Scientific Research Publishing

Advances in Reproductive Sciences, 2020, 8, 113-125
https://www.scirp.org/journal/arsci
ISSN Online: 2330-0752
ISSN Print: 2330-0744

Findings of Hysterosalpingography in Women Who Underwent Gynaecologic Imaging in a Tertiary Hospital in Douala, Cameroon

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How to cite this paper: Egbe, T.O., Ngombiga, M.D.N., Takang, W.A., Manka'a, E.W., Egbe, D.N., Fon, P.N. and Tendongfor, N. (2020) Findings of Hysterosalpingography in Women Who Underwent Gynaecologic Imaging in a Tertiary Hospital in Douala, Cameroon. *Advances in Reproductive Sciences*, **8**, 113-125.
https://doi.org/10.4236/arsci.2020.82010

Received: March 26, 2020
Accepted: April 12, 2020
Published: April 15, 2020

Abstract

Background: Hysterosalpingography (HSG) is the first-line investigation among infertile women in Cameroon. There is a dearth of studies on the use of HSG in Cameroon. The aim of this study was threefold: 1) to describe the indications; 2) findings of hysterosalpingography and 3) factors associated with abnormal findings on HSG at the Douala General Hospital, Cameroon. **Methods:** We conducted a retrospective descriptive study of 242 files of patients who underwent hysterosalpingography at the Radiology Department of the Douala General Hospital from January 2012 to December 2016. We collected data on the sociodemographic, obstetric variables and indications of HSG using a pretested data collection form. We also interpreted HSG films during the study period. Data analysis was with EPI-INFO version 7. **Results:** The age range was 19 - 46 years with a mean age of 33.16 ± 5.45 years. Majority 138/242 (57.1%) were in the age group 30 - 40 years. The main indication of HSG was infertility 87.2% (211/242). Most of the cases 95.87% (232/242) had abnormal findings at HSG. Tubal and uterine abnormal findings made up 133/232 (57.3%), and 97/232 (41.81%) of cases, respectively. Tubal occlusion and hydrosalpinges were found in 99/232 (42.67%) and 19/232 (8.19%) while uterine fibroids and uterine synechiae were found in 57/232 (24.97%) and 30/232 (12.93%), respectively. The factors independently associated with abnormal findings at HSG were: a history of recurrent pregnancy loss (AOR 2.95; 95% CI: 1.19 - 7.32, p = 0.02) and infertility (AOR 0.24; 95% CI: 0.06 - 0.92, p = 0.038). **Conclusions**: Infertility constituted the main indication, with tubal occlusion

resurging as the most common abnormal finding on hysterosalpingography in this study. A history of recurrent pregnancy loss and infertility were factors independently associated with abnormal findings on hysterosalpingography. Therefore, HSG should be associated with hysteroscopy for uterine pathology and laparoscopy or selective salpingography to decrease the false-positive results of tubal patency in infertile women in Cameroon.

Keywords

Hysterosalpingography, Female Infertility, Uterine Cavity, Tubal Occlusion

1. Background

Hysterosalpingography (HSG) is a radiologic procedure that investigates the cervical canal, uterus and fallopian tubes [1] [2]. It is considered a basic radiographic procedure and is offered by most hospital radiology departments [1]. HSG is a quick and highly accessible test that can be performed by a radiologist or a gynaecologist. However, most fertility centres still refer their patients to specialized radiology facilities for HSG because of availability. Its single most important indication is the evaluation of infertility [3] [4]. Female causes of infertility are responsible for between 25% to 37% of infertility worldwide with larger proportions in sub-Saharan Africa and Southern Asia. It is estimated that 10% to 15% of couples seek treatment for infertility [5].

HSG is considered to have a sensitivity of 51% and specificity of 90% in investigating tubal patency, a sensitivity of 60% - 98% and specificity of 15% - 80% in detecting uterine abnormalities and a sensitivity of 24% and specificity of 45% in diagnosing pelvic adhesions [6].

It is the only radiologic test currently available that is capable of determining the patency of fallopian tubes [7]. Tubal flushing increases pregnancy rates up to 38% compared to the pregnancy rate of up to 21% in women being investigated for infertility who did not undergo HSG [8] [9]. It is equally primordial in the diagnosis of uterine adhesions. It can also be helpful in the diagnosis of other conditions that include repeated miscarriages linked to congenital malformations of the uterus, tumours, endometriosis and uterine adhesions. However, for the latter group of indications, other imaging tests like ultrasonography and MRI produces better results. HSG is an important diagnostic tool but also presents with a certain risk. The procedure is moderately invasive and exposes patients to ionizing radiation, and other (allergies) risks inherent to the use of iodinated contrast media. In addition, women may present with discomfort (pain) during and immediately after the procedure, and in rare cases, may lead to the dissemination of an underlying undiagnosed infection into the peritoneal cavity [10].

