The Obstetrician & Gynaecologist

[Manuscript title] BSGE/ESGE guideline on management of fluid distension media in operative hysteroscopy

[Running title] Fluid distension media in operative hysteroscopy

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Disclosure of interests

SU has received honoraria from Ethicon for the provision of training. ES has received honoraria for the provision of training for healthcare professionals from Ethicon, Karl Storz, Olympus, Fanin and Gedeon Richter. TJC received honoraria for lecturing/training from Medtronic, Bayer, Hologic, Preglem; travel/accommodation expenses from Medtronic, Bayer, Hologic and Lina Medical to attend medical conferences; and research grants from Cytyc, Smith & Nephew and Lina Medical. DM, KA and ET have no conflicts of interest.

Contributions to authorship

This was a joint collaborative guideline between the British Society for Gynaecological Endoscopy and the European Society for Gynaecological Endoscopy. All authors listed have contributed towards the article and have read and approved the final version.

Acknowledgement

The authors acknowledge the contributions of members of the British Society for Gynaecological Endoscopy and the European Society for Gynaecological Endoscopy.

Key content

- Hysteroscopy is a common surgical procedure in gynaecology. Fluid distension media is needed to undertake the procedure.
- The common fluid distension media available are discussed, along with their properties and role in undertaking operative hysteroscopic procedures.
- Some inherent complications can occur when there is excessive fluid absorption during hysteroscopic procedures.
- The monitoring of the fluid distension medium used and how to avoid complications is discussed.

Learning objectives

- To gain a better understanding of the fluid media are available for hysteroscopic surgery.
- To understand the risks associated with the use of different distension fluid media.
- To understand the difference between the various fluid distension media and their effect when excessive absorption occurs.
- To recognise, manage and prevent complications associated with excessive fluid absorption.
- To understand the different monitoring systems available during surgery.

Keywords: distension fluid / fluid overload / hysteroscopy / pulmonary oedema

[Heading 1] Introduction

An important component of hysteroscopy, distension medium is used to visualise the uterine cavity and undertake operative procedures.[1] Hysteroscopic surgery has evolved over the years, with many more procedures being done via the hysteroscopic route. Hysteroscopic surgery may, however, lead to complications, some of which can be serious and life-threatening.[2,3] A significant proportion of these serious complications is related to the distension media. To highlight these risks and provide an evidence-based guidance for the prevention, diagnosis and management of complications arising

from excessive absorption of fluid,[4] the British Society for Gynaecological Endoscopy (BSGE), in association with the European Society for Gynaecological Endoscopy (ESGE), has developed a joint Guideline on the management of fluid distension media in operative hysteroscopy. This article provides a concise summary of these guidelines.

[Heading 1] Rationale for the guideline

Fluid distension media are required to adequately visualise the uterine cavity to facilitate operative hysteroscopy. When these procedures were first developed, the fluids used were non-conductive, non-electrolyte solutions suitable for use with monopolar electrical equipment. Because of their inherent property of being non-isotonic, excessive fluid absorption during the procedure could derange plasma osmolality with potentially life-threatening consequences. The advent of bipolar electrical hysteroscopic systems has necessitated the use of isotonic, conducting media with a lower propensity to alter plasma osmolality.

Fluid media can be either of high or of low viscosity. Dextran 32% is a high viscosity fluid that enables good visualisation of the cavity in the presence of blood because it is immiscible with blood. However, it is known to cause anaphylactic reactions and can also lead to crystallisation within the telescope that can be damaging if not properly cleaned immediately after the procedure. Furthermore, dextran is hypertonic and even small absorbed volumes can lead to disproportionate intravascular expansion and cardiac failure. It is for this reason that such fluids are now rarely used. Contemporary hysteroscopic distension media are low viscosity fluids classified as either isotonic or hypotonic solutions, depending upon their relationship to the osmolality of plasma, which is around 285 mOsm/l. Isotonic, low viscosity media include 0.9% normal saline, Ringer's lactate and 5% mannitol. Low viscosity, hypotonic fluids include 1.5% glycine, 3% sorbitol and 5% dextrose (Table 1).

Excessive vascular absorption of hypotonic fluids not only leads to hypervolaemia but also induces dilutional hyponatraemia. Excessive intravasation can change the osmotic balance between the extracellular and intracellular fluid.[5] Change in the osmotic pressure leads to water being drawn into the brain cells, which in turn leads to cerebral oedema and causes neurological problems, coma, seizures and even death. Excess fluid overload can also accumulate in the extracellular space, leading to pulmonary oedema and congestive cardiac failure. In light of these potentially catastrophic complications, it is recommended to avoid hypotonic distension media where possible and to use isotonic fluids such as 0.9% normal saline in preference. However, it should also be noted that isotonic fluids can lead to serious problems associated with hypervolaemia.

The BSGE/ESGE guideline graded the level of evidence from A to D. Good practice point (GPP) is the recommended best practice based on the clinical experience of the guideline development group. Details of this are in the full guideline.[4]

[Heading 1] Recommendations from the guideline

[Heading 2] Definition of fluid overload

Fluid overload is defined as a fluid deficit of more than 1000 ml when using hypotonic solutions and 2500 ml when using isotonic solutions in healthy women of reproductive age (GPP). Lower thresholds for fluid deficit should be considered in the elderly and women with cardiovascular, renal or other comorbidities. Suggested upper limits are 750 ml for hypotonic solutions and 1500 ml for isotonic solutions, although these limits may be reduced depending upon the woman's clinical condition during surgery (GPP). The fluid deficit threshold should be agreed preoperatively with the anaesthetist and the overall fluid deficit and estimated intravascular component should be communicated to the anaesthetist at the end of the procedure to guide postoperative care (GPP).

