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Safety and efficacy of manual syringe infusion of distending media for hysteroscopic procedures: a case–control study

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ABSTRACT

Objectives: Adverse events associated with large volumes of distending media in hysteroscopic procedures can be life-threatening. The aim of this study was to evaluate the safety and efficacy of manual syringe infusion (MI) of distending media for hysteroscopic procedures.
Study design: Between January 2011 and December 2013, the medical records of all women who underwent hysteroscopic procedures using MI or the conventional pump-infusion method (PI, the control group) were reviewed. The Wilcoxon rank-sum test, the Chi-square test and the multivariate logistic regression analysis were employed for statistical analysis.
Results: The MI group ($n = 82$) had a significantly lower average volume of infused fluid (1117 ± 712 mL vs. 2216 ± 1502 mL, respectively; $p < 0.001$), less operative time (22.2 ± 9.7 vs. 30.4 ± 9.8 min, respectively; $p < 0.001$) and lower postoperative abdominal pain scores (0.6 ± 0.7 vs. 0.8 ± 0.7, respectively; $p = 0.04$) than the PI group ($n = 58$). Subgroup analysis of women who underwent hysteroscopic myomectomy revealed a significantly lower amount of infused fluid for the MI group than for the PI group (1737 ± 905 mL vs. 3441 ± 1952 mL, respectively; $p = 0.001$). Infused fluid amount (coefficient = 0.08, $p < 0.001$) was the only significant independent factor affecting fluid deficit, with a constant of 76.1.
Conclusion: The MI method appears to be a safe and feasible method for delivering distending media during hysteroscopic procedures.

Introduction

Distending media is necessary in hysteroscopic procedures to allow for optimal uterine visualization. For operative procedures using monopolar electrosurgical instruments, an electrolyte-free media is required to avoid thermal injury, whereas in bipolar electrosurgical procedures, isotonic electrolyte-rich solutions are useful and safer media [1]. Adverse events associated with large volumes of distending media in hysteroscopic procedures can be life-threatening [2,3]. Regardless of the type of distending media used, excess absorption of fluid media may result in dilutional hyponatremia. Patients can develop right-sided heart failure or pulmonary and cerebral oedema, sometimes resulting in death [3]. Therefore, minimizing the systemic absorption of the distending media is an important measure in reducing media-related hysteroscopy complications.

In an attempt to decrease the incidence of dilutional hyponatremia or the systemic absorption of the distending media, various methods have been used [4], including automated fluid monitoring [5,6], intraoperative oxytocin or vasopressin use [7,8], pretreatment with danazol or gonadotropin-releasing hormone agonists [9,10], use of 1.5% glycine [11], or use of a bipolar resectoscope [12]. In order to minimize the amount of distending media infused during hysteroscopic procedures, we used the manual syringe infusion (MI) method to infuse distending media. The aim of this retrospective study is to evaluate the safety and efficacy of the MI method for hysteroscopic procedures.

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Materials and methods

The study took place in the Department of Obstetrics and Gynecology at Far Eastern Memorial Hospital. The medical records of all women who had hysteroscopic procedures at our institution using the MI method or the conventional pump-infusion (PI) method between January 2011 and December 2013 were reviewed. The inclusion criterion was women ≥20 years old, and those without a recorded amount of infused and collected distending media were excluded from this study. This study was approved by the Research Ethics Committee of the Far Eastern Memorial Hospital.

The MI method was performed solely by the corresponding author (S.M. Hsiao). The MI method for hysteroscopic procedure was performed according to the following procedure: under intravenous anaesthesia, cervical dilatation was performed with Hegar uterine dilators; following this, a unipolar resectoscope with an outer diameter of 8 mm (Karl Storz, Tuttlingen, Germany) was inserted into the uterine cavity. The uterine cavity was then infused with distilled water for inspection, resection, or ablation of tissue. An assistant helped to pump the distilled water into the resectoscope manually using a 60 mL disposable syringe (BD Plastipak TM, BD Medical, Oxford, United Kingdom) via a 90 cm extension tube (Perfect®, Perfect Medical Co. Ltd, Taiwan) during the surgical procedure (Fig. 1). Two 60 mL syringes were used to minimize the waiting time required for refilling the syringe. A large collecting bag was tucked beneath the woman's gluteal region and secured to the surgeon's gown to capture fluid spilled from the cervix and the resectoscope. The total volumes of infused fluid and outflow fluid were recorded.

Hysteroscopic procedures using the PI method were performed by 4 other gynaecologic surgeons at our institution, who had at least 3–10 years of clinical experience. Women who had procedures using the PI method were allocated to the control group. In the PI method, a pump device was used to deliver the fluid media at a constant intrauterine pressure of 100 mmHg, and the remaining procedures were performed in a manner similar to that of the MI group.

