A COMPARISON BETWEEN HYSTEROSCOPY AND THREE DIMENSIONAL HYSTEROSONOGRAPHY IN THE DIAGNOSIS OF INTRACAVITARY UTERINE ABNORMALITIES

Thesis

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By

Mosaad Mohammed Diab Anwar Ahmed
M.B.B.Ch. 2002 (Sohag University)

Under Supervision of

Prof. Hatem Saad Shalaby
Professor of Obstetrics and Gynecology
Faculty of Medicine - Ain Shams University

Dr. Hosam Mohammed Hemeda
Lecturer of Obstetrics and Gynecology
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
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الأستاذ الدكتور/ حاتم سعد شلبى
أستاذ أمراض النساء والتوليد
كلية الطب - جامعة عين شمس

الدكتور/ حسام محمد حميدة
مدرس أمراض النساء والتوليد
كلية الطب - جامعة عين شمس

كلية الطب - جامعة عين شمس
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INTRODUCTION

Hysteroscopy is the visual examination of the canal of the cervix and the interior of the uterus using thin, lighted and flexible tube called hysteroscope inserted through the vagina. It is one of the very earliest approaches to the direct study of the uterine cavity that was when ***D.C. Pantaleoni*** performed the first hysteroscopy in 1869 to evaluate postmenopausal bleeding and discovered an endometrial polyp. Unfortunately the lesion could not be removed. But that first vision of the uterine cavity obtained by Pantaleoni was censored by his peers for ***"undue curiosity" (Isaacson and Keith, 2002).***

Office hysteroscopy is a critical component of a modern gynecologic practice. It is easy to learn and simple to incorporate into a busy gynecologic group practice and the popularity of this office approach to endometrial evaluation is steadily increasing. Now an entire generation of gynecologists are mesmerized by the view within the uterus and, most importantly, by their ability to see, treat, and cure numerous diseases within the uterus with operative hysteroscopy ***(Bradley, 2009).***

The direct or magnified observation of the uterine cavity by hysteroscopy may offer a more precise diagnosis, a better ground for therapy or verification of results as compared to other methods such as hysterography.

Although still hysteroscopy could be considered an invasive diagnostic procedure yet in all studies it is considered as the gold standard for evaluation of the uterine cavity ***(Ong, 2007).***

Ideally, a non-invasive investigation is preferred over an invasive one and also an economical investigation preferred over an expensive one; this applies equally to affluent countries and third world, that's why ultrasonography by any modality is considered to be a non invasive procedure to investigate uterine lesions rather than hysteroscopy which is a highly invasive one with a high cost ***(Walker et al., 2007).***

Two-dimensional ultrasound (2DUS) traditionally has relied on acquisition of images from a variety of orientations in which the operator has a good eye - linkage to assist in feature recognition. As a result, ultrasound imaging has been one of the few areas of medical imaging that has not routinely used standardized viewing orient relying instead on the interactivity of the imaging process to optimize visualization of patient anatomy ***(Salim and Jurkovic, 2009).***

Recently, several authors have reported the use of ultrasound contrast media in the assessment of uterine cavities during trans-vaginal ultrasound, and have emphasized the place of three-dimensional hystero-sonography (3-DHS) in the imaging of uterine cavities. The benefits of (3-DHS) compared to any other method of investigation like conventional 2D transvaginal ultrasound or hysterosalpingogram include: reproducible and reliable assessment of tubal patency, better assessment of uterine cavity, enables visualization of ovarian morphology and soft tissue abnormalities, such as fibroids or congenital anomalies of the uterus; feasible, minimal invasiveness and relatively few contraindications; avoidance of exposure to X-rays, allergic reactions and general anesthesia: the possibility of being performed as an outpatient procedure; the fact that it is well tolerated, rapid ***(Kurjak et al., 2008).***

By instillation of contrast media (sterile saline) into the uterine cavity, the contour of the uterine cavity can be visualized. Conventional two-dimensional hysterosonography (2-DHS) has limitations in that the full contour of the uterine cavity has rarely been depicted in a single scanning plane because of limited projection angles of the ultrasound beam. Therefore, the outcome is heavily dependent on the skill of the examiner with repeated trials of injecting the contrast medium. These time-consuming and occasionally painful procedures with 2-DHS sometimes require sedation or anesthesia, which can be a burden to the patients ***(Kupesic and Plavsic, 2007).***

