***Can saline infusion sonohysterography replace hysteroscopy in classification and preoperative assessment of submucous fibroids?***

**Ahmed L. Aboul Nasr M.D.1, Mohamed A. Abd El Kader M.D.1, Sherine H. Gad Allah M.D.1, Shimaa Mostafa M.Sc.1, Ahmed Alaa-El-Din M.Sc.1**

**1Department of obstetrics and gynecology, Kasr Alainy Hospital, Cairo University, Egypt.**

**ABSTRACT:**

**OBJECTIVE(S):** To compare saline-infusion sonohysterography (SIS) - both 2D and 3D - to diagnostic hysteroscopy regarding accuracy in classification of submucous fibroids in patients with premenopausal bleeding. Also, to determine the role of sonohysterography in preoperative assessment of these lesions.

#### STUDY DESIGN: Prospective study.

#### MATERIAL AND METHOD(S): 68 premenopausal women with abnormal uterine bleeding women and suspected submucous fibroids were subjected to 2D-saline sonohysterography, 3D-saline sonohysterography & diagnostic hysteroscopy. The protrusion index was calculated during each method.

**RESULT(S):** 2D-SIS showed an accuracy of 86.4% for type 0 fibroids, 75% for type 1 fibroids and 70.4% for type 2 fibroids. Accuracy of 3D-SISwas 95.5%, 87.5% and 74.1% for type 0, type 1 and type 2 fibroids respectively.

**CONCLUSION(S):** SIS (especially 3D-SIS) can be an acceptable substitute to hysteroscopy for classification of fibroids according to their degree of protrusion into the uterine cavity. The accuracy of estimating the protrusion index declines as the intramural component increases. SIS can reliably assess feasibility for hysteroscopic resection, with the advantage of visualizing the intramyometrial portion and identifying associated pathologies.

**KEYWORD(S):** 2D-sonohystrography, 3D- sonohysterography, hysteroscopy, submucous fibroid, protrusion index

**INTRODUCTION:**

Fibroids are the most common benign tumors in females and typically found during the middle and later reproductive years [1]. Results from some ultrasonographic studies indicate the presence of fibroids in over 50% of women. Of these women, 10 to 50% have fibroids of clinical significance [2]. Submucous fibroids are a recognizable cause of abnormal uterine bleeding (AUB), including menorrhagia and inter-menstrual bleeding [3]. In more than 40% of the referred patients, polyps and myomas have been reported [4]. Saline infusion sonohysterography is an easy to perform, safe and well-tolerated procedure yielding high diagnostic accuracy [5]. It has few contraindications and virtually no complications [6]. Its diagnostic accuracy is superior to sonography and very close to diagnostic hysteroscopy; especially with intracavitary lesions as endometrial polyps and submucous fibroids [5].

3D sonohysterography combines the advantages of conventional sonohysterography, with the advantage of the third dimension. Several authors concluded that it may replace diagnostic hysteroscopy [7]. Although hysteroscopy could still be considered an invasive diagnostic procedure; yet in all studies it is considered as the gold standard for evaluation of the uterine cavity [8].

The purpose of this study was to compare the diagnostic accuracy of two-dimensional saline-infusion sonohysterography, three-dimensional saline-infusion sonohysterography and diagnostic hysteroscopy in the classification of submucous fibroids in women with premenopausal bleeding. Another purpose is to determine the role of sonohysterography in preoperative assessment of such fibroids, and the possibility in determining feasibility for hysteroscopic resection.

**PATIENTS & METHODS:**

Patients complaining of abnormal uterine bleeding and suspected to have submucous fibroids by conventional transvaginal sonography were recruited from the outpatient gynecology clinic, Kasr Alainy Hospital, Cairo University from July 2012 till January 2015 to participate in the study. The internal ethics committee approved the study protocol. Informed consent was obtained from all participants after the nature of the procedures had been fully explained. All of them were subjected to full history taking and general, abdominal & pelvic examination. This was followed by 2D-SIS, 3D-SIS and diagnostic hysteroscopy.

