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Research Paper

Improving the quality of orthopaedic elective and trauma operative notes: A completed audit loop study

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ABSTRACT

Introduction: Good medical practice dictates that comprehensive documentation of all surgical procedures is paramount in maintaining a high standard of patient care. This study audited the quality of operative note keeping for elective and trauma procedures against the standards set by the British Orthopaedic Association (BOA) and The Royal College of Surgeons of England (RCSE) guidelines.
Patients and methods: A retrospective assessment of the operative notes of every patient undergoing a total knee and hip replacement (elective cases) was carried out over a period of 2 months. Data recorded were compared against BOA guidelines. Within this time a randomised selection of trauma operative notes were also assessed, and the recorded data were compared against RCSE guidelines. Change in practice was implemented and the audit cycle completed. A total of 173 operative notes were evaluated.
Results: There was a significant improvement (p-value < 0.05) in the quality of total knee replacement notes, with an increase in the percentage of data points from 68.6% to 93%. Similarly the quality of total hip replacement notes showed significant improvement (p-value < 0.01) with an increase in the percentage of data points from 67.5% to 86%. However trauma operative notes showed minimal improvement.
Discussion: This study showed that the quality of elective operative notes was improved through surgeon education and the circulation of a guideline based electronic operative note. We have further plans to implement procedure specific notes for the most common types of trauma cases to help improve the quality of trauma operative notes.

1. Introduction

Good medical practice states that accurate and detailed operative notes are of paramount importance in all surgical specialities not only to maintain a high standard of patient safety but also to provide key information for research, audit and medicolegal purposes [1].

There has been a year on year increase in NHS claims, with the National Health Service Litigation Authority (NHSLA) estimating that there are currently over 18.9 billion pounds worth of potential clinical negligence claims against the NHS [2]. Getting it Right First Time, a recent review of adult elective orthopaedic services published in 2015 explained how surgical specialities were found to have the highest litigation rates with orthopaedics second to obstetrics and gynaecology. Orthopaedics accounts for more than 50% of claims if obstetrics and gynaecology is excluded [3]. Of particular concern is that the rate of litigation within trauma and orthopaedics is rising, with a 16% increase in claims between 2010/11 and 2011/12; this is in comparison to a 6% increase in claim volume in the NHS as a whole over the same time [4]. The medicolegal impact of unsatisfactory operative notes was exemplified in an audit conducted by Lefter et al. [5], where 44.73% of 190 operative notes were found to be non-defensible after scrutiny by a medico-legal lawyer. With the rates of litigation in trauma and orthopaedics outstripping rates in the majority of other specialities, this makes it even more important to ensure legible and accurate documentation.

It is well understood that there is a greater risk of misinterpretation when communicating a management plan through a handwritten note as compared to a typed form, as the legibility of the surgeon's writing dictates the quality of the handwritten note. This is reflected in the latest Royal College of Surgeons of England (RCSE) guidelines which now state a preference for typed notes [6]. In fact two recent studies assessing the quality of operative notes showed that only 66% [7] and 80% [8] of notes were considered fully legible.

Dr Atul Gawande in his book "Checklist Manifesto – How to Get Things Right" [9] makes a strong case for the greater implementation of checklists to help reduce death rates stemming from medical

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error, where in the United States estimated rates range from 48,000 to 98,000 [10]. He cites examples of how industries such as aviation and construction improve efficiency and reduce error by utilising checklists. This led to the development of the World Health Organisation (WHO) Safe Surgery Checklist which was piloted across eight hospitals worldwide in 2007. This checklist has been shown to reduce deaths and complications following surgery by up to a third [11]. Templated operative notes and checklists work on similar principles as they both reduce the complexity of the task at hand but at the same time ensure that none of the salient points are missed. The WHO safe surgery checklist is a clear example of how simple measures can maintain patient safety to a high standard.

The study compared orthopaedic notes against standards set by the RCSE and British Orthopaedic Association (BOA). We looked specifically at elective notes that were either total knee or hip replacements and assessed them against BOA bluebook guidelines [12,13]. Trauma notes were assessed against RCSE guidelines [6], which no previous study has specifically examined.

