Original Article

The impact of altering filling pressures in diagnostic outpatient hysteroscopy on the procedure completion rates and associated pain: a randomised double-blind controlled trial

Hisham M. HAGGAG[1,2] and AbdelGany M.A. HASSAN[1]

[1]*Faculty of Medicine, Cairo University, Cairo, Egypt and* [2]*Department of Obstetrics and Gynecology, University of Saarland, Homburg, Germany*

Background: Several studies have compared different distension media and analgesics to optimise the efficiency of outpatient hysteroscopy. However, studies comparing different uterine filling pressures are scarce.
Aim: The objective of this study was to evaluate and compare different uterine filling pressures during diagnostic outpatient hysteroscopy in an attempt to find the optimal pressure allowing adequate visualisation while minimising pain and increasing patient satisfaction.
Materials and Methods: This was a double-blind randomised controlled trial. A total of 240 women who had diagnostic outpatient hysteroscopy were randomly divided into three equal groups: the uterine filling pressure was 30 mm Hg in group 1, 50 mm Hg in group 2 and 80 mm Hg in group 3. The primary outcome was adequate visualisation, and secondary outcomes were the proportion of completed procedures, pain perceived during the procedure, immediately after the procedure and 30 min later.
Results: Adequate visualisation was lower in group 1 (88.7% vs 97.5% and 98.7%; $P = 0.009$), but was not different between groups 2 and 3 ($P > 0.999$). The proportion of completed procedures was not different among the groups. There was a progressive increase in pain scores from the lower to the higher pressure groups during the procedure, immediately after the procedure and 30 min after completing the procedure.
Conclusion: Uterine filling pressure of 50 mm Hg was associated with better visualisation than 30 mm Hg and lower pain scores than that of 80 mmHg with no difference in the proportion of completed procedures.

Key words: filling pressure, hysteroscopy, pain.

Introduction

Hysteroscopy is currently the most informative investigation for women with abnormal uterine bleeding and uterine factor infertility.[1] Outpatient hysteroscopy is comparable with surgical inpatient hysteroscopy but offers reduced anaesthesia risks and decreased overall costs.[2] It involves the use of miniaturised endoscopic equipment to directly visualise the endometrial cavity without the need for formal operating room facilities or anaesthesia.[3]

Correspondence: Mr. AbdelGany Hassan, 60 Fostat apartments, Masr ElKadeema, Cairo 11411, Egypt. Email: abdelgany2@gmail.com

Study registration number: www.clinicaltrials.gov, NCT02142686.

Received 12 July 2015; accepted 31 August 2015.

Hysteroscopy involves uterine cavity distension to allow adequate visualisation. Higher uterine filling pressures ensure adequate visualisation but might cause excessive pain, the severity of which may warrant cancellation of the procedure. The optimal filling pressure should provide adequate visualisation without causing excessive pain.[4] Several studies have compared different distension media and analgesics to optimise the efficiency of outpatient hysteroscopy.[5,6] However, studies comparing different uterine filling pressures in outpatient hysteroscopy are scarce. Only one randomised trial compared adequate visualisation and pain scores of 40 mm Hg, 70 mmHg and 100 mm Hg filling pressures in diagnostic outpatient hysteroscopy.[4] The roles of other filling pressures, which might have better clinical roles in outpatient hysteroscopy, have not been investigated.

The objective of the study was to study and compare the roles of 30, 50 and 80 mm Hg in diagnostic outpatient hysteroscopy in an attempt to find the optimal filling pressure allowing adequate visualisation while minimising pain and increasing overall patient satisfaction.

Materials and Methods

This was a single centre, prospective, balanced randomisation (allocation ratio 1:1:1), double-blind controlled study. The study was conducted in the outpatient hysteroscopy clinic at Cairo University hospitals from May 2014 to April 2015. The study was approved by the research ethics committee of Cairo University. The clinical trials registration number was NCT02142686.