Because viewing of important landmarks is essential for interpretation and identification of anatomy, particularly in less skilled practitioners, one benefit that 3DUS brings to patient diagnosis is that data review may be carried out at the console after the patient has left the clinic. Because patient data can be re-oriented to standard anatomic position, viewer comprehension and recognition of anatomy are enhanced ***(Bragg et al., 2010).***

An important part of 3DUS is the ability to review patient data interactively. The flexibility to rotate, scale, and view objects from perspectives that optimize visualization of the anatomy of interest is critical. Physician involvement in optimizing and enhancing the tools to accomplish this is essential in the ongoing evaluation of all these techniques ***(Sconfienza et al., 2010).***

AIM OF THE WORK

The aim of the study is to compare 3-dimensional hysterosonography with diagnostic hysteroscopy regarding the diagnosis of intrauterine cavitary lesions.

HYSTEROSCOPY

Historical background

Bozzini (1773-1809), a German, was the first to invent endoscope. His light conductor was a hollow tube divided by a vertical septum fitted with a concave mirror that, by transmitting the light of a candle, permitted the visualization and exploration of externally accessible body cavities such as the mouth, nose, ears, vagina, cervix and uterus, urethra and urinary bladder, and rectum ***(Van der Pas et al., 1983).***

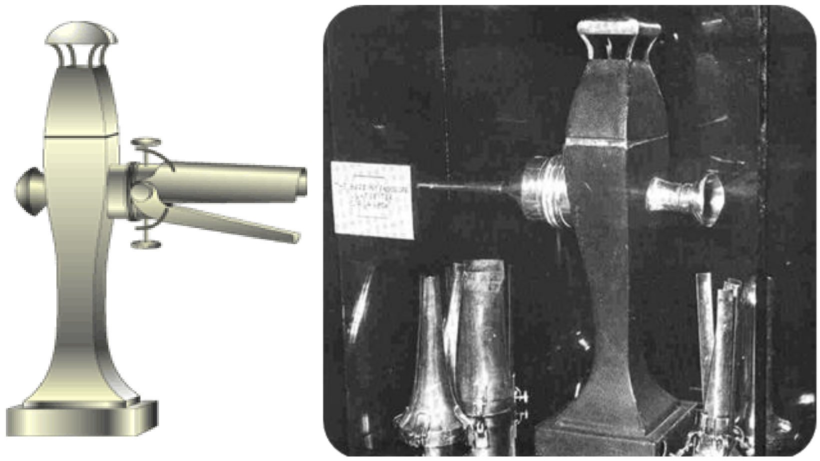

Fig. (1): Bozzini's endoscope displayed at the American College of Surgeons headquarters in Chicago ***(Valle, 2007).***

The French ***Désormeaux*** presented the first truely workable cystoscope in ***1853***. It allowed a direct view through a central perforation, and light from an alcohol and turpentine lamp reflected by a concave mirror inserted in a viewing tube ***(Désormeaux, 1855).***

Sixteen years later, particularly in ***1869, Pantaleoni***, using Desormeaux's cystoscope, performed a hysteroscopic examination in a postmenopausal woman with abnormal uterine bleeding and reported that he found a polypoid growth in the uterus and cauterized it under hysteroscopic view with silver nitrate.

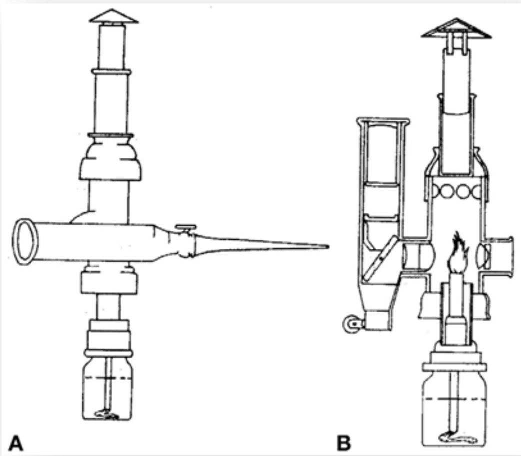

Fig. (2): Diagram of Desormeaux's endoscope. (A) Endoscope. (B) Sagittal view showing flame and reflecting lens ***(Valle, 2007)***.

