subarachnoid space of brain<br>Temporal subarachnoid space of brain<br>Parietal subarachnoid space of brain<br>Occipital subarachnoid space of brain<br>Saggital subarachnoid space of brain<br>Extradural space of brain<br>Frontal extradural space of brain,Temporal extradural space of brain,Parietal extradural space of brain,Occipital extradural space of brain,Saggital extradural space of brain | |
| Units | mmHg,kPa,cmH2O | |

Page: 184
[RMT55]

| **Object:** Extracranial cerebrospinal fluid pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Site of measurement | Subarachnoid space<br>Cervical subarachnoid space<br>Thoracic subarachnoid space<br>Lumbar subarachnoid space<br>Sacral subarachnoid space | |
| Units | mmHg,kPa,cmH2O | |

Page: 184
[ICB56]

| **Object:** Cerebral perfusion pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mmHg,kPa | |

Page: 184
[ICB57]

| **Object:** Cerebral blood flow | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mls/min | |

Page: 184
[ICB58]

| **Object:** Oxygen delivery | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mls/minute | |

Page: 184
[ICB59]

| **Object:** Indexed oxygen delivery | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mls/minute/metre squared | |

Page: 184
[ICB60]

| **Object:** Oxygen consumption | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mls/minute | |

Page: 184
[ICB61]

| **Object:** Indexed oxygen consumption | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mls/minute/metre squared | |

Page: 184
[ICB62]

| **Object:** Oxygen extraction ratio | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Nil | |

Page: 185
[ICB63]

| **Object:** Oxygen uptake | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mls/minute | |

Page: 185
[ICB64]

| **Object:** Basal metabolic rate | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | kiloJoules/litre oxygen consumed/day,kiloCalories/litre oxygen consumed/day | |

Page: 185
[ICB65]

| **Object:** Respiratory quotient | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | Nil | |

Page: 185
[ICB66]

| **Object:** Energy expenditure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | kiloJoules/hour,kiloJoules/day,Joules/hour,Joules/day,kilocalories/hour,kilocalories/day | |
| Method | Direct calorimetry,Indirect calorimetry,Harris Benedict equation,Schofield equation,Doubly labelled water | |
| Type of energy expenditure | Total | |

Page: 185
[ICB67]

| **Object:** Nitrogen balance | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | g nitrogen/day | |

Page: 185
[ICB68]

| **Object:** Gas flow measurement | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of gas flow | Peak,Mean,Trough | |
| Site | Oxygen rotameter,Nitrous oxide rotameter,Carbon dioxide rotameter,Air rotameter,Common gas outlet, Breathing circuit | |
| Units | litres/ minute | |

Page: 185
[ICB69]

| **Object:** Fresh gas flow | |
|---|---|
| **Attribute:** | **Value:** |
| Site | Common gas outlet |

[ICB70]

| **Object:** Gas cylinder pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Cylinder identity | Oxygen, Carbon dioxide, Nitrous oxide, Air, Entonox, Cyclopropane, Helium, Helium /oxygen mixture, Oxygen /carbon dioxide mixture | |
| Units | kPa, lbs per sq. inch, bars | |

Page: 185
[ICB71]

| **Object:** Gas pipeline pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |

| | | |
|---|---|---|
| Pipeline identity | Oxygen, Nitrous oxide, Air, Entonox | |
| Units | kPa, lbs per square inch, bars | |

Page: 185
[ICB72]

| **Object:** Pressure in the breathing system | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Site in breathing system | Inspiratory limb,Expiratory limb | |
| Units | cm H2O, mmHg, kPa | |

Page: 185
[ICB73]

| **Object:** Airways pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of pressure | Peak pressure<br>Mean pressure<br>Trough pressure,*Baseline pressure,<br>Plateau pressure | |
| Units | cmH2O,mmHg,kPa | |

Page: 185
[ICB74]

| **Object:** Positive end-expiratory pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of pressure | Positive end-expiratory pressure | |

Page: 185
[ICB75]

| **Object:** Negative end-expiratory pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of pressure | Negative end-expiratory pressure | |

Page: 185
[ICB76]

| **Object:** Continuous positive airways pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |

| | | |
|---|---|---|
| Type of pressure | Continuous positive airways pressure | |

Page: 185
[ICB77]

| **Object:** Airway device cuff pressure measurement | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Cuff type | Tracheal tube cuff, Endobronchial tube tracheal cuff, Endobronchial tube bronchial cuff, Tracheostomy tube cuff | |
| Units | mmHg, kPa, cmH2O | |

Page: 185
[ICB78]

| **Object:** Duration of tourniquet inflation | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | minutes | |

Page: 186
[ICB79]

| **Object:** Tourniquet inflation pressure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | mmHg,kPa | |

Page: 186
[ICB80]

| **Object:** Length of vascular catheter in body | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Units | cm | |
| Type of catheter | Central venous<br>Pulmonary artery floatation catheter,*Swan-Ganz catheter | |

Page: 186
[ICB81]

| **Object:** Examination and analysis of patient charts | | |
|---|---|---|
| **Attribute:** | **Value:** | |

| | | |
|---|---|---|
| Data collection method | Manual recording of data,<br>Automated recording of data | |
| Display of data | Visual display unit,<br>Paper | |
| Analysis method | Human,<br>Automated | |

Page: 186
[ICB82]

| **Object:** Analysis of value | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Parameter measured | Any parameter from measurements lists | |
| Value of parameter | Actual value | |
| Units of value | | |

Page: 187
[ICB83]

| **Object:** Analysis of trends | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Parameter analysed | Any measurable parameter | |

Page: 187
[ICB84] Time value required
Page: 187
[ICB85]

| **Object:** Analysis of waveform | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Parameter displayed | Any measurable parameter | |

## 4:7 Notable or Untoward Events in Patient Care*[ICB1]*

This file was written to include all terms to describe incidents or events which may happen during the peri-operative phase of patient care.