By considering adequate visualisation to be the primary outcome, sample size calculation was performed using the comparison of the proportion of adequate visualisation using 30, 50 and 80 mmHg IU pressure. Calculation was based on comparing the least expected two proportions from independent samples using chi-square test. The α-error level was fixed at 0.05 and the power was set at 80%. To the best of our knowledge, no previous studies have investigated the roles of 30, 50 and 80 mm Hg filling pressures in outpatient hysteroscopy with no previous data on similar pressures to calculate the sample size. Assuming that the least expected difference in proportion of adequate visualisation would be 15% (80% and 95%) between the 50 and 80 mmHg pressure groups, the optimum sample size should be 75 cases in each arm. Five cases were added to each arm accounting for any missing data with 80 cases in each group. Sample size calculation was performed using PS Power and Sample Size Calculations software, version 3.0.11 for MS Windows (William D. Dupont and Walton D. Vanderbilt, USA).

Two hundred and forty women were enrolled in the study after providing written consent and were randomly divided into three equal groups. An independent person generated the allocation sequence using computer-generated random numbers. Allocation was concealed using sequentially numbered opaque sealed envelopes kept with the attending nurse. The inclusion criteria were age from 20 to 60 years and a clear indication for diagnostic outpatient hysteroscopy which included infertility, abnormal uterine bleeding, recurrent miscarriage and suspected intrauterine lesion. Exclusion criteria were known medical disorders such as diabetes, hypertension, cardiac, renal or liver disease.

All procedures were scheduled postmenstrually and were performed in the lithotomy position. As it is recommended to give analgesia before outpatient hysteroscopy,[7] women received oral diclofenac 100 mg 1 h before the procedure. We used a 30° angle 2.9 mm rigid hysteroscope with 3.8-mm diagnostic sheath [Karl Storz®, Germany], a Teknolight 180 XA light source, a Xenon high-density fibre-optic light cable 3.5 mm, 2300-mm light cable without adaptors and a T Camera teknocam 2000S pro. All the equipments was provided by Tekno GmbH and Co®, Germany. The same equipment was used for all procedures.

Saline was used as the distension medium and the pressure was set at 30 mm Hg in group 1, 50 mm Hg in group 2 and 80 mm Hg in group 3. A saline bag was placed in a bag chamber and an automated pressurised pump was used to maintain an even pressure throughout the procedure (Ultimate high flow pump and bag chamber, Hertfordshire, UK). The pressure was adjusted by the attending nurse who had the allocation sequence, neither the operator or the woman knew the filling pressure until the codes were broken at the end of the study. Those particular pressure values were selected because 80 mm Hg is the usual filling pressure used at our institution. Most of the procedures could be completed with this pressure, but pain was its main limitation. It was hypothesised that the two lower levels of pressure were likely to be less painful, while still allowing the procedure to be performed. The same equipment was used in all the procedures. Women with diagnosed intrauterine lesions were scheduled to be treated in another session.

Vaginoscopic approach was used for insertion of the hysteroscope in all cases. The hysteroscope was introduced into the uterine cavity after visualisation of the cervix and identification of the external os. The anterior wall, posterior wall and tubal ostia were visualised; any polyps, adhesions septa, congenital malformations or submucous fibroids were noted. The procedure was stopped if adequate visualisation was not obtained or when pain was intolerable. The woman's perception of pain was assessed on three occasions: during the procedure; after the hysteroscope is introduced in the uterine cavity, immediately after the procedure; when the hysteroscope was withdrawn from the uterus and 30 min later. To assess the pain during the procedure, the attending nurse gave the woman the VAS and the woman marked the point she thought was corresponding to her pain on the graph. After completing the procedure, the VAS was given to the woman and she marked the point corresponding to her pain immediately after the procedure and then 30 min later.

