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Diagnostic evaluation of Karman endometrial aspiration in patients with abnormal uterine bleeding

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Abstract

Aim: To assess sensitivity and specificity of Karman aspiration in the diagnosis of abnormal endometrium compared with the final diagnosis and evaluate tissue adequacy obtained by Karman aspiration.

Methods: The study group were women who presented with abnormal uterine bleeding to Songklanagarind Hospital between August 2003 and July 2004 and who underwent Karman aspiration prior to conventional curettage. The final diagnosis was defined as the most severe histopathology from either Karman aspiration or conventional curettage. Abnormal endometrium included inflammation, polyp, hyperplasia and malignant changes.

Results: Two hundred and twenty-six women were assessed. Endometrial aspiration showed a sensitivity of 89.6% and specificity 100.0% in diagnosis of abnormal endometrium. Abnormal endometrium was detected in 58 women. Of 11 women diagnosed with endometrial cancer, only one case was undetected by Karman aspiration due to a failure to create negative pressure in the uterus. Endometrial aspiration yielded adequate tissue in 86.7%.

Conclusion: Karman endometrial aspiration is an accurate and easy procedure, and should be considered in the initial evaluation of abnormal uterine bleeding.

Key words: aspiration biopsy, syringe Karman, uterine aspirator, uterine bleeding, vacuum aspiration.

Introduction

Abnormal uterine bleeding is a common gynecologic problem that causes a great deal of patient anxiety. The causes of bleeding can be hormonal abnormalities, infections and benign or malignant tumors. In 1995, Wichitsanguan *et al*. reported that the most common pathologic diagnosis of abnormal uterine bleeding was functional endometrium (66.8%), followed by inflammation (15.6%), polyp (10.7%), hyperplasia (4.5%), and endometrial carcinoma (2.4%).[1]

Because of the risk of endometrial cancer, a woman with abnormal uterine bleeding should have her endometrial tissue sampled. For decades, the standard procedure for diagnosis of intrauterine disorders was fractional curettage (F/C). Nevertheless, F/C has some disadvantages such as it takes time and requires anesthesia. This technique has been replaced by

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endometrial biopsy, which can be done in an out-patient clinic. The diagnostic accuracy of office-based endometrial biopsy was reported to be excellent at 90–98% when compared with subsequent findings at uterine curettage or hysterectomy.[2–4]

The Karman aspirator is an endometrial sampling device that is made of flexible polyethylene tubing, a material that is strong yet flexible enough to reduce the possibility of uterine perforation. It has a larger cannula diameter than other endometrial sampling devices. In women with large endometrial polyps or submucous myoma, no diagnostic procedures are able to cure the disease except hysteroscopy with resectoscope at the same procedure. In regards to the Karman aspirator, which can be used to terminate early pregnancy up to 7 weeks, it has the potential to remove small polyps as well as the entire endometrium. Thus bleeding might be stopped after Karman aspiration. It is a reusable device and needs no electrical suction, so it might be suitable for developing countries. The ultimate goal for using the Karman aspirator is out-patient service without anesthetic procedure. However, the aim of the first phase of our study is to confirm its accuracy in the detection of severe endometrial pathology compared with the gold standard technique of F/C. Thus we performed Karman aspiration in the same context with F/C. In the second phase we will study in the out-patient clinic to evaluate the feasibility of this technique. If the result is positive, Karman aspiration might replace conventional F/C with compatible accuracy, cost reduction and anesthetic risk elimination.

Our assumption is that Karman aspiration can stop uterine bleeding at the initial visit, and obtain a significant amount of endometrial tissue for histopathological diagnosis. If its accuracy is comparable to other out-patient techniques, it will be the ideal procedure. Our initial idea was formed because there are a few studies about the diagnostic value of Karman endometrial biopsy to detect endometrial pathology.

The objective of the present study was to evaluate the sensitivity and specificity of Karman endometrial aspiration in detecting the endometrial pathology with comparison to the final diagnosis.

Methods

The study group comprised non-pregnant women aged more than 35 years who presented with abnormal uterine bleeding to Songklanagarind Hospital between August 2003 and July 2004. Women who had pelvic inflammatory disease, coagulopathy or a Pap smear positive for carcinoma were excluded. Sample size was calculated using the previous reported sensitivity of 71%,[5] the precision of 10%, the level of confidence at 95% and the prevalence of abnormal histopathologic endometrium of 27%,[1] indicating at least 223 women were required. All women signed informed consent before taking part in the study.