It is important that HSG should be carried out only when it is indicated, when no other alternative exists, or when the results will have an impact on the management of the condition under evaluation. The American College of Radiology

(ACR) Committee on Appropriateness Criteria and its experts' panel has developed criteria for determining the right imaging technique for different clinical presentations. According to the criteria, HSG is the preferred imaging modality compared to transvaginal ultrasound and MRI of the pelvis when there is a high suspicion of tubal occlusion, PID (inflammation of the upper genital tract including the uterus, fallopian tubes, ovaries, and pelvic peritoneum) [11], or a history of pelvic surgery. Where there is a history or suspicion of endometriosis, MRI of the pelvis is preferred to transvaginal ultrasound and HSG. In a case of recurrent pregnancy loss, saline infusion sonohysterography is preferred over MRI of the pelvis and HSG [12].

Several studies have reported the indications and findings of HSG comparing HSG with hysteroscopy (HSC), transvaginal sonography (TVS), saline infusion sonohysterography (SIS), hysterosalpingo contrast sonography (HyCoSy), and laparoscopy in assessing female infertility. In Cameroon Guena *et al.* [13] found that the main indication of HSG was infertility (67.5%) followed by tubal permeability assessment after myomectomy (16.9%), recurrent abortions (5.8%), chronic pelvic pains (5.0%) and metrorrhagia 5%. Eighty-nine percent of HSG were abnormal. The most frequent findings were tubal obstruction (36.6%) followed by uterine malformation (12.5%), hydrosalpinges (8.35%), suggestive of myoma (6.7%), cervical incompetence (5.8%), uterine synechia (5.8%), and peritoneal adhesions (5.8%). They concluded that HSG was the most performed radiologic investigation in the workup of female infertility [14]. In another study by Ngowa *et al.* reported a sensitivity of 51% for HSG with a specificity of 90% and a negative predictive value of 52.9% in the diagnosis of tubal occlusion compared to laparoscopy as goal standard [15]. They concluded that HSG is of limited diagnostic value in tubal infertility. Therefore laparoscopy should be performed in cases of abnormal HSG and even in cases of normal HSG in the context of unexplained infertility [13]. However, sometimes-tubal obstruction can be due to artefacts because of technical failure and differences in resistance between the two tubes. However, it has been concluded that laparoscopy is the best standard available [13].

There are several indications for HSG with a variety of outcomes. In Cameroon, gynaecologists' primary investigation during infertility workup is HSG, especially in urban centres. However, most patients with infertility, present initially at the primary care setting and usually in rural areas. Despite the high prevalence of infertility in our setting, very few studies have been carried out to describe the indications, and findings of HSG.

By describing the indications and findings of HSG, we hope to show the diagnostic value of this investigation thereby raising awareness among physicians of the important role of HSG to evaluate female infertility

The goal of this study was to check and analyze the findings of HSG and to assess the factors associated with the findings of hysterosalpingography in women who undergo the procedure, to find its diagnostic value.

Specifically, we sought 1) to find the indications of HSG, 2) describe the findings of HSG, and 3) to identify the factors associated with abnormal HSG findings at the uterine cervical canal, uterine cavity and fallopian tubes.

2. Materials and Methods

2.1. Study Design

After obtaining ethical clearance from the Institutional review board of the Faculty of Health Sciences, University of Buea (Ref. 2017/336/UB/VD/RC/FHS) and administrative approval from the Douala General Hospital (Ref. 155 AR/MINSANTE/HGD/DM/02/17), we conducted a hospital-based retrospective descriptive study of hospital records of HSG from January 2012 to December 2016 at the Douala General Hospital. We conducted the study from January 2017-April 2017 and we interpreted all the HSG films de novo.

2.2. Study Area and Setting

We conducted the study in Douala, the capital of the Littoral region. The Douala General Hospital (DGH) is a tertiary care health facility with an Obstetrics and Gynaecology unit that has eight specialists and that offers emergency obstetric and neonatal care to a population of over 2.444.945 inhabitants. The Radiology Department has three experienced radiologists and performs standard and advanced radiology imaging (magnetic resonance imaging, etc.). The Department of Radiology performs an average of 20 HSG per month. Patients attending the hospital come from both within and outside the city including other countries of the central African sub-region (Tchad, Central African Republic, Congo and Gabon). The DGH also serves as a teaching hospital for undergraduate and postgraduate medical students.

2.3. Study Population and Sampling

This study-involved file of patients who underwent hysterosalpingography from January 2012 to December 2016. We selected files by using a consecutive sampling method. We included in the study files of patients that were complete (containing the socio-demographic data, indication for HSG and good quality images).

2.4. Study Procedure

We identified files of patients who underwent HSG using the register of the Radiology Department and information was recorded on a pretested structured data collection form. The data collected consisted of: socio-demographic characteristics (age, marital status, occupation, level of education, etc.) and clinical data (indication for HSG from patients' medical records in the Obstetrics and Gynaecology Department as well as HSG reporting register from the Radiologic Department. We obtained radiologic data from HSG register reports. The prin-

cipal investigators were also trained on how to read and interpret HSG by the consultant Radiologists. The principal investigator and a Consultant radiologist and gynaecologist with more than 10 years of experience interpreted all the HSG images. The HSG was usually performed from day 7 to day 12 of the menstrual cycle (the first day being the onset of bleeding in a regular cycle) using the standard technique [3] [6].