Cardiovascular events

**Cardiac arrest**

Cardiac arrest- asystole

Cardiac arrest- electromechanical dissociation

Cardiac arrest- ventricular fibrillation

**Myocardial infarction**

**Cardiac arrhythmia**[ICB2]

Cardiac arrhythmia compromising circulation

Cardiac arrhythmia not compromising circulation

Electrical interference with artificial cardiac pacemaker

**Vaso-vagal episode**

**Embolism**[ICB3]

Thromboembolism

Arterial thromboembolism

Venous thromboembolism

Pulmonary thromboembolism

Tumour embolism

Air embolism

Carbon dioxide embolism

Fat embolism

Amniotic fluid embolism

**Cerebrovascular accident**

**Hypertension**[ICB4]

**Hypotension**

**Hypervolaemia**

**Hypovolaemia**

**Haemorrhage**[ICB5]

**Haematoma formation**

**Vasodilatation**[ICB6]

**Left ventricular failure**

**Right ventricular failure**

**Myocardial depression**

**Cardiac tamponade**

**Impaired venous return**

Caval compression

Aorto-caval compression

**Suspected abnormal capillary leakage**

**Intravascular cannulation problems**[ICB7]

Intravascular access difficult

Intravascular cannula incorrectly inserted

Intravascular cannula incorrectly sited

Intravascular cannula incorrectly sited into artery

Intravascular cannula incorrectly sited into vein

Intravascular cannula incorrectly sited extravascularly

Intravascular cannula tip incorrectly sited[ICB8]

**Pulmonary artery catheter- unable to wedge**

*Pulmonary artery catheter- unable to occlude*

Respiratory events

**Aspiration of gastric contents into lower respiratory tract**[ICB9]

Aspiration of gastric contents into lower respiratory tract- liquid only

Aspiration of gastric contents into lower respiratory tract- particulate matter

**Aspiration of non-gastric material into lower respiratory tract**

Aspiration of blood into lower respiratory tract

Aspiration of pus into lower respiratory tract

Aspiration of foreign body into lower respiratory tract

**Airway problem**

Airway patency lost

*Airway obstruction*

Laryngospasm

Tracheal compression

Difficult intubation

Failed intubation

Tracheal tube/ endobronchial tube incorrectly positioned

Inadventent oesophageal intubation

Inadvertent endobronchial intubation

Accidental tracheal extubation

Airway device cuff problems[ICB10]

Airway device cuff underinflated

Airway device cuff overinflated

Airway device cuff herniation

**Pneumothorax**

Pneumothorax- traumatic

Pneumothorax- traumatic tension

Pneumothorax- traumatic non-tension

Pneumothorax- spontaneous

Pneumothorax- spontaneous tension

Pneumothorax- spontaneous non-tension

**Haemothorax**

Haemothorax- spontaneous

Haemothorax- traumatic

**Haemopneumothorax**

Haemopneumothorax -traumatic

**Hydrothorax**

**Chylothorax**

**Pyothorax**

**Bronchospasm**

**High airways pressure**

High airway pressure from breathing system

**High mean intra-thoracic pressure**

**Pulmonary barotrauma**

**Pulmonary/ lobar /segmental collapse**

**Oedema of respiratory tract**[ICB11]

Oedema of upper respiratory tract

Laryngeal oedema

Oedema of lower respiratory tract

Pulmonary oedema

**Adult respiratory distress syndrome**

**Contamination of inspired gases**

Air entrainment into equipment

Dilution of inspired gases

Dilution of inspired oxygen but above 21%

Dilution of inspired oxygen to below 21%

*Hypoxic mixture*

Dilution of inspired anaesthetic agents

Excessive re-breathing of gases

**Ventilation problems**

Failure of mechanical ventilation

Complete failure of mechanical ventilation

Partial failure of mechanical ventilation

Unintentional one-lung ventilation

Unintentional apnoea- spontaneous ventilation

*Respiratory arrest*

*Apnoea*

**Hypercapnia**

*Hypercarbia*

**Hypocapnia**

*Hypocarbia*

**Hyperoxia**

**Hypoxia**

Desaturation of blood[ICB12]

Cyanosis

Central cyanosis

Peripheral cyanosis

**Inadequate clearance of respiratory tract secretions**

**Atelectasis**

**Pneumonia**

Unintended tissue damage during surgical or medical procedure[ICB13]