2. Patients and methods

A retrospective (September–October 2014) and prospective (March–May 2015) assessment was carried out of the operative notes of every patient undergoing a total knee and hip replacement in accordance with SQUIRE 2.0 guidelines [14]. During this time a predetermined number of randomly selected trauma operative notes were examined. Randomisation was achieved by assigning each trauma operative note a number which was processed using a computer randomisation generator. British Orthopaedic Association (BOA) guidelines were broken down into individual data points and transferred to a checklist that was used to assess elective case (knee and hip replacements) operative notes. Similarly trauma cases were assessed using a checklist developed from the Royal College of Surgeons of England (RCSE) guidelines. In total 173 operative notes were assessed. The BOA and RCSE guidelines were chosen as the gold standard as they are a well-recognised, reliable and valid measure of operative note quality.

The grade of operating surgeon and whether the operative note was typed or handwritten were also recorded. When the operator note entry was deemed illegible it was not credited as a present data point; this decision had to be validated by the second auditor. All notes were assessed by the same two investigators throughout the study.

Prior to the audit, a group of senior orthopaedic surgeons was consulted regarding the applicability of some of the data points to specific orthopaedic procedures. For example “details of serial numbers of prosthetics used” would not be applicable to an incision and drainage of a wound. A list of further examples was drawn up and these were taken into account when collecting data.

After the first audit cycle, our findings were presented at an orthopaedic departmental meeting where areas that needed improvement were highlighted to the surgeons present. In addition electronic templated notes based upon BOA and RCSE guidelines for total knee/hip replacement and trauma surgery were showcased (Appendices S1 and S2). The location of the templates on the hospital-shared hard drive was shown. The templates allowed variable data to be added such as patient details but could be modified by individual surgeons to any of their own additional specifications.

The second audit cycle commenced two months after the presentation of the new electronic templates to allow the surgeons time to adjust to the new operative notes. The continued assessment of operative notes is now an important aspect of departmental clinical governance.

Data were inputted and analysed using Microsoft Excel. Initial results were all found to follow a Gaussian distribution (D'Agostino and Pearson omnibus normality test, $p > 0.05$), favouring analysis using unpaired t-tests. In cases where an F-test showed the variances between the initial and re-audit results to be unequal ($p < 0.05$), an unpaired t-test with Welch's correction was performed. The prevalence of individual criteria was compared using Fisher's Exact Test. A value of $p < 0.05$ was considered significant. All data were rounded to three significant figures and was collected confidentially in accordance with Data Protection Laws and Caldicott Principles.

3. Results

A total of 173 operative notes were audited of which 109 were for elective procedures (59 total knee replacements and 50 total hip replacements) and 64 were for trauma surgery (Table 1).

Total Knee Replacement (TKR) operative notes initially scored on average 13 out of 19 data points ($n = 28$); after re-audit the average number of data points increased to 17.7 ($n = 31$). This increase in percentage of average data points from 68.6% to 93% was found to be significant ($p < 0.05$) using un-paired t-test analysis. Of the 19 data points that were assessed using Fisher's Exact test, there was significant improvement ($p < 0.05$) in 6 of the data points after re-audit (Table 2).

Total Hip Replacement (THR) operative notes initially scored on average 16.2 out of 24 data points ($n = 20$); after re-audit the average number of data points increased to 20.6 ($n = 30$). This increase in percentage of average data points from 67.5% to 86% was found to be significant ($p < 0.01$) using un-paired t-test analysis. Out of the 24 data points that were assessed using Fisher's Exact test, there was significant improvement ($p < 0.05$) in 9 of the data points after re-audit (Table 3).

On average, trauma operative notes initially met 68.2% of datapoints ($n = 29$); on re-audit there was a slight improvement with an average of 73.7% of data points met ($n = 35$), but the changes were insignificant. Two of the 11 data points showed a significant improvement (p-value <0.05); these were diagnosis made and details of serial numbers of prosthetics used (Table 4). However one of the data points (details of tissue removed/altered/added) after re-audit was shown to worsen significantly (p-value <0.05).

The initial cycle showed on average 85.7% of operative notes were typed ($n = 77$); on re-audit there was a significant improvement (p-value <0.05) with an average of 95.8% of notes being typed ($n = 92$).

All notes were written by either a consultant or registrar. In the case of consultants they wrote 91.7% of all elective operative notes ($n = 109$); in contrast they wrote only 25% of all trauma operative notes ($n = 64$), and this difference was statistically significant (p-value <0.05).