Women were also asked to report the site of pain in the first pain assessment occasion whether central in the pelvis or referred to the flanks. Pain was assessed using a visual analogue scale (VAS), VAS of 0 indicated no pain and VAS of 10 indicated the worst possible experienced pain.

The primary outcome was adequate visualisation defined as the possibility to visualise the cervical canal, uterine walls, ostia and the whole extent of any encountered intrauterine lesion. Secondary outcomes were pain perceived during the procedure, immediately after the procedure and 30 min later assessed by VAS.

Data were statistically described in terms of mean ± standard deviation (± SD), or frequencies (number of cases) and percentages as appropriate. Comparison of numerical variables between the study groups was done using one-way analysis of variance (ANOVA) test; comparison between 2 study groups was done using Student's *t*-test. For comparing categorical data, chi-square (χ^2) test was performed. Exact test was used instead when the expected frequency is less than 5. *P* values less than 0.05 was considered statistically significant. All statistical calculations were done using

SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) release 15 for Microsoft Windows (2006).

Results

We approached 312 women referred to the outpatient hysteroscopy clinic at Cairo University Hospitals to undergo diagnostic hysteroscopy. The study was explained to all women, but only those who provided written consent were included. Fifty-three women declined to participate and 19 women were excluded. The remaining 240 women were equally divided into the three study groups (Fig. 1). There were no significant differences among the groups in age, body mass index (BMI), parity, menopausal status and the duration of the procedure (Table 1). There was no significant difference in the indications for hysteroscopy among the groups (Table 2).

There was a significant and progressive increase in pain scores from the lower to the higher pressure groups during the procedure, immediately after the procedure and 30 min after completing the procedure. The proportion of women reporting central pain referred to the flanks progressively increased from the lower to the higher pressure groups ($P < 0.001$; Table 3).

Adequate visualisation was significantly lower in group 1 when compared with the other 2 groups ($P = 0.009$), but there was no difference in visualisation between groups 2 and 3 (97.5% vs 98.7%, $P > 0.999$). The proportion of completed procedures was not different among the groups ($P = 0.115$), and the procedure could not be completed in ten women in group 1 because of poor visualisation in nine women and a vasovagal episode manifested by bradycardia and dizziness in one woman. Four procedures could not be completed in group 2 because of poor visualisation in two women, a vasovagal episode in one woman and intolerable pain in another. Four procedures could not be completed in group 3 because of intolerable pain in two women, a vasovagal episode in one woman and inadequate visualisation in another woman. Intention to treat analysis was adopted and all women were included in the analysis. In procedures that could not be completed, pain during the procedure was assessed when the operator decided to stop the procedure but they were excluded from pain assessment immediately after the procedure and 30 min later.