**Unintended nerve damage**

Unintended spinal cord damage

Unintended brain damage

Unintended cranial nerve damage

Unintended peripheral nerve damage

**Unintended vessel damage**

Unintended vessel rupture

**Unintended cardiac damage**

**Unintended airway damage**

Tooth knocked out

Tooth broken

Airway rupture

**Unintended urethral damage**

**Unintended ocular damage**

**Unintended skin damage**

**Unintended musculoskeletal damage**

Unintended bony damage

**Unintended thermal damage**

Diathermy plate burn

**Unintended electrical damage**

Microshock

**Unintended radiation damage**

**Unintended organ ischaemia**

Steal syndrome

Cerebral steal syndrome

Coronary steal syndrome

Inverse steal syndrome

**Unintended organ infarction**

**Stricture formation**

**Fistula formation**

**Abscess formation**

Extradural or subdural abscess

Musculoskeletal

**Myalgia**

Upper body and shoulder girdle myalgia

Suxamethonium pains

**Muscle spasm**

Masseter spasm

**Chest wall rigidity**

Neurological

**Convulsion**

**Neuromuscular blockade**

Unexpectedly prolonged neuromuscular blockade

Suxamethonium apnoea

Mivacurium apnoea

Phase II block

*Dual block*

Incompletely reversed neuromuscular blockade

Recurarisation of patient

Unexpected resistance to neuromuscular blockade

**Shivering**

Shivering and muscle rigidity following anaesthesia

*Halothane shakes*

**Failure to wake up following anaesthesia**

**Anaesthesia-related alteration in intra-cranial pressure**

**Anaesthesia-related alteration in intra-ocular pressure**

**Psychological problems associated with anaesthesia**

Awareness under general anaesthesia

Dreams under general anaesthesia

Emergence from anaesthesia phenomena

Mental problems post- cardiopulmonary bypass

Phobia of general anaesthesia

Phobia of needles

**Headache**

Postural headache

Post- dural puncture headache

*Spinal headache*

Local anaesthetic problems

**No effect from local anaesthetic administration**

**Unilateral sensory blockade after local anaesthetic administration**

**Patchy sensory block after local anaesthetic administration**

**Missed segment after local anaesthetic administration**

**Unilateral motor blockade after local anaesthetic administration**

**Patchy motor block after local anaesthetic administration**

**Excessive blockade after local anaesthetic administration**

Excessive cephalad spread after local anaesthetic administration

Excessive caudal spread after local anaesthetic administration

**Inability to locate epidural space**

**Inability to locate subarachnoid space**

**Inability to locate nerve or nerve plexus**

**Failure to thread epidural catheter**

**Dural tap**

Dural tap with needle

Dural tap with catheter

**Blood vessel tap**

*Bloody tap*

Blood vessel tap with needle

Blood vessel tap with catheter

**Backache after local anaesthetic procedure**

**Neurological deficit after local anaesthetic procedure**

**Arachnoiditis**

**Pruritis**

Haematological

**Blood transfusion**

Blood transfusion labelling error

Blood or blood product label not checked

Incompatible blood or blood product given

ABO incompatibility reaction

Rh incompatibility reaction

Massive blood transfusion

**Methaemoglobinaemia**

**Coagulation**

Patient over-anticoagulated

Patient under-anticoagulated

Coagulopathy

Disseminated intravascular coagulation

Metabolic

**Hyperthermia**

Malignant hyperthermia

*Malignant hyperpyrexia*

**Hypothermia**

**Blood chemical level abnormality**

Electrolyte imbalance

TUR syndrome

Osmotic disturbance

**Acid/base disturbance**

Gastrointestinal

**Regurgitation of stomach contents**

**Enteral tube incorrectly sited**[ICB14]

**Hepatitis**

Halothane hepatitis

Enflurane hepatitis

Renal/ urinary

**Urine output low**

**Urine output high**

**Urinary retention**

**Urinary catheter**

Urinary catheter incorrectly inserted

Urinary catheter incorrectly sited

Failed catheterisation of urinary tract

**Renal failure**

**Haematuria**

**Myoglobinuria**

Infection Problems

**Transmission of infection via blood or blood product**

**Transmission of infection via unsterile equipment**

**Transmission of infection from hospital staff to patient**

**Transmission of infection from patient to hospital staff**

**Septicaemia**

Death of patient

Pharmacological

**Drug administration problem**[ICB15]

Adverse drug reaction

Anaphylactic reaction

Anaphylactoid reaction

**Histamine release**

Drug interaction

Drug interaction in drug administration system

Drug interaction within patient

Incorrect drug administered

Incorrect drug administered after syringe swap

Drug administered despite contra-indication

**Drug administered despite known allergy**

Drug incorrectly labelled

Drug administered at incorrect rate

Drug administered too quickly

Drug administered too slowly

Drug administered in incorrect dilution

Drug administered in incorrect solution

Drug given at inappropriate time

Incorrect dose of drug

Overdosage of drug given

**Overtransfusion**

Underdosage of drug given

Incorrect placement of drug

Drug incorrectly given into peripheral vein

Drug incorrectly given into central vein

Drug incorrectly given into epidural vein

Drug incorrectly given into artery

Drug incorrectly given extravascularly

Inflammable agent used in incorrect environment

Ignition of flammable agent

Explosion of flammable agent

Breast milk transfer of drug

Trans-placental transfer of drug affecting fetus

Environmental pollution from anaesthetic drug

**Extravasation of intravenous fluid**

**Failure to give prophylaxis**

**Failure of prophylaxis**

Equipment problems[ICB16]

**Equipment not available**

Correct size equipment not available

Equipment missing

**Equipment inadequate for purpose**

**Equipment not checked**

**Equipment failure or malfunctiuon**

Equipment stuck in fixed position

Equipment temperature control faulty

Equipment supply failure

Electrical power failure

**Hopital generator test**

**Hospital power cut**

Battery power failure

Steam supply failure

Piped suction failure

Equipment electrical fault

Equipment earth faulty

Equipment insulation faulty

Local area network faulty

Equipment cuff or balloon rupture

Unexpected tourniquet deflation

Equipment gas supply fault[N17]