With an empty bladder and in lithotomy position, 2D-SIS was performed by instilling saline using a 6-8 French Foley catheter passed into the uterine cavity through the cervix. The amount of instilled fluid varied, depending upon distension of the endometrial cavity as seen on the ultrasound monitor, and also on patient comfort. Then, sonography was carried out using *Voluson 730 Pro (General Electric Healthcare, Austria)* ultrasound machine, with a real-time 4D micro-convex endovaginal curved linear probe (RIC5-9W) with frequency 5-9 MHz. During SIS the whole uterine cavity was meticulously and systematically scanned from one side to the other on a sagittal section through the uterus, and from the bottom to the top of the uterine cavity on a transverse section through the uterus. The 3D volume box was then applied covering the entire uterus & then a 3D volume was generated by the automatic sweep of the mechanical transducer. The volume was stored digitally and analyzed off-line. The sonographic diagnosis of *“submucous fibroid”* was given to those intracavitary lesions which were well defined, broad-based, hypoechoic or isoechoic to the endometrium, and distorting the endometrial–myometrial interface.

Submucous fibroids were assessed for location, size and their protrusion index into the uterine cavity. The protrusion index was calculated using the formula:
B / (B + A) x 100, where (A) is the intramyometrial portion of the fibroid and (B) is its intracavitary portion (Figure 1). According the protrusion index, fibroids were classified as type 0 (fibroid completely within the uterine cavity i.e. fibroid polyp, type 1 (protrusion index less than 50%) and type 2 (protrusion index more than 50%).

A

B

Myometrium

Uterine cavity

Figure (1): Schematic presentation demonstrating the method of measurement of protrusion index during SIS.

In another setting, detailed hysteroscopic examination was performed for all patients under general anesthesia. The light source used in this study was a metal halide automatic light source from *Circon ACMI G71A (Germany)* with a 150 Watt lamp, connected to the hysteroscope through a fibro-optic cable. Constant uterine distention was by attaching plastic bags of distilled water. Infusion pressure was elevated by pneumatic cuff under manometric control at a pressure of 100-120 mmHg. The procedure was monitored using a single chip video and the image was displayed on a monitor visible to the operator. The camera was *Karl Storz (Germany)* with a focal length varying from f 70 to f 140. The hysteroscopist had no knowledge of the ultrasound findings when performing the hysteroscopy. Hysteroscopic diagnosis of *“submucous fibroid”* was made when an intracavitary lesion was exophytic, covered by endometrium, but when palpated with the tip of the hysteroscope, resistance is met and can not be pushed away from the hysteroscope. Location and size of the fibroids was determined. Submucous fibroids were classified according to Wamsteker classification [9] adopted by European Society for Hysteroscopy. According to this classification, fibroids are classified to type 0 fibroids (completely within the uterine cavity i.e. fibroid polyp), type 1 fibroids (more than 50% of the fibroid protrudes into the uterine cavity and makes an angle of less than 90o with the adjacent uterine wall), and type 2 fibroids (less than 50% of the fibroid protrudes into the uterine cavity and makes an angle of 90o or more with the adjacent uterine wall).

**RESULTS:**

69 premenopausal patients with AUB and having 73 suspected submucous fibroids consented for the study. Their age ranged between 40 and 53 years with a mean of 44.8 ± 2.87 years. Their parity ranged between 0 and 13 with a mean of 4.73 ± 2.51. All patients had AUB, with heavy vaginal bleeding being the complaint in 33 patients (47.8%), irregular vaginal bleeding in 26 (37.7%) and inter-menstrual bleeding in the 10 rest (14.5%). None of the patients withdrew from the study. Sonohysterography & diagnostic hysteroscopy were possible in all patients.

Regarding estimation of the size of the fibroid, there was no significant statistical difference between 2D-SIS, 3D-SIS and hysteroscopy (Table 1).

Currently hysteroscopy is the gold standard for classification of fibroids, so it was used in our study as the standard to which 2D & 3D saline-infusion sonohysterography were compared (Table 2). 2D-SIS accurately diagnosed 7 out of 8 type 0 fibroids (87.5%), 6/8 (75%) type 1 fibroids and 6/9 (66.7%) type 2 fibroids. Accuracy of *3D-SIS* was 8/8 (100%) for type 0 fibroids, 7/8 (87.5%) for type 1 fibroids and 7/9 (77.8%) for type 2 fibroids.

**Table (1): Comparison between 2D-SIS & 3D-SIS compared to DH regarding estimation of size of submucous fibroids (values in cm).**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Mean | SD | *P* value |
| 2D-SIS | 7.21 | 0.89 | > 0.05 |
| 3D-SIS | 6.71 | 0.66 |
| DH | 6.60 | 0.60 |

2D-SIS: Two dimensional saline-infusion sonohysterography, 3D-SIS: Three dimensional saline-infusion sonohysterography, DH: Diagnostic hysteroscopy, SD: Standard deviation, *P* value: Probability value.