In ***1879, Nitze*** introduced his cystoscope, in which distal illumination was provided by a platinum loop cooled with fluid circulating around the endoscope. The fact that; the thin-walled urinary bladder could be distended by gravity pressure and, unlike the uterus, didn't bleed on contact, helped the cystoscopy soon to be made practical following the introduction of Nitze's cystoscope. However, hysteroscopy remained unpopular and troublesome.

So, although other physicians followed suit after Pantaleoni's first known hysteroscopic diagnosis and treatment, they were faced by some obstacles including; inadequate light transmission, bleeding inside the uterus, and the inability to distend the organ properly. These factors slowed the development and applications of hysteroscopy. ***David, in 1907,*** developed the first contact hysteroscope.

It was clear that a practical method of viewing the uterine cavity should provide a panoramic view similar to that of cystoscopy, thus, it required intrauterine distension. ***Heineberg in 1914 and Seymour in 1926*** introduced an endoscope that had an internal channel for illumination and contained a system of irrigation with low viscosity fluids to wash any blood and permit uterine distension. This method was the beginning of continuous-flow hysteroscopy and the basis for all such methods introduced later on.

During the next few years, most physicians preferred working with low-viscosity fluids, although ***Rubin*** reported on his experience and excellent results when he used carbon dioxide to distend the uterine cavity for hysteroscopy. Nonetheless, the use of this gas remained rare ***(Rubin, 1925).***

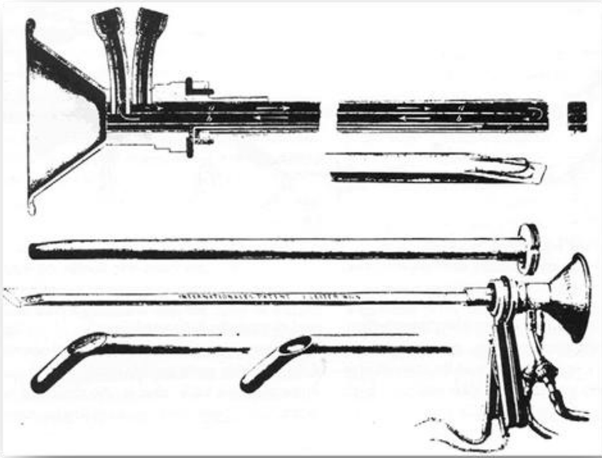

Fig. (3): Nitze's early endoscope with a platinum loop for illumination (1879) ***(Valle, 2007)***

The greatest improvements in distension media took place in the early 1970s when ***Edstrom and Fernstrom (1970)*** utilized successfully a high molecular weight dextran, meanwhile, ***Quinones-Guerrero et al. (1970)*** initiated the use of dextrose 5% in water delivered under pressure as a distension medium, till ***Lindemann (1972)*** re-introduced Rubin's technique of carbon dioxide gas insufflation.

In 1979, ***Hamou*** revolutionized the field of hysteroscopy and further popularized the use of hysteroscopy in 1980s and 90s ***(Hamou, 1981).***

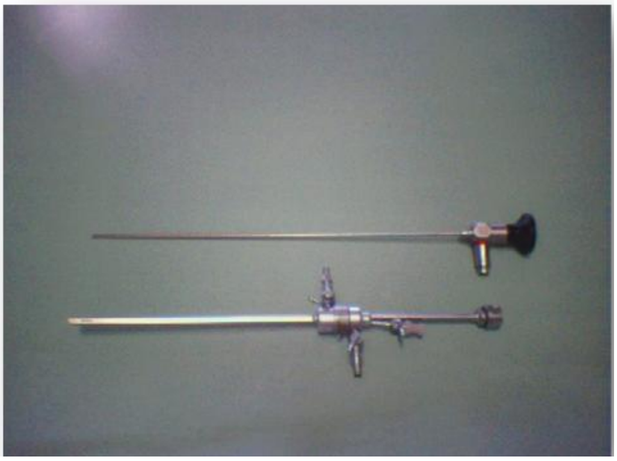

Fig. (4): Bettocchi (traditional) hysteroscope ***(De Placido et al., 2007).***

No significant technologic improvements were reported in the field of hysteroscopes throughout the 1980s. Moreover, electronic devices, such as electronic pumps or endocameras, were not available at a reasonable price. At the beginnings of 1990s, new scopes began to be introduced allowing the physician to adopt an operative scope equipped with mechanical instruments even for a diagnostic procedure ***(Bettocchi et al., 2004).***