Pipeline gas supply failure

Pipeline gas supply contamination

Cylinder gas supply failure

Cylinder gas supply contamination

Cylinder gas supply low

Gas pipelines transposed

**Equipment not switched on**

**Equipment switched on in error**

**Equipment exhausted**

**Equipment disconnected**

Failure of reconnection of equipment after intentional disconnection

Breathing system disconnection

**Equipment incorrectly assembled**

Incorrect connection of components

**Leakage from equipment system**[ICB18]

**Equipment incorrectly maintained**

**Equipment incorrectly calibrated**

Measuring device not zeroed

Measuring device gain not calibrated

**Equipment incorrectly applied to patient**

**Equipment dislogded from correct position**[ICB19]

Catheter migration

Epidural catheter migration

Intravascular cannula displaced extravascularly

*Cannula tissued*

Equipment pulled out of patient

Equipment pulled out of patient by patient

**Equipment incorrectly stored**

**Equipment settings incorrect**

Alarm limits set incorrectly

Alarms inappropriately disabled

Equipment tubing blocked

Equipment tubing blocked by loose body

Equipment tubing blocked by blood clot

Equipment tubing blocked by sputum plug

Equipment tubing blocked by cuff herniation

Equipment tubing knotted

Equipment tubing kinked

Equipment tubing squashed

**Equipment damaged**

**Equipment indwelling in patient after breakage**

**Equipment inadequately fixed**

**Equipment not sterile**

Preoperative preparation

**Patient inadequately prepared for theatre**

*Patient preparation inadequate*

Patient inadequately medically treated pre-operatively

Pre-operative therapy not given

**Normal medication not given**

Pre-operative therapy inadequate

Pre-operative therapy given at inappropriate time

Patient inadequately resuscitated pre-operatively

Patient inadequately fasted pre-operatively

*Patient not starved pre-operatively*

Patient make-up not removed pre-operatively

Patient jewellery not removed pre-operatively

Patient clothing not removed pre-operatively

Patient prosthesis not removed pre-operatively

Patient dentures not removed pre-operatively

Wrong anatomical site prepared for operation

**Theatre list problem**

Patient details incorrect on theatre list

Patient not on theatre list

List order changed

Operation details incorrect on theatre list

Operation site incorrect on theatre list

Late addition to theatre list

List overrun

Wrong patient in anaesthetic room

**Consent form inadequate**

Consent form incorrect

Wrong operation on consent form

Wrong operation site on consent form

Consent form not signed

Consent form out of date

**Patient assessment problem**

Patient inadequately assessed pre-operatively by medical staff

Patient inadequately assessed preoperatively by anaesthetist

Patient not seen preoperatively by anaesthetist

Patient inadequately assessed preoperatively by surgical staff

**Patient not clerked in**

Anaesthetist not informed of patient

Patient identity not checked pre-anaesthetic

Operation site not checked pre-anaesthetic

**Patient records not available**

Patient records not available at time of pre-operative visit

Patient records not available at time of operation

Patient previous anaesthetic record not available

Temporary notes only available

Incorrect records accompanying patient

**Preoperative investigations not available**[ICB20]

Preoperative investigations not available- not ordered

Preoperative investigations not available- not ordered in time

Preoperative investigations not available -results not received

Preoperative investigations not available- emergency operation

Wrong investigation done

Wrong result of investigation given

Different patient's investigations in notes

**Cross-matched blood not available**

**Premedication problem**

Prescribed premedicaton not given

Prescribed premedication given too late

Prescribed premedication given too early

**Patient's admission delayed**

**Patient's operation cancelled**

Patient unfit for operation

**Patient's operation delayed**

**Nurse not accompanying patient**

Staff problems

**Staff delay**

Nurse delay

Porter delay

Surgeon delay

Anaesthetist delay

ODA delay

Radiographer delay

Photographer delay

**Innapropriate grade of staff**

Inappropriate grade of anaesthetist for case

Senior anaesthetic help not available

**Staff unavailable**

Anaesthetist unavailable

Anaesthetist unavailable- busy elsewhere

Anaesthetist unavailable- paging system malfunction

Assistant anaesthetist unavailable

Replacement anaesthetist unavailable

Anaesthetist absent

**Staff unwell**

Anaesthetist unwell

Anaesthetist collapse during case

Anaesthetist working having had inadequate rest

**Inadequate trained assistance**

Inadequate anaesthetic assistance

Untrained anaesthetic assistant

No anaesthetic assistant available

No recovery room personnel available

Operating theatre problem

**Closed for maintenance**

**Lack of sterile supplies**

Operation problem

**Operation overrun**

**Operation abandoned**

Hospital problem

**Hospital water supply failure**

**Hospital emergency**

Hospital fire

Major accident

Bomb scare

**Post operative facilities inadequate**

Intensive care unit full

Recovery unit full

High dependency unit full

Patient problems

**Pre-existing patient morbidity**

Pre-existing patient morbidity discovered intra-operatively

Day case patient unsuitable for such treatment

**Patient height problem**

**Patient weight problem**

Patient obese

**Patient non-cooperation**

Patient refusal for treatment

Patient refuses operation

Non-admission of relevant information by patient

**Patient missing**

**Patient admission delayed**

**Preoperative nausea and vomiting**

**Pre-operative anxiety**

Anaesthetic problem

**Inadequate analgesia**

**Inadequate muscle relaxation**

**Inadequate depth of anaesthesia**

**Nausea**

Post-operative nausea

**Vomiting**

Post-operative vomiting

Patient positioning problems

**Patient injured during during positioning**

**Patient dropped during transfer**

**Patient inadequately secured**

**Patient slipped on operating table**

**Patient fall off operating table**

**Patient too big for operating table**

**Patient unable to keep still**

**Patient unable to adopt desired position**

**Excessive patient movement by surgeon**

Anaesthetist

**Anaesthetist put under undue pressure to proceed**

Page: 207
[ICB1]