Table 1
Summary table of results for elective and trauma surgery.

Type of Surgery	Percentage of average data points met in the initial cycle (%)	Number of operative notes (initial cycle)	Percentage of average data points met after re-audit (%)	Number of operative notes (re-audit)
Total knee replacement*	68.6	28	93.0	31
Total hip replacement**	67.5	20	86.0	30
Trauma surgery	69.2	29	73.7	35

* Significant improvement after re-audit with p-value <0.05.
** Significant improvement after re-audit with p-value <0.01.

Table 2
Percentage of total knee replacement operation notes with the required data point recorded.

Data point	Initial audit (n = 28) notes with data point (%)	Re-audit (n = 31) notes with data point (%)
Name of operating surgeon	96	94
Name of responsible consultant	**14**	**94**
Diagnosis made	**36**	**81**
Procedure performed	100	94
Description of findings	**39**	**94**
Details of tissue removed/altered/added[a]	93	94
Details of serial numbers of prosthetics used	**29**	**84**
Details of sutures used	**43**	**94**
Accurate description of any difficulties/complications and how these were overcome[a]	**4**	**87**
Immediate post-op instructions	100	94
Surgeon's signature	86	81
Date of operation	96	94
Assistants	96	94
Details of incision and additional procedures to achieve satisfactory exposure	100	94
Details of soft tissue release procedures[a]	100	94
Details of bone grafting[a]	4	23
Post-surgery flexion range	89	94
Tourniquet time[a]	82	84
Details of component alignment and rotation	96	94

Statistically significant improvement (p-value < 0.05) of results are indicated in bold.
[a] Data points that are not applicable to all total knee replacements.

Table 3
Percentage of total hip replacement operation notes with the required data point recorded.

Data point	Initial audit (n = 20) notes with data point (%)	Re-audit (n = 30) notes with data point (%)
Name of operating surgeon	95	100
Name of responsible consultant	**15**	**97**
Diagnosis made	**65**	**90**
Procedure performed	100	100
Description of findings	**60**	**100**
Details of tissue removed/altered/added[a]	95	100
Details of serial numbers of prosthetics used	**45**	**100**
Details of sutures used	**55**	**100**
Accurate description of any difficulties/complications and how these were overcome[a]	**25**	**83**
Immediate post-op instructions	100	100
Surgeon's signature	90	70
Date of operation	100	100
Assistants	95	100
Details of incision and additional procedures to achieve satisfactory exposure	95	100
Details of soft tissue release procedures[a]	**80**	**100**
Details of bone grafting[a]	15	0
Patient positioning	**60**	**100**
Name of anaesthetist	85	97
Type of anaesthesia	90	100
Description of other procedures performed such as catheterisation/calf stimulators/foot pumps	10	13
Details of antibiotic prophylaxis	**45**	**97**
Details of VTE prophylaxis	90	100
Joint stability post-procedure	90	100
Details of HSSD tracking procedures	20	17

Statistically significant improvement (p-value < 0.05) of results are indicated in bold.
[a] Data points that are not applicable to all total hip replacements.

Table 4
Percentage of the trauma operation notes with the required data point recorded.

Data point	Initial audit (n = 29) notes with data point (%)	Re-audit (n = 35) notes with data point (%)
Name of operating surgeon	100	100
Name of responsible consultant	48	49
Diagnosis made	**76**	**100**
Procedure performed	100	100
Description of findings	48	40
Details of tissue removed/altered/added[a]	76	46
Details of serial numbers of prosthetics used	**12**	**56**
Details of sutures used	86	97
Accurate description of any difficulties/complications and how these were overcome	17	14
Immediate post-op instructions	100	100
Surgeon's signature	93	97

Statistically significant improvement (p-value < 0.05) of results are indicated in bold.
[a] Statistically significant worsening (p-value < 0.05) of results.

4. Discussion

The concept of using a standardised proforma for postoperative notes is not a novel idea. Many studies have shown that a general aide memoir or templated note based upon guidelines can improve the quality of operative notes [15–18].

This study went one step further by using the specific BOA guidelines for total knee and hip replacements rather than broad guidelines, thereby ensuring a better assessment of these operative notes. The other aspect of this study looked at operative notes for trauma cases. Due to the diverse nature of trauma surgery, there were no specific guidelines for each type of procedure and hence they were assessed using RCSE guidelines.