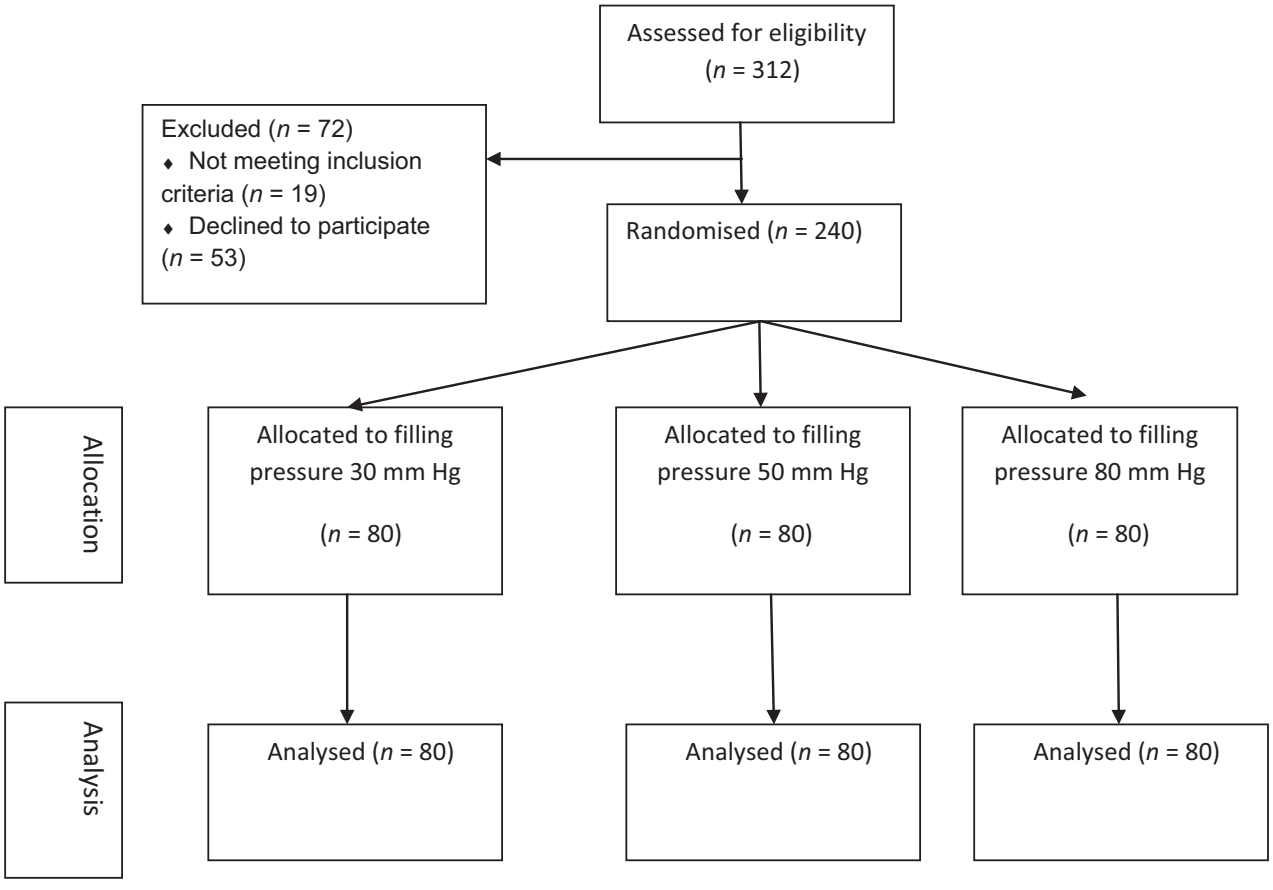

Figure 1 CONSORT flow diagram.

Table 1 Baseline characteristics of the groups†

	30 mm Hg Group (n = 80)	50 mm Hg group (n = 80)	80 mm Hg group (n = 80)	P value
Age (years)	31.2 ± 8.5	30.3 ± 7.6	31.6 ± 8.8	0.592
Parity	1 ± 1.6	0.7 ± 1.3	1 ± 1.6	0.271
Body mass index (Kg/m^2)	29.6 ± 3.1	29.7 ± 3.2	29.5 ± 3.3	0.876
Menopausal women	3 (3.7%)	1 (1.2%)	4 (5%)	0.541
Duration (minutes)	2 ± 1	1.9 ± 0.9	2 ± 1	0.675

†Data are presented as means and standard deviations, and menopausal women data are presented as frequencies and percentages.

Table 2 Indications for hysteroscopy†

	30 mm Hg group (n = 80)	50 mm Hg group (n = 80)	80 mm Hg group (n = 80)	P value
Infertility	24 (30%)	29 (36.2%)	30 (37.5%)	0.565
Bleeding	34 (42.5%)	31 (38.8%)	27 (33.8%)	0.521
Recurrent miscarriage	10 (12.5%)	10 (12.5%)	4 (5%)	0.189
Suspected intrauterine lesion	12 (15%)	10 (12.5%)	19 (23.7%)	0.139

†Data are presented as frequencies and percentages.