| **Object:** Notable or Untoward Events in Patient Care | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Timing of event | Pre-operative,<br>At induction,<br>Intra-operative,<br>During recovery,<br>Post-operative | |
| Time to recognition of event | Immediate recognition,<br>Delayed recognition, | |
| Type of event | Complication,<br>Contributing factor to other event,<br>Critical incident | |
| Severity of event | Grade 1- transient abnormality unnoticed by patient<br>Grade 2 - transient damage with full recovery<br>Grade 3 - potentially permanent but not disabling damage<br>Grade 4 - potentially permanent disabling damage<br>Grade 5 - death | |
| Duration of event | Time value | |
| Onset of event | Acute,<br>Acute on chronic | |

Page: 207
[ICB2] The arrhythmia will need to be specified
Page: 207
[ICB3]

| **Object:** Embolism | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Site of embolism | Anatomical qualifier | |

Page: 208
[ICB4]

| **Object:** Hypertension | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type | Primary, Secondary | |

Page: 208
[ICB5]

| **Object:** Haemorrhage | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type | Spontaneous, Traumatic, Surgical | |

Page: 208
[ICB6] Vasodilatation in this sense is used more as a pathological term. It may also exist as a procedure or as an examination term.
Page: 208
[ICB7]

| **Object:** Intravascular cannulation problems | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of cannulation | Peripheral venous, Central venous, Arterial, Pulmonary arterial | |

Page: 208
[ICB8]

| **Object:** Intravascular cannula tip incorrectly sited | | |
|---|---|---|
| **Attribute:** | **Value:** | **C/Q/P** |
| Position of tip | Anatomical term | |

Page: 209
[ICB9]

| **Object:** Aspiration of gastric contents into lower respiratory tract | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Cricoid pressure used | Cricoid pressure applied prior to aspiration,<br>Cricoid pressure not applied prior to aspiration | |

Page: 209
[ICB10]

| **Object:** Airway device cuff problems | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of cuff | Tracheal tube cuff, Tracheostomy tube cuff, Endobronchial tube tracheal cuff, Endobronchial tube bronchial cuff | |

Page: 210
[ICB11] Anatomical qualifier required
Page: 211
[ICB12]

| **Object:** Desaturation of blood | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Blood type | Systemic arterial,<br>Venous,<br>Mixed venous,<br>Capillary | |

Page: 211
[ICB13]

| **Object:** Unintended tissue damage during surgical or medical procedure | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Anatomical site of damage | Anatomical term | |

Page: 216
[ICB14] An anatomical qualifier required to describe site
Page: 217
[ICB15]

| **Object:** Drug administration problem | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Drug identity | Drug name | |

Page: 218
[ICB16]

| **Object:** Equipment problems | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Equipment involved | Term from equipment list | |

Page: 219
[N17]

| **Object:** Equipment gas supply fault | | |
|---|---|---|
| **Attribute:** | **Value:** | |

| | | |
|---|---|---|
| Gas supply type | Oxygen<br>Nitrous oxide<br>Carbon dioxide<br>Air<br>Cyclopropane | |

Page: 220
[ICB18]

| **Object:** Leakage from equipment system | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Type of leakage | Gas,<br>Electrical,<br>Liquid | |

Page: 220
[ICB19]

| **Object:** Equipment dislogded from correct position | | |
|---|---|---|
| **Attribute:** | **Value:** | |
| Site from which equipment dislodged | Anatomy term | |
| Site to which equipment dislodged | Anatomy term | |

Page: 222
[ICB20] The missing investigation will need to be specified

## 4:8 Abbreviations and acronyms

This list contains abbreviations and acronyms which anaesthetists may wish to record.

Specific areas which have caused problems include:

1. Units; Some, such as BPM [beats per minute] which can be considered as being specific to the practice of medicine have been included. Other units such as mm Hg, or SI units have not been included, with the exception of measurements of cannula gauge, as these often appear on anaesthetic records.

2. Many standard scientific notations or symbols could be included in the list ,but apart from such basic terms such as O2, N2O, CO2, we have not done so.

3. Unusual characters are needed for some of the terms. For example, Cv*O2, denoting the oxygen content of mixed venous blood should be annotated with a bar over the "v". Similarly for the terms for oxygen delivery, oxygen delivery index, oxygen saturation for mixed venous blood, minute volume, oxygen consumption and indexed oxygen consumption.

4. There are many areas of overlap with other specialities. These have been annotated. They have been included as they are useful to anaesthetists.

5. Some abbreviations are meant to be used in combination with other abbreviations; e.g. ET[end-tidal] can be combined with O2, CO2,etc.