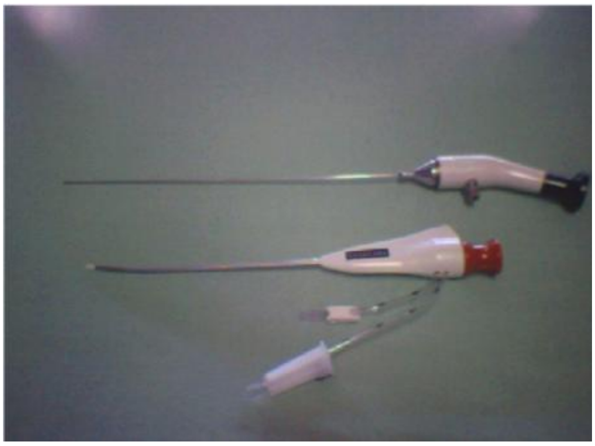

Fig. (5): Mini-hysteroscope ***(De Placido et al., 2007).***

Instrumentation:

To perform a hysteroscopy, the essential equipment is: (1) hysteroscope and optical system, (2) light source, (3) isufflation medium, and (4) camera equipment.

1- Hysteroscope and optical system:

The basic hysteroscope is a thin optical telescope or fiberoptic device connected to a light source. A video camera may be attached at the proximal end of the hysteroscope. Video monitoring and photography allow the patient to observe the procedure and provide photo documentation for the clinical record ***(Bradley, 2009).***

Hysteroscopes can be divided into two types, rigid and flexible and come in external sheaths varying in diameters from 3 to 10 mm. Then, Flexible hysteroscopes is usually preferred for office-based diagnostic hysteroscopy to be used in an outpatient clinic setting. Whilst, rigid scopes are more commonly used for patients undergoing general anesthesia or operative hysteroscopy, as the diameter of the latter is usually larger ***(Cheong and Ledger, 2007).***

Hysteroscopes are available in different degrees of angulations, namely 0°, 12° and 30°. The 30° hysteroscope is usually used for diagnostic purposes, as their external diameters vary from 1.2 mm to 4 mm and the telescope is inserted into an examination sheath of 3–5 mm diameter. At 30° the uterine cavity can be inspected easily in its entirety just by adjusting the direction of the scope. However, as the scope is pointing 30° upwards, it needs to be borne in mind when advancing the hysteroscope that the endocervical canal should be at the 6 o'clock view in order to be able to advance the hysteroscope smoothly without traumatizing the surrounding tissue unnecessarily and causing patient discomfort ***(Bakour et al., 2006 and Cheong and Ledger, 2007).***

The operating hysteroscope can be used for minor surgery, such as for the biopsy or removal of small fibroids. It has an extra channel for the passage of small instruments such as scissors or the biopsy forceps and is usually about 3–7 mm in diameter.

On the other hand, The resectoscope, operative hysteroscope equipped with specialized devices for performing surgical procedures, has an outer diameter of 7–10 mm, and is usually 12° downwards, thus allowing the operating loop to be in view all the time. Surgery via the resectoscope is usually via monopolar electrosurgical energy, but bipolar and laser energy has also been used. Light cables with a diameter of 5 mm and length of 180 cm are usually used for hysteroscopy ***(Cheong and Ledger, 2007 and Bradley, 2009).***

2- Light source:

Light is considered an indispensable component of endoscopy. Satisfactory sources of “cold” light have been available for several years. The power required varies from 100 to 300 watts, but in general, a low-power light source of at least 150 watts is good enough to obtain a satisfactory illumination, particularly for diagnostic hysteroscopy, If a video camera is used, a higher-power xenon or halogen light source is necessary ***(Lindemann, 1994 and Bradley, 2009).***

3- Distension media:

Inflation of the uterine cavity is achieved through insufflation of carbon dioxide gas or instillation of normal saline. These are the most commonly used distension medium for diagnostic hysteroscopy. Although carbon dioxide gas is generally well tolerated, uterine distension with normal saline has been shown to be more comfortable for the patient, to be more cost effective, and to provide superior hysteroscopic views in cases of intrauterine bleeding ***(Di Spiezio Sardo et al., 2008).***

a- Gaseous medium:

As it was mentioned before, Rubin was the first to report on his excellent results using CO2 to distend the uterine cavity for hysteroscopy in 1926. Nonetheless, the