**Table (2): Classification of submucous fibroids based on DH
& comparison of its accuracy to that of 2D-SIS & 3D-SIS.**

|  |  |  |  |
| --- | --- | --- | --- |
|  **Tool****Type** | **DH** | **2D-SIS** | **3D-SIS** |
|  | **Accuracy** |  | **Accuracy** |
| **0** | 22 | 19/22 | 86.4% | 21/22 | 95.5% |
| **1** | 24 | 18/24 | 75.0% | 21/24 | 87.5% |
| **2** | 27 | 19/27 | 70.4% | 20/27 | 74.1% |

2D-SIS: Two dimensional saline-infusion sonohysterography, 3D-SIS: Three dimensional saline-infusion sonohysterography, DH: Diagnostic hysteroscopy.

**DISCUSSION:**

In our study hysteroscopy was used as the gold standard to which other diagnostic modalities were compared; due to its outstanding accuracy in diagnosis of intracavitary lesions, and this principle was adopted in several previous studies [5, 9-12].

The advantage of *2D-sonohysterography* when dealing with intracavitary lesions –mainly polyps and submucous fibroids– is supported by several previous studies [5, 9, 13-16]. Furthermore, the high diagnostic accuracy of relatively new imaging modality
–*3D-sonohysterography*– was not a surprise. Several studies have previously demonstrated that 3D-SIS has an accuracy approaching 100% in detection of intrauterine polyps and fibroids [17-21].

We noticed that the accuracy of *sonohysterography* –whether 2D or 3D– in estimating the protrusion index of fibroids declines when the intramural component increases. Meanwhile, the accuracy is higher as the intracavitary portion of the fibroid increases. This is line with studies of *Salim et al.*, *Bartkowiak et al.* and 2 studies by *Negm et al* [22-25]. In the study of *Salim et al.* to compare 3D-SIS and diagnostic hysteroscopy for the classification of submucous fibroids, a total of 61 submucous fibroids was identified in 49 symptomatic women. There was agreement between the two methods in 11/12 cases of type 0 fibroids (92%), 34/37 (92%) of type 1 fibroids and 9/12 (75%) of type 2 fibroids [22]. Similarly, in the work of *Bartkowiak et al.*on 68 premenopausal women, 74 submucous myomas were identified. 3D-SIS agreed with hysteroscopy in 95% (20/21) of cases with type 0 fibroids, 88% (31/35) of cases with type 1 fibroids and in 77% (14/18) of cases with type 2 fibroids [23]. In a study by *Negm et al.* on 55 patients, 46 submucous fibroids were identified. 3D-SIS accurately classified 12/13 (92.3%) cases of type 0 myomas, 11/13 (84.6%) cases of type 1 myomas and 16/20 (80%) of type 2 myomas [24]. In another study by *Negm et al.* 3D-SIS suspected 14 out of 16 myomas diagnosed as type 0 by hysteroscopy (87.5%), 20/24 (83.3%) of type 1 myomas and 23/30 (76.6%) for type 2 myomas [25].

Moreover, 3D sonohysterography offered the advantage of visualizing the intramyometrial portion of the fibroid or associated subserous fibroids, which could not have been visualized by hysteroscopy. Moreover, in 14 cases (20%), associated pathologies (adnexal lesions) were visualized, which would have never been identified by hysteroscopy alone. This advantage is supported by the study of Lev-Toaff et al. (2001) on 20 patients to demonstrate advantages of 3D-SIS. In 5 of their 20 patients (i.e. 25%) 3D imaging showed additional lesions [26].

An important finding in our work is appreciating the role of *3D SIS* in planning the management of *submucous fibroids*. We have found 3D SIS to be accurate in localization of fibroids, measurement of their size, estimation of their protrusion index and detection of concomitant lesions; all of which aid in determining feasibility for subsequent hysteroscopic resection. When proposed resectable, hysteroscopy should be carried out from the start by an expert hysteroscopist to spare the patient an unnecessary second setting.

The easiness, simplicity, safety and accuracy of 3D-SIS has recently encouraged several authors [22,23, 27-29] to recommend it to assess feasibility of hysteroscopic resection, and so does our study.