AA:Anaesthetic agent

A-a D:Alveolar -arterial difference

ABC:Airway ,breathing ,circulation

ABG:Arterial blood gases

ABP:Arterial blood pressure

ACD:Acid citrate dextrose

ACF:Ante-cubital fossa

ACV:Ante-cubital vein

ACh:Acetylcholine

AChE:Anticholinesterase

ACLS:Advanced cardiac life support

ADE:Humphrey ADE circuit

A&E:Accident and emergency

AEP:Auditory evoked potentials

AER:Auditory evoked response

Alf:Alfentanil

AN:Anaesthetic nurse

APACHE:Acute physiology and chronic health evaluation

APL:Adjustable pressure-limiting valve

AR:Anaesthetic room

ASA:American society of Anaesthesiologists

ATLS:Advanced trauma and life support

A-V diff:Arterio-venous difference

BJA:British Journal of Anaesthesia

BLS:Basic life support

BMI:Body mass index

BOC:British Oxygen Company

BP:Blood pressure

BPM:Beats per minute

BPM:Breaths per minute

BS:British standard

BS:Breath sounds

BSA:Body surface area

CaO2:Arterial oxygen content

CBF:Cerebral blood flow

CBV:Cerebral blood volume

CCT:Central conduction time

CCU:Coronary care unit

Ccw:Chest wall compliance

CFAM:Cerebral function analysing monitor

CFM:Cerebral function monitor

CH:Condenser humidifier

ChE:Cholinesterase

CHFV:Combined high frequency ventilation

CI:Cardiac index

Cl:Clearance

Cl:Lung compliance

CMRO2:Cerebral metabolic rate for oxygen

CMV:Continous mechanical ventilation

CNETT:Cuffed nasal endotracheal tube

CNS:Central nervous system

CO:Cardiac output

CO2:Carbon dioxide

COETT:Cuffed oral endotracheal tube

CONS:Consultant

CP:Cricoid pressure

CPAP:Continuous positive airways pressure

CPD:Citrate phosphate dextrose

CPD-A:Citrate phosphate dextrose adenine

CPP:Cerebral perfusion pressure

CPR:Cardiopulmonary resuscitation

CSA:Compressed spectral array

CSF:Cerebrospinal fluid

Ct:Total lung compliance

CTG:Cardiotocogram

CVP:Central venous pressure

CvO2:Venous oxygen content

C*vO2:Mixed venous oxygen content

CXR:Chest x-ray

DA:Diploma in Anaesthetics

DA:Dopamine

DBS:Double burst stimulation

Dl:Diffusing capacity of the lung

DLF:Dorsum left foot

DLH:Dorsum left hand

D*O2:Oxygen delivery

D*O2i:Oxygen delivery [indexed]

dp/dt:Rate of change of pressure [arterial waveform]

DRF:Dorsum right foot

DRH:Dorsum right hand

DTC:dextro Tubocurarine

EAR:Expired air resuscitation

EBL:Estimated blood loss

EBT:Endobronchial tube

EBV:Estimated blood volume

ECG:Electrocardiogram

ECM:External cardiac massage

EEG:Electroencephalogram

EEMG:Evoked electromyogram

EMG:Electromyogram

EMLA:Eutectic mixture of local anaethetics

EMMV:Extended mandatory minute ventilation

EMO:Epstein ,Macintosh ,Oxford

Enfl:Enflurane

EP:Evoked potentials

ER:Extraction ratio

ERV:Expiratory reserve volume

ET:End-tidal

Etom:Etomidate

ETT:Endotracheal tube

EVR:Evoked response

Exp:Expired

FCAnaes:Fellow of the College of Anaesthetists

Fe:Expired fraction

Fent:Fentanyl

FEV1:Forced expiratory volume in one second

FFARCS:Fellow of the Faculty of Anaesthetists, Royal College of Surgeons

FFARCSI:Fellow of the Faculty of Anaesthetists, Royal College of Surgeons in Ireland

FFP:Fresh frozen plasma

Fi:Inspired fraction

FiAA:Inspired fraction of anaesthetic agent

FiCO2:Inspired fraction of carbon dioxide

FiN2:Inspired fraction of nitrogen

FiN2O:Inspired fraction of nitrous oxide

FiO2:Inspired fraction of oxygen

FG:French gauge

FGF:Fresh gas flow

FHR:Fetal heart rate

FRC:Functional residual capacity

FRCA:Fellow of the Royal College of Anaesthetists

FVC:Forced vital capacity

GA:General anaesthetic

GCS:Glasgow Coma Scale

GTN:Glyceryl trinitrate

HAFOE:High air flow oxygen enrichment

HAS:Human albumin solution

Halo:Halothane

HCO3:Bicarbonate

HDU:High dependency unit

HFJV:High frequency jet ventilation

HFO:High frequency oscillation

HFPPV:High frequency positive pressure ventilation

HR:Heart rate

Ht:Height

IBV:Intracranial blood volume

ICP:Intracranial pressure

ICU:Intensive care unit

ID:Intradermal

ID:Internal diameter

I/E:Inspired / expired ratio

IM:Intramuscular

IMV:Intermittent mandatory ventilation

Insp:Inspired

IOP:Intraocular pressure

IPPV:Intermittent positive pressure ventilation

IRV:Inspiratory reserve volume

ISMN:Isosorbide mononitrate

Iso:Isoflurane

ISO:International Standards Organisation

ISS:Injury severity score

IT:Implant tested

ITU:Intensive therapy unit

IV:Intravenous

IVI:Intravenous infusion

IVRA:Intravenous regional anaesthetic

JVP:Jugular venous pressure

KTS:Knife to skin

LA:Local anaesthetic

LAP:Left atrial pressure

LAS:Level of awareness score

LFA:Left forearm

LIJ:Left internal jugular

LMA:Laryngeal mask airway

LOS:Lower oesphageal sphincter

LP:Lumbar puncture

LVEDP:Left ventricular end-diastolic pressure

LVSW:Left ventricular stroke work

LVSWI:Left ventricular stroke work index

MAC:Minimum alveolar concentration

MAOI:Monoamineoxidase inhibitor

MAP:Mean arterial pressure

MC:Mary Catterall [mask]

