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Review Article

MISSUE Consensus on Fluid Dynamics, Monitoring, and Complication Prevention

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Abstract

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Background: Fluid overload is a significant risk during hysteroscopic procedures, potentially leading to severe complications including pulmonary edema and cardiac arrest. This consensus statement addresses the need for standardized guidelines to prevent fluid misuse during hysteroscopy.
Objectives: To provide comprehensive recommendations for preventing and managing fluid overload during hysteroscopy, aiming to improve patient safety and reduce the risk of complications.
Methods: Expert panel discussions were conducted on Hystropedia I, a social media platform established by Prof. Usama Shawki of Cairo University. The panel included gynecologists, anesthesiologists, and surgical technicians with extensive experience in hysteroscopic procedures. Recommendations were formulated based on clinical expertise, current literature, and best practices.
Results: Key recommendations include limiting surgical time to 25-30 minutes, maintaining fluid flow rates below 300 mL/min, carefully monitoring fluid deficit with intervention at 1 liter and procedure termination at 2 liters, preferring normal saline over glycine as the distension fluid, considering patient-specific factors in risk assessment, implementing specific equipment and technical considerations to prevent air embolism, coordinating with anesthesia teams regarding IV fluid administration, and recommending spinal anesthesia for longer procedures.
Conclusions: This consensus provides a comprehensive framework for preventing and managing fluid overload during hysteroscopy. It emphasizes vigilant monitoring, proactive management, and consideration of multiple factors including fluid dynamics, patient characteristics, and procedural techniques. Adherence to these guidelines can significantly enhance patient safety in hysteroscopic procedures.

Introduction

Hysteroscopy is a widely used minimally invasive procedure for diagnosing and treating various intrauterine pathologies [1]. However, the misuse of distension media during operative hysteroscopy can lead to severe complications, including fluid overload and cardiac arrest [2-4]. This consensus statement addresses the critical need for standardized guidelines to prevent and manage these potentially life-threatening complications.

Uterine distension is crucial for visualization during hysteroscopy, achieved by converting the virtual endometrial cavity into a suitable working space. While carbon dioxide was historically used, liquid distension media are now preferred. However, their use is governed by stringent rules, as excessive fluid absorption can rapidly transform a patient's vital parameters from normal to critical, necessitating reanimation [2].

The incidence of fluid overload and dyselectrolytemia during operative hysteroscopy is less than 5%, but the consequences can be severe [5]. The British Society for Gynaecological Endoscopy (BSGE) and the European Society for Gynaecological Endoscopy (ESGE) define fluid overload thresholds based on solution type and patient characteristics. For hypotonic solutions, the threshold is 1000 mL in healthy women of reproductive age and 750 mL for elderly women or those with cardiac and renal comorbidities. For isotonic solutions, the thresholds are 2500 mL and 1500 mL, respectively [6, 7]. Factors influencing fluid absorption include the type of distension media, intrauterine pressures, depth of myometrial penetration, duration of surgery, and size of the uterine cavity. The misuse of these factors can significantly increase the risk of complications. The contributing factors to fluid overload include the volume of fluid used, duration of surgery, fluid pressure and flow rate, type of fluid used, patient variation, and the type of surgery and pathology [5, 8].

This consensus aims to provide comprehensive, evidence-based recommendations for preventing and managing fluid misuse during hysteroscopy, focusing on the proper use of distension media and monitoring techniques. It is crucial to remember that in hysteroscopy surgery, we can always complete the surgery on another day rather than risking complications.

Material and method

This consensus was developed through expert panel discussions on Hystropedia I, a social media platform established by Prof. Usama Shawki of Cairo University. The panel included gynecologists, anesthesiologists, and surgical technicians with extensive experience in hysteroscopic procedures. The platform facilitated real-time, international collaboration among experts in the field of hysteroscopy. The discussions were conducted in a semi-structured format, allowing for both guided topics and open dialogue. The recommendations were formulated based on clinical expertise, current literature, and best practices.

Evidence Review:

Prior to the discussions, panel members reviewed current literature, including peer-reviewed articles on fluid management in hysteroscopy, existing guidelines from various international gynecological societies, and case reports and series detailing fluid overload complications. This literature review provided a foundation for evidence-based discussions.

Consensus Building:

The consensus was reached through an iterative process. Initial propositions were made based on literature and clinical experience, followed by open discussion and debate on each proposition. Recommendations were then refined based on collective input, leading to final agreement on key points through informal voting. While formal Delphi methodology was not employed, the process ensured that each recommendation had broad support among the expert panel.

