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[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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Contributions to authorship
Fluid distension media in operative hysteroscopy

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.

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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. 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. 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
Fluid distension media in operative hysteroscopy

from excessive absorption of fluid, 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).
Fluid distension media in operative hysteroscopy

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 distension media in operative hysteroscopy

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

118

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

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

125

[Heading 2] Management of fluid overload

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

136

[Heading 2] Choice of distension medium
Fluid distension media in operative hysteroscopy

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).
Fluid distension media in operative hysteroscopy

[Heading 2] Monitoring fluid deficit during operative hysteroscopy

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

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

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

176 [Heading 2] Air or gas embolism during hysteroscopic procedures

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

181 [Heading 1] Conclusion

182 A good understanding of the importance of distention media for operative hysteroscopy and
183 awareness of problems associated with excessive fluid overload is important for patient safety.
184 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


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

<table>
<thead>
<tr>
<th>Distension media (normal plasma osmolality 285 mOsm/l)</th>
<th>Procedure</th>
<th>Electrolyte free</th>
<th>Osmolality</th>
<th>Energy</th>
<th>Comments</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Usage</th>
<th>Isotonic</th>
<th>Mechanical Energy Required</th>
<th>Technical Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal saline 285mOsm/l</td>
<td>Diagnostic and operative hysteroscopy</td>
<td>No</td>
<td>Isotonic</td>
<td>Mechanical bipolar, laser</td>
</tr>
<tr>
<td>Ringer’s lactate 279 mOsm/l</td>
<td>Diagnostic and operative hysteroscopy</td>
<td>No</td>
<td></td>
<td>Not recommended with monopolar energy as it disperses electric current without having any surgical effect on the tissue</td>
</tr>
<tr>
<td>Glycine 1.5% 200 mOsm/l</td>
<td>Operative hysteroscopy</td>
<td>Yes</td>
<td>Hypotonic</td>
<td>Monopolar</td>
</tr>
<tr>
<td>Dextrose 5%</td>
<td>Operative hysteroscopy</td>
<td>Yes</td>
<td>Hypotonic</td>
<td>Monopolar</td>
</tr>
<tr>
<td>Sorbitol 3% 165 mOsm/l</td>
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<td>Yes</td>
<td>Hypotonic</td>
<td>Monopolar</td>
</tr>
<tr>
<td>Mannitol 5% 274 mOsm/l</td>
<td>Operative hysteroscopy</td>
<td>Yes</td>
<td>Isotonic</td>
<td>Monopolar</td>
</tr>
</tbody>
</table>