When total knee and hip replacement operative notes were assessed using the more stringent BOA criteria they both showed a significant improvement in overall note quality (p-value <0.05 and <0.01 respectively). In contrast trauma operative notes showed minimal improvement that was not significant (Table 1). This could have been due to the level of surgeon that were writing these operative notes, with registrars writing 75% of all trauma notes compared to 91.7% of elective notes written by consultants. Therefore the quality of operative note could be dependent on the level of surgeon with the more experienced consultant writing better operative notes. Another factor that may explain this lack in improvement was that 15.6% of trauma notes were handwritten compared to only 4.59% of elective notes. This concurs with Baigrie et al.'s [19] findings that trauma operative notes were more likely to be handwritten and therefore routinely lacked information and were difficult to read.

This study showed that after re-audit the percentage of operative notes that were typed improved from 85.7% to 95.8%. This follows the trend set by the latest RCSE guidelines [6] that all operation notes should now be "preferably typed" giving a clear indication of the shift to use electronic proformas to improve legibility of notes. By being stored electronically, operative notes have multiple added benefits when compared to typed notes. For example by having the notes stored on a secured shared drive, this allows a backup copy to be available if the paper notes were lost or destroyed. Furthermore it allows ease of access of the notes for auditing and research purposes.

Electronic templates like medical proformas have shown to be effective in speeding up the process of inputting data and require minimal training to use [20], with the added benefit of being cheap to design and implement. Furthermore templated operative notes can be adjusted by individual surgeons to their own preferences but at the same

time key guidelines kept intact. However Coughlan et al. [21] highlighted that some surgeons use illustrations to explain complex procedures. This would be difficult to do with the current templates but could be overcome in the future with the use of touch technology.

One study [17] showed that the quality of operative notes was preserved over a prolonged period of time (5 years), demonstrating that "a high standard can be maintained even when the novelty has worn off". This gives strength to the argument that templated operative notes have longevity in daily practice.

Overall there was a clear improvement in the quality of elective operative notes. However, with some of the BOA, data points were found to be too broad; for example post-operative instructions for total knee replacements needed to be broken down into more detailed data points such as post-operative VTE, antibiotics, X-ray as illustrated in Morgan et al. [22]. Additionally due to the relatively small numbers of operative notes there was no obvious recorded significant change in Datix incidences but overall there was an expression in the department that notes were easier to read and less phone calls were subjectively received querying postoperative instructions.

More work is required to improve the quality of trauma operative notes with continued surgeon education at the heart of this. Also plans have been made to audit the 5 most common trauma case procedures in the department and develop operative notes specific to these cases to see if quality of trauma notes will improve.

Financial pressures in the NHS are mounting [23] on top of billions of pounds worth of clinical negligence claims against it. The Rt Hon Lord Justice Jackson is quoted as saying "Litigation is, however a matter of last resort. There is huge need to prevent claims arising in the first place. That is by far the most effective way to reduce legal costs and to promote patient satisfaction" [4]. Therefore it has never been more important that clinicians look to find ways of reducing this deficit by changing current practice. Dr Gawande's WHO Safe Surgery Checklist Program exemplifies the impact of how small change to current practices can have wider reaching implications. By the relativity simple step of standardising all operative notes to meet RCSE and BOA guidelines this one measure would improve patient safety with the added benefit of reducing litigation rates.

5. Conclusion

We have successfully shown an improvement in the quality of operative notes for elective cases by improving surgeon education and developing a freely accessible templated operative note based upon BOA guidelines. We have further plans to implement procedure specific notes for the most common types of trauma cases to help improve the quality of trauma operative notes.

Ethical approval

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Author contribution

Parth A Shah: Concept/design, data analysis/interpretation, drafting article, Submission of article.

Raj Badiani: Concept/design, data analysis/interpretation, critical revision of article, approval of article.

Benjamin M Davies: Data analysis/interpretation, critical revision of article, approval of article.

Yeggapan Kalairajah: Critical revision of article, approval of article.

Conflict of interest

No conflicts of interest.

Guarantor

Mr Yeggapan Kalairajah.

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Appendix: Supplementary material

Supplementary data to this article can be found online at doi:10.1016/j.ijso.2016.04.005.

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