All women were placed in the lithotomy position and given general anesthesia by propofol. The surgeon first swabbed the perineal area under antiseptic technique, and a pelvic examination was performed to assess the position of the uterus after the urinary bladder was empty. The cervix was identified and stabilized with a tenaculum. Endocervical curettage was then performed in a routine fashion. Endometrial aspiration was performed using the aspiration syringe kit with a Karman syringe and cannula. The kit consists of a 50 cc Karman syringe equipped with a locking valve, plunger handle, collar stop and the sterilized, flexible Karman cannula in three diameters: 4 mm, 5 mm, and 6 mm (Fig. 1).

Figure 1 Karman cannula equipment: Karman syringe and cannulae.

The sterile cannula was inserted into the cervix. The largest cannula (6 mm) was used first to gain the optimal adequacy of tissue. If it was not successful, the smaller size was substituted. If cervical stenosis was found, a Hegar dilator was applied until the 4 mm cannula was able to be used. When the cannula was in place, the surgeon attached the pre-evacuated syringe to the cannula to create negative pressure and rotated the cannula while moving it in and out with a gentle stroking motion covering the entire endometrial surface. The procedure was ended once there was a gritty feeling of the cannula against the myometrium and the presence of air bubbles in the cannula.

Then, sharp endometrial curettage was performed to check the completeness of tissue. The tissues were sent to the pathologist in three bottles as tissues from (i) endocervical curettage, (ii) Karman endometrial aspiration, and (iii) endometrial curettage. The tissues from endometrial procedures were blindly reviewed by the same pathologist via a coded number method. Tissue adequacy and histopathology were described and recorded for each specimen individually. Tissue adequacy was determined as whether there was both adequate endometrial gland and adequate stroma to identify endometrial histology. In the case of insufficient tissue, the diagnosis was defined as atrophic endometrium.

Endometrial tissue from the Karman aspiration and the endometrial curettage were compared. Specimens were classified as normal or abnormal endometrium. Normal endometrium was proliferative, secretory phase, atrophic endometrium, and hormonal effect. Abnormal endometrium was inflammation, polyp, endometrial hyperplasia, and carcinoma. According to the 1994 WHO classification,[6] endometrial hyperplasia was defined as proliferation of glands of irregular size and shape with an increase in the gland–stroma ratio. Based on degree, simple hyperplasia consists of cystically dilated glands and the surrounding stroma shows increased cellularity with plump and enlarged nuclei and indistinct cytoplasm. Complex hyperplasia shows an increasing degree of architectural abnormality of the glands characterized by complex and branched glands and papillary infolding into the lumens. The crowded glands often compress the intervening stroma resulting in 'back to back' glandular crowding. Atypia was characterized by nuclear stratification, loss of polarity and increase in nuclear/cytoplasmic ratio. The nuclei are enlarged, irregular in size with coarse chromatin clumping.[6] According to our aim to use Karman aspiration as the initial investigation as a substitute for endometrial curettage, the final diagnosis was defined as the most severe histopathology from either Karman cannula or endometrial curettage.

Intraoperative complications were recorded. Women were then discharged and returned to the clinic in the next 2 weeks. Late complications were evaluated by telephone contact and medical records.

The percentage of individual tissue diagnoses between procedures was described. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) with 95% confidence interval of tissue from Karman cannula endometrial aspiration were calculated by STATA version 7 (STATA Corporation, College Station, TX, USA).

Results

Two hundred and twenty-six women were enrolled in this study. Mean age was 47 years (range 35–79 years). Parity ranged from 0 to 11 with a median of 2. Reproductive status and presenting symptoms are shown in Table 1.

The Karman cannula could be accessed into the uterus in 207 women (91.6%). The largest Karman cannula was successfully inserted into the uterus in 136 women. The smaller diameters of 5 mm and 4 mm were used in 66 and 24 women, respectively. There were 19 women who underwent cervical dilation because of a lack of cervical patency. There was no significant association between accessibility of cannula and reproductive status ($P = 0.12$). Parity (nulliparity and multiparity) did not appear to influence accessibility of cannula ($P = 0.74$).