**REFERENCES:**

1. Verkauf BS. Myomectomy for fertility enhancement and preservation. *Fertil Steril*, 58:1–15, 1992.
2. Day Baird D., Dunson DB., Hill MC., Cousins D., & Schectman, JM.. High cumulative incidence of uterine leiomyoma in black and white women: ultrasound evidence. *Am J Obstet Gynecol*, 188(1), 100-107, 2003.
3. Clevenger-Hoeft M., Syrop CH., Stovall DW., and Van Voorhis BJ. Sonohysterography in premenopausal women with and without abnormal bleeding. *Obstet Gynecol*, 94: 516–520, 1999
4. Emanuel MH., Verdel MJ., Wamsteker K. and Lammes FB. A prospective comparison of transvaginal ultrasonography and diagnostic hysteroscopy in the evaluation of patients with abnormal uterine bleeding: clinical implications. *Am J Obstet Gynecol*, 172(2 Pt 1):547‐552, 1995.
5. [Bingol B](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Bingol%20B%22%5BAuthor%5D)., [Gunenc MZ](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Gunenc%20MZ%22%5BAuthor%5D)., [Gedikbasi A](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Gedikbasi%20A%22%5BAuthor%5D)., [Guner H](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Guner%20H%22%5BAuthor%5D)., [Tasdemir S](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Tasdemir%20S%22%5BAuthor%5D)., and [Tiras B](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Tiras%20B%22%5BAuthor%5D). Comparison of diagnostic accuracy of saline infusion sonohysterography, transvaginal sonography and hysteroscopy in postmenopausal bleeding. *Arch Gynecol Obstet,* 284(1):111-117, 2011.
6. Wamsteker K., Emanuel MH., and de Kruif JH. Transcervical hysteroscopic resection of submucous fibroids for abnormal uterine bleeding: results regarding the degree of intramural extension. *Obstet Gynecol*, 82(5): 736-740, 1993.
7. Sala E., Allison S., Ascher SM., and Hricak H. Imaging in Gynaecology. In: Adam A. & Dixon A.K. (eds.) *Grainger & Allison's Diagnostic Radiology*, 5th ed, Florida, Churchill Livingstone, Volume 2, Section 6, Chapter 54, p1217-1241, 2008.
8. Belitsos P., Papoutsis D., Rodolakis A., Mesogitis S., and Antsaklis A. Three‐dimensional power Doppler ultrasound for the study of cervical cancer and precancerous lesions. *Ultrasound Obstet Gynecol*, 40(5): 576-581, 2012.
9. Kelekci S., Kaya E., Alan M., Alan Y., Bilge U., and Mollamahmutoglu L. Comparison of transvaginal sonography, saline infusion sonography, and office hysteroscopy in reproductive-aged women with or without abnormal uterine bleeding. *Fertil Steril*, 84(3):682-686, 2005.
10. Karageyim Karsidag AY., Buyukbayrak EE., Kars B., Unal O., and Turan MC. Transvaginal sonography, sonohysterography, and hysteroscopy for investigation of focal intrauterine lesions in women with recurrent postmenopausal bleeding after dilatation & curettage. *Arch Gynecol Obstet,* 281(4):637-643, 2010.
11. Grimbizis GF., Tsolakidis D., Mikos T., Anagnostou E., Asimakopoulos E., Stamatopoulos P., and Tarlatzis BC. A prospective comparison of transvaginal ultrasound, sonohysterography and diagnostic hysteroscopy in the evaluation of endometrial pathology. *Fertil Steril*, 94(7):2720-2725, 2010.
12. Khan F., Jamaat S., and Al-Jaroudi D. Saline infusion sonohysterography versus hysteroscopy for uterine cavity evaluation. *Ann Saudi Med,* 31(4):387-392, 2011.
13. Allison SJ., Horrow MM., and Lev-Toaff AS. Pearls and Pitfalls in Sonohysterography. *Ultrasound Clin*, 5(2):195-207, 2010.
14. de Vries LD., Dijkhuizen FP., Mol BW., Brölmann HA., Moret E., and Heintz AP. Comparison of transvaginal sonography, saline infusion sonography, and hysteroscopy in premenopausal women with abnormal uterine bleeding. *J Clin Ultrasound*, 28(5):217-223, 2000.