Fluid absorption of more than 1000 ml of hypotonic solution can cause clinical hyponatraemia (D). Mild symptoms can develop even with absorption of 500–1000 ml of a hypotonic solution (C). Larger volumes of isotonic solution must be absorbed to cause symptomatic fluid overload but there are no data to define a safe threshold (D).

[Heading 2] Incidence and risk factors of fluid overload during hysteroscopic surgery

The incidence of fluid overload varies according to case mix and type of hysteroscopic surgery. Factors that can lead to systemic fluid absorption are high intrauterine distension pressure, low mean arterial pressure, deep myometrial penetration, prolonged surgery, resection of large vascular myomas and large uterine cavities. Severe complications are more likely with hypotonic electrolyte-free solutions, in pre-menopausal women and those with cardiovascular or renal disease.

[Heading 2] Management of fluid overload

Where excessive systemic absorption of fluid distension media is suspected, strict fluid balance monitoring should be commenced, a urinary catheter inserted and serum electrolytes measured. If the patient develops signs of cardiac failure or pulmonary oedema then a cardiac echocardiogram and chest X-ray should be undertaken (GPP). Asymptomatic hypervolaemia with or without hyponatraemia should be managed by fluid restriction with or without diuretics (GPP). The management of symptomatic hypervolaemic hyponatraemia requires multidisciplinary involvement including anaesthetists, physicians and intensivists in a high dependency or intensive care unit. Initial treatment with 3% hypertonic sodium chloride infusion is indicated to restore serum sodium concentrations to safe levels (GPP).

[Heading 2] Choice of distension medium

Isotonic media are safer than hypotonic media because fluid absorption does not cause hyponatraemia (A). However, fluid deficit should still be closely monitored when using either hypotonic or isotonic distension media because there is a risk of hypervolaemia with either type of fluid, leading to cardiovascular overload and collapse (GPP). Isotonic electrolyte-containing distension media such as normal saline should be used with mechanical instrumentation and bipolar electrosurgery because they are less likely to cause hyponatraemia if fluid overload occurs (D). Hypotonic, electrolyte-free distension media such as glycine and sorbitol should only be used with monopolar electrosurgical instruments (D). Carbon dioxide gaseous media should not be used for operative hysteroscopy (GPP).

[Heading 2] Measures to reduce fluid absorption

Preoperative administration of gonadotrophin-releasing hormone (GnRH) agonists should be considered in premenopausal women before hysteroscopic resection of fibroids. This is because there is evidence to show that premenopausal women are more susceptible to electrolyte imbalances (B). Intracervical injection of dilute vasopressin can be considered before dilatation of the cervix (B). The intrauterine pressure needed for distension should be maintained as low as possible to allow adequate visualisation and kept below the mean arterial pressure (B).

[Heading 2] Methods for delivering distension media

Distension medium can be safely and effectively delivered using simple gravity, pressure bags or automated delivery systems (D). Automated pressure delivery systems facilitate the creation of a constant intrauterine pressure and accurate fluid deficit surveillance, which is advantageous with prolonged cases such as endometrial resection or hysteroscopic myomectomy (D).

[Heading 2] Monitoring fluid deficit during operative hysteroscopy

Mechanisms should be in place to monitor fluid deficit during operative hysteroscopic surgery (GPP). Closed systems should be used because they allow fluid output to be measured more accurately (GPP). Drapes containing a fluid reservoir should be used because they allow fluid output measurement (GPP). Automated fluid measurement systems are more accurate than manual measurements, but they can still overestimate fluid deficit. Their use cannot guarantee safety but might be useful when undertaking complex hysteroscopic procedures where fluid absorption is anticipated (D). Measurement of the fluid deficit is very important and should be done at a minimum of 10-min intervals during hysteroscopic surgery (GPP).

[Heading 2] Anaesthesia and impact upon fluid overload and electrolyte imbalance

Where feasible, the use of local anaesthesia with sedation, rather than general anaesthesia, should be considered for operative hysteroscopic procedures because fluid overload can be minimised (B).

[Heading 2] Air or gas embolism during hysteroscopic procedures

Clinically significant gas or air embolism is a rare complication of hysteroscopy. However, this diagnosis should be considered if the patient develops sudden oxygen desaturation or cardiovascular collapse during the procedure (D).

[Heading 1] Conclusion

A good understanding of the importance of distention media for operative hysteroscopy and awareness of problems associated with excessive fluid overload is important for patient safety. Clinicians performing these procedures must be familiar with the measures to reduce fluid overload

and manage it when it occurs. The guideline group has developed a fluid monitoring chart (details of this chart can be found in the full guideline[4]) that can be used to help prevent and detect excessive vascular absorption of fluid and manage complications arising from this potentially serious complication.

[Heading 1] References

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Table 1. Types of distension media and their applicability in operative hysteroscopy

Distension media (normal plasma osmolality 285 mOsm/l)	Procedure	Electrolyte free	Osmolality	Energy	Comments

Normal saline 285mOsm/l	Diagnostic and operative hysteroscopy	No	Isotonic	Mechanical bipolar; laser	Not recommended with monopolar energy as it disperses electric current without having any surgical effect on the tissue
Ringer's lactate 279 mOsm/l	Diagnostic and operative hysteroscopy	No			
Glycine 1.5% 200 mOsm/l	Operative hysteroscopy	Yes	Hypotonic	Monopolar	
Dextrose 5%	Operative hysteroscopy	Yes	Hypotonic	Monopolar	
Sorbitol 3% 165 mOsm/l	Operative hysteroscopy	Yes	Hypotonic	Monopolar	
Mannitol 5% 274 mOsm/l	Operative hysteroscopy	Yes	Isotonic	Monopolar	

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