The median tissue volume from Karman cannula endometrial aspiration was 1.0 mL (range 0–20 mL). Karman cannula endometrial aspiration yielded sufficient tissue for diagnosis in 197 patients (87.2%). The

Table 1 Demographic variables

Variable	No. patients (%)
Reproductive status	
Premenopause	175 (77.4)
Postmenopause	51 (22.6)
Indication for endometrial curettage	
Metrorrhagia	102 (45.1)
Postmenopausal bleeding	44 (19.5)
Menometrorrhagia	33 (14.6)
Menorrhagia	31 (13.7)
Endometrial hyperplasia after medical treatment	13 (5.7)
Postcoital bleeding	3 (1.3)

median tissue volume from F/C was 0.5 mL (range 0.0–1.0 mL) after completion of the aspiration procedure. There were only eight women (3.5%) for whom the tissue obtained from Karman aspiration was adequate for diagnosis but no tissue was obtained from conventional curettage.

Abnormal endometrium was detected in 58 patients (25.6%), including myoma in one (0.4%), inflammation in four (1.8%), carcinoma in 11 (4.8%), hyperplasia in 19 (8.4%), and submucous endometrial polyp in 23 (10.2%). The patients with endometrial hyperplasia were further divided as either without histological atypia (14 with simple hyperplasia and two with complex hyperplasia) or with histological atypia (one with simple hyperplasia and two with complex hyperplasia). One patient with endometrial carcinoma was undetected by Karman aspiration because the tissue was insufficient for diagnosis. This woman had a large cervical os. Despite of the use of the largest cannula, it failed to establish negative pressure in the uterus. The tissue obtained from aspiration was 0.2 mL. She was subsequently treated by surgery at our hospital. The hysterectomy specimen showed a 1.5 cm tumor located at the posterior wall of the uterine cavity. She was classified in stage Ia and received no further treatment except close follow-up. There were five other cases of abnormal endometrium that were undetected by Karman cannula aspiration. These consisted of three cases of endometrial polyp, one of endometrial hyperplasia, and one of inflammation. Histological agreement of tissue obtained by two techniques was 63.3% (143 patients) (Table 2).

No complications occurred during the aspiration procedure. Three patients during conventional curettage were complicated by uterine perforation: two patients from inserting Hegar dilators and one patient during endometrial curettage. All three patients were admitted for observation, but there was no serious bleeding. Late complications included five patients with moderate pelvic pain in the first few days after the operation and all were spontaneously resolved by the end of first week. Four patients were diagnosed and treated for metritis and three patients were treated for cervicitis and vaginitis by oral antibiotics.

The endometrial biopsy from Karman aspiration for final diagnosis showed a sensitivity of 89.6% (95% confidence interval CI 84.6–93.1) and a specificity of 100.0%. The positive and negative predictive values were 100.0% and 96.6% (95% CI 93.1–98.4) (Table 3). Overall accuracy was 97.3% (95% CI 94.3–99.0). The false negative rate was 3.5% (95% CI 1.1–5.9).

Table 2 Tissue correlation between Karman aspiration histology and fractional curettage (F/C) histology

Karman aspiration histology	F/C histology										
			Normal EM					Abnormal EM			
	No tissue	Tissue insufficient	Proliferative	Secretory	Atrophic	Hormonal effect	Other	Inflammation	Polyp	EM hyperplasia	EM carcinoma
Normal EM											
No tissue	2	2	3	–	2	–	–	–	–	–	–
Tissue insufficient	5	19	3	3	4	–	–	1	–	–	1
Proliferative	1	5	47	2	6	–	–	–	1	1	–
Secretory	4	4	1	33	1	–	–	–	2	–	–
Atrophic	2	3	2	–	9	–	–	–	–	–	–
Hormonal effect	–	–	–	1	–	3	–	–	–	–	–
Other	–	–	–	–	–	–	1	–	–	–	–
Abnormal EM											
Inflammation	–	–	–	2	–	–	–	1	–	–	–
Submucous myoma	–	–	–	1	–	–	–	–	–	–	–
Polyp	–	2	6	4	1	–	–	–	7	–	–
EM hyperplasia	–	2	3	–	–	–	–	–	–	13	–
EM carcinoma	1	1	–	–	–	–	–	–	–	–	8

EM, endometrium; other, cervical carcinoma.