Discussion

Outpatient hysteroscopy is a safe, successful and well-tolerated procedure. However, it can be associated with significant pain, anxiety and embarrassment affecting women's satisfaction with the procedure and limiting the feasibility, effectiveness and safety of the procedure. Several methods have been used to minimise discomfort, including variations in hysteroscopic equipment, and use of pharmacological agents and adaptations to the technique. Limited data are available on the role of uterine filling pressures in reducing hysteroscopy associated pain.

The progressive increase in pain scores from the lower to the higher pressure groups observed in this study demonstrates that higher filling pressures can cause more pain. There are several causes of pain during and after hysteroscopy, the first cause is usually cervical manipulations, and the vaginoscopic technique causes less pain as cervical manipulations are minimised.[7] Distension of the uterus also causes pain, touching the endometrium induces uterine contractions and causes further pain. Delayed pain is caused by prostaglandins release secondary to uterine distension and uterine manipulations.[5] Uterine distension is the main mechanism by which uterine filling pressure causes pain, higher filling pressures are expected to cause more distension and consequently more pain.

Our results indicate that higher filling pressures are associated with better visualisation; adequate visualisation was lower in the 30 mmHg group. However, the number of successfully completed procedures was not different the other 2 groups. Adequate visualisation and the proportion of completed procedures were not different between the 50 and 80 mm Hg groups, and this suggests that the filling pressure of 50 mm Hg passed the threshold needed for adequate visualisation in diagnostic hysteroscopy. The filling pressure of 50 mm Hg had the advantage of lower pain scores indicate than 80 mm Hg.

Comparison between 30 and 50 mmHg showed that the latter had the advantage of providing better visualisation and a higher proportion of completed procedures, but this was not statistically significant. Although the pain scores were statistically higher in the 50 mm Hg group, the difference was not clinically significant to favour the use of 30 mm Hg. Thus, even though the 30 mmHg group had lower pain scores and no procedures were stopped due to severe pain, in contrast to the 50 mmHg group, it had the drawback of providing less visualisation. With the available data, 50 mm Hg can be recommended as the filling pressure in diagnostic outpatient hysteroscopy. Operators could begin the procedure by using 30 mm Hg as a filling pressure to minimise the patient's discomfort and to raise the pressure to 50 mmHg if adequate visualisation is not obtained.

Lower filling pressures cause pain by distending the uterine cavity. Higher filling pressures might have forced saline into the tubes causing tubal spasm and flank pain in addition to the central pain. This may explain our results showing that the proportion of women reporting pain central pain referred to the flanks progressively increasing from the lower to the higher pressure groups.

Shahid *et al.* randomised 234 women undergoing diagnostic outpatient hysteroscopy to have a uterine filling pressure of 40, 70 or 100 mmHg. The mean pain score was not significantly different among the groups, and adequate visibility was significantly lower in the 40 mm Hg group when compared to the other groups.[4]

The studied pressure values in this study were different from those of Shahid *et al.* Whereas diclofenac

Table 3 Hysteroscopy outcomes and pain scores†

	30 mm Hg group (n = 80)	50 mm Hg group (n = 80)	80 mm Hg group (n = 80)	P value
Adequate visualisation	71 (88.7%)	78 (97.5%)	79 (98.7%)	0.009*
Completed procedures	70 (87.5%)	76 (95%)	76 (95%)	0.115
Pain during the procedure	2.5 ± 0.7	3.8 ± 1.7	3.4 ± 1.3	<0.001*
Women reporting central pain	80 (100%)	55 (68.8%)	15 (18.8%)	<0.001*
Women reporting central pain referred to the flanks	0	25 (31.2%)	65 (81.2%)	<0.001*
Pain immediately after the procedure	1.3 ± 0.9	2 ± 1.4	3.4 ± 1.3	<0.001*
Pain 30 min after the procedure	0.1 ± 0.3	0.6 ± 0.7	1.7 ± 1	<0.001*

*Significant value.