MEAC:Minimum effective analgesic concentraion

MH:Malignant hyperthermia =malignant hyperpyrexia

MHE:Malignant hyperthermia [equivocal]

MHS:Malignant hyperthemia [susceptible]

MIC:Minimum infusion concentration

MIE:Medical and Industrial Equipment Ltd

MIR:Minimum infusion rate

MILT:Manual in-line traction

MLT:Microlaryngoscopy tube

MPM:Mortality prediction model

MMV:Mandatory minute volume

N2O:Nitrous oxide

NCEPOD:National Confidential Enquiry into Peri-operative Deaths

NEEP:Negative end-expiratory pressure

NETT:Nasal endotracheal tube

NG:Nasogastric

NIBP:Non-invasive blood pressure

NMJ:Neuromuscular junction

N/P:Nasopharyngeal

N/S:Normal saline

NSAID:Nonsteroidal anti-inflammatory drug

O2:Oxygen

O2cap:Oxygen capacity

O2cont:Oxygen content

OD:Outside diameter

ODA:Operating department assistant

ODP:Operating department practitioner

ODO:Operating department orderly

OETT:Oral endotracheal tube

OLV:One-lung ventilation

OSP:Oesophageal sphincter pressure

OR:Operating room

OT:Operating theatre

P:Pulse

PA:Partial pressure in alveolus

Pa:Partial pressure in artery

PAFC:Pulmonary artery floatation catheter

PAOP:Pulmonary artery occlusion pressure

PAP:Peak airways pressure

PAP:Pulmonary arterial pressure

Pc:Partial pressure in capillary

PCA:Patient-controlled analgesia

PCB:Pancuronium bromide = Panc.

PCWP:Pulmonary capillary wedge pressure

PDPH:Post-dural puncture headache

PEEP:Positive end-expiratory pressure

PEFR:Peak expiratory flow rate

pH:Acidity / alkalinity

PI:Pin index

Pi:Inspired pressure

pKa:Negative logarithm of dissociation constant

PMo:Pressure at the mouth

PO:Oral

PONV:Post-operative nausea and vomiting

PPF:Plasma protein fraction

PR:Rectally

PreO2:Preoxygenation

Prop:Propofol

PTC:Post-tetanic count

Pv:Partial pressure in venous blood

PVR:Peripheral vascular resistance

PVRI:Peripheral vascular resistance index

Qs / Qt:Shunt fraction

RAE:Ring, Adair, Edwin

Rairw:Airway resistance

RAP:Right atrial pressure

RCA:Royal College of Anaesthetists

REG:Registrar

RGM:Respiratory gas monitor

RFA:Right forearm

RIJ:Right internal jugular

RPP:Rate pressure product

RQ:Respiratory quotient

RR:Respiratory rate

RR:Recovery room

RSI:Rapid sequence induction

RV:Residual volume

RVEDP:Right ventricular end-diastolic pressure

RVSW:Right ventricular stroke work

RVSWI:Right ventricular stroke work index

SAB:Sub-arachnoid block

SAG-M:Saline adenine glucose mannitol

SaO2:Oxygen saturation of arterial blood

SAP:Systemic arterial pressure

SAP:Systolic arterial pressure

SAPS:Simplified acute physiology score

SC:Subcutaneous

SCATA:Society for Computing and Technology in Anaesthesia

SE:Spectral edge

SIMV:Synchronised intermittent mandatory ventilation

SHO:Senior House Officer

SL:Sub-lingual

SpO2:Oxygen saturation at the periphery

SR:Senior registrar

SR:Spontaneous respiration

SSEP:Somatosensory evoked potentials

StdHCO3:Standard bicarbonate

STP:Sodium thiopentone

SUX:Suxamethonium

SV:Spontaneous ventilation

SV:Stroke volume

SVI:Stroke volume index

SvO2:Oxygen saturation of venous blood

Sv*O2:Oxygen saturation of mixed venous blood

SVP:Saturated vapour pressure

SVR:Systemic vascular resistance

SVRI:Systemic vascular resistance index

SWG:Steel wire gauge

T1/2alpha:Redistribution half-life

T1/2beta:Elimination half-life

TEMP:Temperature

TENS:Transcutaneous electrical nerve stimulation

THCO3:Total bicarbonate

Thio:Sodium thiopentone

TILC:Temperature indicated, level compensated

TIVA:Total intravenous anaesthetic

TLC:Total lung capacity

TOF:Train of four

TOFC:Train of four count

TOFR:Train of four ratio

TOP:Topically

TPR:Temperature, pulse, respiration

TNS:Transcutaneous nerve stimulation

Trac:Atracurium

TV:Tidal volume

UOS:Upper oesophageal sphincter

V:Ventrum[of wrist]

Va:Alveolar volume

VC:Vital capacity

Vd:Dead space

Vec:Vecuronium

VIC:Vaporiser in circle

VIE:Vacuum insulated evaporated

V*min:Minute volume

V*O2:Oxygen consumption

V*O2i:Oxygen consumption [indexed]

VOC:Vaporiser out of circle

V/Q:Ventilation/perfusion

Vt:Tidal volume

Wt:Weight

## Section 4:9 References for Section 4

1. Banks IC, Tackley RM. Anaesthetic chapter. In: *Read Clinical Classification*, Version 3. Loughborough, NHS Centre for Coding and Classification, 1995.