Table 3 Comparing endometrial aspiration histology with the final diagnosis

Endometrial aspiration histology	Final diagnosis		
	Abnormal	Normal	Total
Abnormal	52	0	52
Normal	6	168	174
Total	58	168	226

Discussion

Karman aspiration has been widely used throughout the world for induced abortion up to 7 menstrual weeks' gestation as well as abnormal uterine bleeding. In 1983, Ramon *et al*. documented the feasibility and adequacy of endometrial aspiration with the Karman cannula.[7] Forty-nine women were evaluated by this technique prior to diagnostic dilatation and curettage. Endometrial aspiration yielded tissue adequate for histological evaluation in 82% of cases as compared with 76% of uterine curettage cases.

In 1994, Mateo *et al*. reported the adequacy of endometrial biopsy specimens from Karman cannula compared with the curetted sample with Novak cannula. Two hundred and thirty endometrial biopsies were taken in women with fertility problems. The samples were divided into two equal groups. In the Karman cannula group, 92.2% of the tissue samples were adequate for diagnosis, compared with 84.4% in the Novak cannula group.[8] In the present study, Karman endometrial aspiration yielded adequate tissue, which is comparable with the previous studies.

In 2000, Suarez *et al*. reported the diagnostic value of manual vacuum aspiration (MVA) with Karman cannula for the detection of endometrial hyperplasia and cancer in patients with abnormal uterine bleeding. Fifty patients with abnormal uterine bleeding were evaluated with MVA prior to dilatation and curettage (D & C). Cervical dilatation was performed more frequently than D & C ($P < 0.001$). The endometrial biopsy for MVA showed a sensitivity of 71% and a specificity of 93% in the diagnosis of hyperplasia and carcinoma. This instrument is good for diagnosis of polyp. It could detect 20 cases of polyp (86.9%).[5]

The present study found endometrial curettage yielded tissue of 0.5 mL after complete Karman endometrial aspiration. This demonstrates that Karman aspiration did not aspirate all tissue from the endometrial cavity. Hale *et al*. performed endometrial aspiration by Karman cannula on 80 women immediately prior to hysterectomy. They observed that the cornual area of the uterus was not well evacuated.[9] In addition to a failure to establish negative pressure, the site of pathology may contribute to a false negative result.

In our study, 1 in 11 cases of endometrial carcinoma was undetected by Karman cannula aspiration. The cause may be due to a relatively small and localized lesion, technical errors by the surgeon, or a failure to create negative pressure as a result of a large cervical os from multiparity. The latter limitation may be resolved by using a larger diameter cannula, which has recently become available from 4 to 12 mm, or grasping the cervix with a tenaculum to decrease os diameter.

The serious adverse effects of endometrial biopsy are very small. Hofmeister *et al*. reported the absence of complications in a series of 20 000 patients who underwent endometrial biopsy.[10] There is a possibility that prolonged bleeding may occur after the procedure. There is also a slightly chance of infection. Very rarely, there were reports of uterine perforation or cervical tear because of the biopsy. The complications of uterine curettage included uterine perforation (6–13 per 1000 patients), infection (3–5 per 1000 patients), and laceration of the cervix.[2,11,12] Severity of postoperative pain varied from mild (72%), moderate (24%) to severe (4%).[13]

In the present study, we did not use histology from a hysterectomy specimen or hysteroscopic biopsy as the gold standard. Because our purpose is to replace endometrial curettage with Karman aspiration in our hospital, we defined the final diagnosis as the most severe pathology from either fractional curettage or cannula aspiration. In general practice, the histopathological diagnosis of 'inadequate tissue or tissue insufficient for diagnosis' is occasionally reported. The negative predictive value of this situation was very high as reported by Harmali *et al*., who found that only 1 in 38 who subsequently had endometrial sampling had complex hyperplasia without atypia.[14] In our study, 28 out of 226 cases were in this category. They came from both the Karman aspiration as well as the F/C group. All others had final diagnoses. For the women whose tissue was insufficient for diagnosis, we assumed that they had atrophic endometrium.

Endometrial aspiration with the Karman cannula seems to be a simple, accurate and inexpensive technique for detecting endometrial pathology. The use of a manual vacuum aspiration technique reduces the cost of the diagnostic work up for abnormal uterine bleeding. The accuracy should be aware if the obtained tissue is insufficient for the diagnosis. For patients in

whom creation of negative pressure in the uterus is unsuccessful or who still have further uterine bleeding, with undetermined endometrial pathology, other investigations such as hysteroscopy should be performed. In the low resource setting, conventional fractional curettage is still the procedure of choice. Further studies on pain and patients' acceptance of the aspiration procedure should be conducted.

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