†Duration of the procedures and pain analysis data are presented as means and standard deviations, other data are presented as frequencies and percentages. Only completed procedures were included in the analysis of the duration of the procedures and pain assessment after the procedures.

was administered to all the participants in this study, Shahid *et al.* administered mefenamic acid before the procedure to 'most of the ladies'. Uneven administration of mefenamic acid among the groups could have masked potential differences in pain scores between the higher and lower pressure groups. In this study, a rigid hysteroscopy was used, while Shahid *et al.* noted the use of a semirigid hysteroscope set. Rigid hysteroscopes are known to be more painful than flexible and semirigid ones.[8] A 30° hysteroscope was used in contrast to a 0° hysteroscope by Shahid *et al.*, which causes more movements in the cervix causing more pain. Finally, the vaginoscopy technique was used in this study, while Shahid *et al.* used a vaginal speculum to visualise the cervix, which is more painful and caused more discomfort.

Baker and Adamson assessed the minimal intrauterine filling pressure needed to achieve adequate uterine distension with saline in seven women undergoing laparoscopy and hysteroscopy.[9] Distension of the uterine cavity was achieved when the intrauterine perfusion pressure reached a median of 40 mm Hg (range 25–50 mm Hg). These results agree with ours, we found that adequate visualisation was significantly lower in the 30 mmHg group when compared with the other two groups.

We conclude that 50 mm Hg was associated with better visualisation than 30 mmHg and lower pain scores than 80 mmHg with no difference in the proportion of completed procedures. The main limitation of the study was the sample size which might have not been large enough to detect a difference in the proportion of completed procedures among the groups.

Acknowledgement

We would like to thank all the gynaecology registrars in Cairo University hospitals for their effort that allowed this work to be completed. This study was self-funded.

References

1 Sharma JB, Aruna J, Kumar P *et al.* Comparison of efficacy of oral drotaverine plus mefenamic acid with paracervical block and with intravenous sedation for pain relief during hysteroscopy and endometrial biopsy. *Indian J Med Sci* 2009; **63**: 244–252.

2 Moawad NS, Santamaria E, Johnson M, Shuster J. Cost-effectiveness of office hysteroscopy for abnormal uterine bleeding. *JSLS* 2014; **18**: e2014.00393. http://doi.org/10.4293/JSLS.2014.00393.

3 Van dongen H, De kroon CD, Jacobi CE *et al.* Diagnostic hysteroscopy in abnormal uterine bleeding: a systematic review and meta-analysis. *BJOG* 2007; **114**: 664–675.

4 Shahid A, Pathak M, Gulumser C *et al.* Optimum uterine filling pressure for outpatient diagnostic hysteroscopy: a double-blind, randomized controlled trial. *Reprod Biomed Online* 2014; **28**: 86–91.

5 Ahmad G, Attarbashi S, O'Flynn H, Watson AJ. Pain relief in office gynaecology: a systematic review and meta-analysis. *Eur J Obstet Gynecol Reprod Biol* 2011; **155**: 3–13.

6 Litta P, Bonora M, Pozzan C *et al.* Carbon dioxide versus normal saline in outpatient hysteroscopy. *Hum Reprod* 2003; **18**: 2446–2449.

7 Royal College of Obstetricians and Gynaecologists. Green top guideline No 59: Best Practice in Outpatient Hysteroscopy, London: Royal College of Obstetricians and Gynaecologists, 2011.

8 Unfried G, Wieser F, Albrecht A *et al.* Flexible versus rigid endoscopes for outpatient hysteroscopy: a prospective randomized clinical trial. *Hum Reprod* 2001; **16**: 168–171.

9 Baker VL, Adamson GD. Minimum intrauterine pressure required for uterine distention. *J Am Assoc Gynecol Laparosc* 1998; **5**: 51–53.