Results

The consensus recommendations are categorized as follows:

a) Pre-procedure considerations:

- Assess patient-specific factors such as age, BMI, and cardiovascular and pulmonary function
- Consider the type of pathology (e.g., hyper-vascular fibroid with a large base vs. pedunculated fibroid with a small base)
- Note that intrauterine adhesions are usually accompanied by endarteritic changes, leading to lower absorption compared to a septum

b) Intra-procedure monitoring and management:

- Limit surgical time to 25-30 minutes maximum
- Monitor total fluid used and deficit closely
- Never allow the flow rate to exceed 300 mL/min
- Keep the outlet closed, opening only to clear bubbles and clear the field
- When more than 7-9 liters of fluid is used, examine the deficit
- Administer Furosemide if the deficit exceeds 1 liter
- Stop the procedure if the deficit exceeds 2 liters
- Consider injecting 20 mL of diluted vasopressin in the cervix as an alternative measure
- Monitor urine output and color carefully
- Once 7 liters of inflow fluid is used, the technical person/nurse must warn the physician to stop and finish the surgery
- Another strategy: When the fluid balance is 800 ml, give half a Furosemide ampoule and finish the procedure, then, drain the bladder before sending the patient to the recovery room.

c) Fluid selection and administration:

- Avoid glycine due to potential complications including pulmonary edema, hyponatremia, changes in osmolality causing cellular edema, and hyperammonemia
- Prefer normal saline for distension

- Maintain flow rate below 300 mL/min
- Keep distension pressure at a minimum (e.g., 200 mmHg on Karl Storz machine)
- If higher pressure is needed, use the Shawki machine

d) Equipment and technical considerations:

- Use larger bags of normal saline to reduce bottle changes
- Prevent air bubble entry during bottle changes
- Remove trapped air from tubing immediately
- The nurse/technician must remain focused and change bottles before they are completely empty
- If air is trapped inside the tube, remove it and close the inflow suction of air

e) Anesthesia considerations:

- Coordinate with the anesthesia team regarding IV fluid administration
- Consider spinal anesthesia for longer procedures, as it allows early detection of abnormal signs and works with a continuous open outflow channel

f) Post-procedure care:

- Monitor urine output and color
- Drain bladder before transfer to a recovery room

g) Intravasation prevention:

- Be aware that open vessels, especially with vascularized fibroids, represent routes for intravasation
- Perform hemostasis for these vessels
- Note that higher pressure increases the risk of intravasation
- Be aware that the uterus is more vascularized than organs like the bladder and requires higher pressure to be distended

Discussion

This consensus emphasizes the critical importance of proper use of distension media and vigilant monitoring to prevent fluid overload during hysteroscopy. The recommendations highlight the potential for misuse of these media and provide clear guidelines for their safe application.

We strongly advise against the misuse of hypotonic, electrolyte-free solutions like glycine, mannitol, and sorbitol, which can cause serious fluid overload [9]. Instead, we recommend isotonic, electrolyte-containing media such as normal saline for use with mechanical instrumentation and bipolar electrosurgery, due to the lower risk of hyponatremia and fluid overload.

The misuse of intrauterine pressures is addressed, with the consensus noting that pressures exceeding 75 mmHg increase the risk of fluid entering the peritoneal cavity via the fallopian tubes. Furthermore, if

intrauterine pressures exceed mean arterial pressure, especially in elderly patients or those with cardiac-renal comorbidities, the risk of fluid absorption significantly increases [5].

The consensus provides detailed guidance on monitoring fluid deficit, recommending the use of closed systems, drapes with fluid reservoirs, and automated fluid measurement systems to prevent misuse and ensure accurate tracking. It emphasizes the importance of monitoring fluid deficit at least every 10 minutes and at the end of each fluid bag used, to promptly detect any misuse or excessive absorption.

The consensus also suggests considering local anesthesia with sedation rather than general anesthesia for operative hysteroscopic procedures. This recommendation aims to reduce the risk of fluid overload by allowing for earlier detection of symptoms and potentially shorter procedure times.

Moreover, the recommendations stress the importance of considering individual patient characteristics in preventing misuse of distension media. Premenopausal patients are noted to have a higher risk of neurological complications, while elderly women and those with cardiovascular or renal disease are less able to adapt to sudden increases in intravascular fluid [10, 11].

By implementing these guidelines, which cover proper use of distension media, monitoring techniques, and patient-specific considerations, clinicians can significantly reduce the incidence of fluid overload and its associated complications. The comprehensive nature of these recommendations provides a thorough framework for safe hysteroscopic practice, aiming to prevent misuse at every stage of the procedure.

Future research should focus on validating these recommendations and exploring additional strategies to further reduce fluid-related complications. There is also a need for ongoing education and training to ensure that all members of the surgical team are aware of and adhere to these guidelines, preventing misuse of distension media and monitoring techniques.

Conclusion

This consensus statement provides a comprehensive framework for preventing and managing fluid overload during hysteroscopy. It emphasizes that complications, while terrible to experience, can happen to anyone, especially when the underlying mechanisms are not fully understood. By adhering to these guidelines, which cover fluid selection, administration, monitoring, equipment considerations, and patient-specific factors, clinicians can enhance patient safety and improve outcomes in hysteroscopic procedures. Future research should focus on validating these recommendations and exploring additional strategies to further reduce fluid-related complications.

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