2. *Read Clinical Classification*, Version 3. Loughborough, NHS Centre for Coding and Classification, 1995.

# Section 5

# Conclusions

## Section 5: Conclusions

Section 1 of the thesis has outlined the situations in the Health Service, and more specifically for anaesthesia, where a standard language would be of benefit. The existing standard terms applicable for use in anaesthesia have also been examined, as has the role of coding a standard language. The way in which anaesthetic records are used to record data at present has been demonstrated.

Section 2 of the thesis has explored the means whereby a standard language, based on terms, can be created. As well as the content of the thesaurus of terms, the structure and form of terms for the standard thesaurus has been discussed.

Section 3 has examined whether terms produced for a standard thesaurus are of sufficient quality to be used by anaesthetists, and others, in a hospital setting. The means of ensuring this quality have been reviewed, and further suggestions made as to how terms can be evaluated further. This section also includes a discussion as to the ways that these standard terms can be applied to the hospital setting in the future.

Section 4 contains lists of terms produced by the Anaesthetic Specialty Working Group. These lists, produced within the framework of the NHS Centre for Coding and Classification's Clinical Terms Project, are provided as examples of the terms which have been created. These lists consist of terms which, when considered with the other terms of the Clinical Terms Project, contribute a significant part of the standard thesaurus of terms for anaesthesia.

The questions posed in this thesis were as follows:

1. Is there a need for a standardized thesaurus of terms in anaesthesia?
2. Can such a thesaurus be created?
3. Can such a thesaurus be introduced into the National Health Service?

It has been the aim of the thesis to answer these questions.

1. There is a clear need in the National Health Service to improve on existing systems of data collection. There are many different requirements for good quality information in the Health Service, as is shown in Section 1. The specialty of anaesthesia is certainly not remote from this need. Indeed, the review of the present means of recording common, simple parameters demonstrates that there is no uniformity and consensus amongst anaesthetists. The diversity in the methods of information recording that exists does not help in the collection and interpretation of data. As argued in Section 1, correct and useful decisions are very unlikely to result if the person charged with making the decisions bases these decisions on inaccurate or unintelligible information. This may have deleterious effects on both patient care and hospital management. The need for a standard language is clear.

The NHS Executive's information technology strategy is computer-based. There is no doubt that computers have the unrivalled ability to handle vast quantities of information quickly. They are therefore ideal for use in an organization as big as the National Health Service. However, the language which computers can handle most readily cannot easily be translated into from standard prose. It is sensible then, if creating a standard language, to create it in a form that can bridge the gap between existing forms of communications, and computers. It is therefore appropriate that the standard language should be in the form of terms, which can be matched to computer codes.

There are no existing standard terms or coding systems which can provide the information necessary for use in anaesthesia. The only solution is to create a new, standard collection, or thesaurus of terms for the specialty of anaesthesia.

2. The creation of a standard thesaurus of terms requires planning, and it is necessary to examine the structure, and the content of the thesaurus. The way in which in the thesaurus of terms is written needs to be compatible with a computer, but also with the syntax of written and spoken language. This includes the consideration of synonyms, homonyms and other idioms. The form of the terms themselves needs to be decided upon at an early stage, as this will be the basis of term-writing.

The terms created by the Anaesthetic Specialty Working Group are illustrated in Section 4. They correspond to the format described in Section 2, and are based on the core term / qualifying term structure. This form is the most efficient way of handling the necessary information which may need to be recorded. This format can be handled readily by a computer, but can be understood by the person recording or interpreting the information. It avoids lengthy and repetitious terms.

The content of a thesaurus has also been examined. It must reflect all the present aspects of recording of anaesthetic-related information, and it must be flexible enough to cope with the subtleties of language. Examination of terms in Section 2 has shown that this is possible. However, the total number of terms required to cover procedures, history, symptoms, clinical signs, measurements, equipment, administration and drugs is huge. It has also been shown that the links between terms, in the form of contextual information, is essential in the provision of a comprehensive anaesthetic record.
Section 2 shows that it is possible to create terms for a standard thesaurus for anaesthesia. Section 4 contains terms created towards this goal.

3. Section 3 has examined the steps required to develop the thesaurus to a stage where it can be used in the National Health Service. The ways in which quality assurance has been used to improve upon the initial terms produced has been reviewed. The process of refinement has not yet been completed. As terms for the standard thesaurus for anaesthesia have formed part of a wider project, the incorporation of all the terms created has not yet been achieved. Further evaluation of the completed set of terms will be required, in the form of formal trials.

The thesaurus, even when completed, will still be reliant on the computer system in which it will function. If the computer system cannot handle the terms properly, it will not matter how effective the terms are at recording information. A user of the system will quickly become dissatisfied with the terms if he or she is thwarted by an unforgiving computer system. The need for the development of a suitable computer system has been noted in Section 3.

The answer to the question of whether a standard thesaurus of terms can be introduced into the National Health Service therefore cannot be answered fully as yet. The quality assurance work carried out so far has been very useful and fruitful, but further work is required, in the form of large scale trials. The problem of the production of the correct computer system to handle the thesaurus has still not been solved, although the development of such a system is well advanced.

In conclusion, there is a need for a standardized thesaurus of terms for anaesthesia. It is possible to create such a thesaurus, although the assembly of these terms has been, and still is, a major undertaking. The introduction of the thesaurus into the National Health Service has begun.