15. Aslam M., Ijaz L., Tariq S., Shafqat K., Meher-Un-Nisa, Ashraf R., and Kazmi T. Comparison of transvaginal sonography and saline contrast sonohysterography in women with abnormal uterine bleeding: correlation with hysteroscopy and histopathology. *Int J Health Sci,* 1(1):17-24, 2007.
16. Erdem M., Bilgin U., Bozkurt N., and Erdem A. Comparison of transvaginal ultrasonography and saline infusion sonohysterography in evaluating the endometrial cavity in pre- and postmenopausal women with abnormal uterine bleeding. *Menopause*, 14(5):846-852, 2007.
17. Sylvestre C., Child TJ., Tulandi T., and Tan SL. A prospective study to evaluate the efficacy of two-and three-dimensional sonohysterography in women with intrauterine lesions. *Fertil Steril*, 79(5): 1222-1225, 2003.
18. Mora-Guanche P., Sparacino L., García-Guzman R., Bennett RA., Hernández J., and Palumbo A. Three-dimensional sonohysterography (SHG) has improved diagnostic accuracy for intrauterine pathology compared to two-dimensional SHG: a prospective pilot study in infertility patients. *Fertil Steril*. 92(3): S119, 2009.
19. Sconfienza LM., Lacelli F., Caldiera V., Perrone N., Piscopo F., Gandolfo N., & Serafini G. Three-dimensional sonohysterography for examination of the uterine cavity in women with abnormal uterine bleeding: Preliminary findings. *J Ultrasound*. 13(1): 16-21, 2010.
20. Aboulghar MM., Shoeir IK., Momtaz M., El Mohammady M., and Ezzat H. A comparative study of 2-dimensional sonohysterography versus 3-dimensional sonohysterography in infertile patients with uterine cavity lesions and abnormalities. *Middle East Fertil Soc J,* 16(1): 67-71, 2011.
21. Adel M., Kandil M., Abo-Elnasr M., Sanad Z., and Farag, H. Three-dimensional sonohysterography may replace hysteroscopy for women with perimenopausal bleeding. *Climacteric*, 17(1): 55-59, 2014.
22. Salim R., Lee C., Davies A., Jolaoso B., Ofuasia E., and Jurkovic D. A comparative study of three-dimensional saline infusion sonohysterography and diagnostic hysteroscopy for the classification of submucous fibroids. *Human Reproduction*,20(1):253-257, 2005.
23. Bartkowiak R., Wielgos M., Borowski D., Bomba‐Opon DA., Kozlowski S., Kosinska‐Kaczynska K., and Szymusik, I. Comparison of conventional and three‐dimensional sonohysterography in the assessment of submucous uterine myomas before their hysteroscopic resection. *Ultrasound Obstet Gynecol*, 32(3): 258-258, 2008.
24. Negm S., Kamel R., Momtaz M., and Magdy A. Classification of submucous myomas using 3D multislice saline infusion sonohysterography and its correlation with hysteroscopy. *Ultrasound Obstet Gynecol*, 34(S1): 158-158, 2009.
25. Negm SM., Kamel, RA., Momtaz M., Magdi AM., and Azab HS. Correlation between three dimensional multi-slice sonohysterography and hysteroscopy in the diagnosis and classification of submucous myomas. *Middle East Fertil Soc J,* 15(3) 209-215, 2010.
26. Lev-Toaff AS., Pinheiro LW., Bega G., Kurtz AB., and Goldberg, BB. Three-dimensional multiplanar sonohysterography: comparison with conventional two-dimensional sonohysterography and X-ray hysterosalpingography. *J Ultrasound Med*, 20(4): 295-306, 2001.
27. Lee C., Salim R., Ofili-Yebovi D., Yazbek J., Davies A., and Jurkovic D. Reproducibility of the measurement of submucous fibroid protrusion into the uterine cavity using three-dimensional saline contrast sonohysterography. *Ultrasound Obstet Gynecol,* 28(6):837-41, 2006.
28. Leone FPG., Bignardi T., Marciante C., and Ferrazzi E. Sonohysterography in the preoperative grading of submucous myomas: considerations on three‐dimensional methodology. *Ultrasound Obstet Gynecol,* 29(6): 717-718, 2007.
29. Zafarani F. and Ahmadi F. Evaluation of intrauterine structural pathology by three-dimensional sonohysterography using an extended imaging method. *Inter J Fertil Steril*, 7(1): 1-6, 2013.