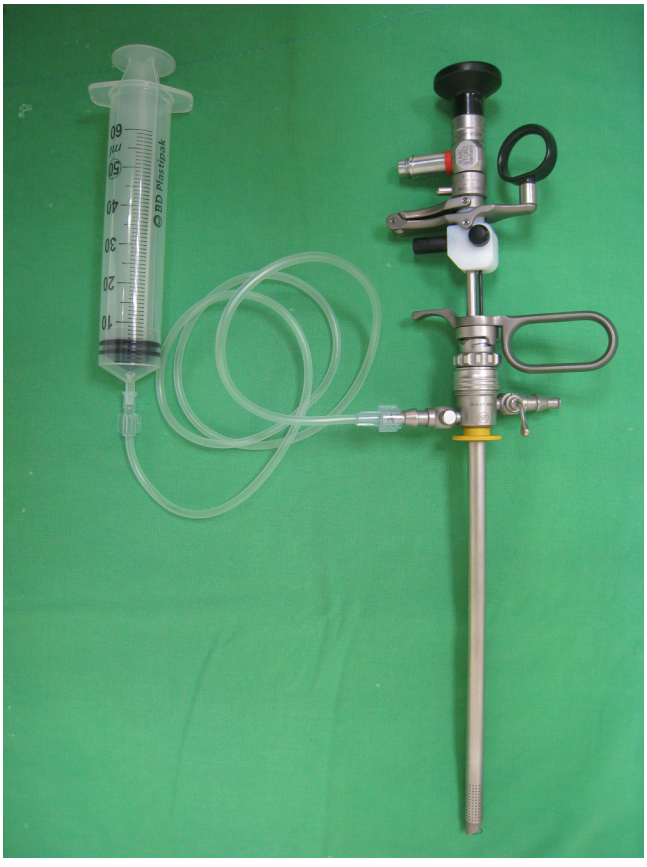

Fig. 1. A unipolar resectoscope with an outer diameter of 8 mm is connected to a 60 mL disposable syringe via a 90 cm extension tube.

The women's characteristics, clinical indications for the hysteroscopic procedure, the volume of distending media used, and perioperative data were recorded. The fluid deficit was calculated by subtracting the total volume of collected media from the total infused volume. The pain scale (0–10) was determined by self-reporting using a visual analogue scale. The visual analogue scale consisted of a 10 cm line with the endpoints 0 for "no pain" and 10 for "worst pain" [13]. The Wilcoxon rank-sum test and the Chi-square test were employed for statistical analysis. A p value of less than 0.05 was considered statistically significant.

The main hypothesis of this study was that the volume of the infused distending media of the MI group differs from that of the PI group. An a priori medical records review was performed for the 15 women in each MI and PI groups (mean total infused volume: 1917 mL vs. 1159 mL min; standard deviation: 1139 mL vs. 770 mL, respectively). A calculation with a significance level of 0.05, a power of 0.8, and an anticipated ratio of sample sizes of 1 suggested that at least 26 subjects in both groups were required to test the above hypothesis of the difference in the volume of infused distending media.

Results

A total of 82 women comprised the MI group (Table 1). All women in the MI group underwent a hysteroscopic procedure without complication. One woman with postmenopausal bleeding was found to have a grade 2 endometrioid endometrial cancer after hysteroscopic examination and endometrial biopsy. She underwent surgical staging in a separate hospital and remained alive with unknown disease status for at least three years, according to outpatient medical records from our institution.

Fourteen women of the PI group were excluded from the study due to incomplete infused fluid data; the remaining 58 women comprised the PI group (Table 1). One woman from the control group, who underwent hysteroscopic myomectomy for a 3.5 cm × 4.8 cm type 2 submucosal myoma with an infused fluid of 3000 mL and a collected fluid of 1070 mL, developed symptomatic hyponatremia with dizziness but recovered fully following a one-day hospital admission. This did not contribute to a statistically significant difference in symptomatic hyponatremia between the groups.

There were no significant differences in the baseline characteristics between the two groups of women. The volume of infused fluid, the operative time, and the postoperative abdominal pain score of the MI group were all significantly lower than that of the PI group (Table 1). The effect size of the volume of infused fluid was large (i.e., Cohen's $d \geq 0.8$) [14].

Further subgroup analysis of women who underwent hysteroscopic myomectomy is shown in Table 2. For these women, the volume of infused fluid in the MI group was significantly lower than in the PI group. The effect size of the volume of infused fluid was large. In addition, a larger volume of estimated blood loss was found in the MI group compared to the PI group (Table 2).

In order to evaluate the factors affecting fluid deficit, we performed multivariate backward stepwise linear regression analysis on the following variables: age, MI vs. PI method, operative time, volume of infused fluid, myomectomy vs. non-myomectomy, and maximum diameter of myoma based on preoperative ultrasonographic measurement. Infused fluid (coefficient = 0.08, $p < 0.001$) was determined to be the only significant