As regards the interpretation of the HSG, each reader used a harmonized and standardized pattern approach. Each part of the female genital tract (cervix, uterine cavity, fallopian tubes, peritoneal cavity) was analyzed meticulously.

We reported our findings in a data collection form. Each reader reported findings separately and blindly from the others. However, in case of discordance between gynaecologist and radiologist, the images were re-analyzed to have a consensus. Furthermore, when there was discordance between the principal investigator and either the gynaecologist or radiologist, the latter had the last word.

2.5. Data Management and Data Analysis

EPI-INFO version 7 for Windows was used for data analysis. Normally distributed continuous variables (age) were expressed as means and standard deviation and results were reported as frequency tables. Categorical variables (marital status, and occupation) were compared using the chi-squared test. To identify the indications and findings of HSG, the frequency, cumulative frequencies and proportion of each indication were calculated and analyzed. To identify the factors associated with abnormal HSG findings, a univariate analysis was carried out and reported as odds ratios and 95% confidence intervals. A probability value of ≤0.05 was considered statistically significant. Those variables that were statistically significant at the 5% level in the univariate analysis were entered into a stepwise binary logistic regression model to generate adjusted odd ratios (AOR) with their 95% confidence intervals (CI).

All the missing data were coded but were not included in the final analysis. We adhered to STROBE guidelines/methodology.

3. Results

A total of 310 files of women who underwent HSG were identified from the radiology and gynaecology registers of the DGH. We excluded 68 files (21.94%) (Of which there were 43 (13.8%) incomplete files, those files that had no films and 25 (8.06%) files had no indication for HSG). The remaining 242 (78.06%) files were analyzed (**Figure 1**).

The age range of studied files was 19-46 years with a mean age of 33.15 ± 5.45 years.

Table 1 shows that 138/242 (57.1%) were in the age group 30 - 40 years, and 188/242 (77.7%) were married while 176/242 (72.7%) had tertiary education.

Furthermore, 194/242 (80.2%) had employment and 235/242 (97.5%) were urban dwellers.

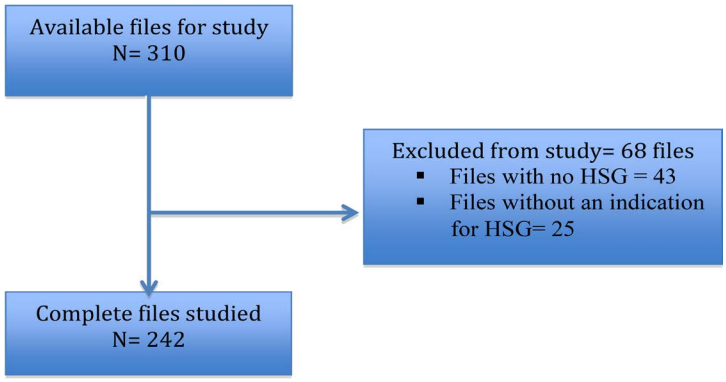

Figure 1. Flow diagram.

Table 1. Demographic characteristics of study population.

Variable	Frequency (N = 242)	Percentage
Age (Years)		
<20	1	0.4
20 - 30	64	26.4
30 - 40	138	57.1
>40	39	16.1
Total	242	100
Marital status		
Married	188	77.7
Single	54	22.3
Total	242	100
Level of education		
Tertiary	176	72.7
Secondary	65	26.9
Primary	1	0.4
Total	242	100
Occupation		
Employed	194	80.2
Unemployed	47	19.4
Unknown	1	0.4
Total	242	100
Residence		
Urban	236	97.5
Rural	6	2.5
Total	242	100

Most, 183 (75.6%) files studied had a positive medical history. Besides, a history of recurrent pregnancy loss was recorded in 100 (41.3%) while PID was recorded in 74 (30.6%) and a history of previous surgery was found in 9 (3.7%) of files. Besides, 141 (58.2%) files had one or more live time pregnancy and 99 (41%) had never been pregnant. Furthermore, 81 (33.2%) had given birth to one or more living children and there were 116 (55%) with secondary infertility (Table 2).

Figure 2 shows that the leading indication for HSG was infertility 211/242 (87.2%), followed by recurrent pregnant loss 10/242 (4.13%) and uterine fibroid 7/242 (2.9%)

As shown in Table 3, there were 232 files with abnormal findings at HSG. Among these files, 133/232 (57.3%) had tubal anomalies. Tubal occlusion was recorded in 99/232 (42.67%) files while hydrosalpinges were found in 19/232 (8.2%) files. Besides uterine anomalies were found in 97/232 (41.81%) with uterine fibroids represented in 57/232 (24.97%) and uterine synechiae/adhesions in 30/232 (12.93%). There were 6/232 (2.59%) cases with congenital anomalies.

In multivariate analysis, a history of recurrent pregnancy loss was 2.95 times associated with abnormal HSG findings (AOR 2.95; 95% CI: 1.19 - 7.32, p = 0.02). Furthermore, the likelihood of having abnormal HSG findings was 76% higher among infertile than fertile couples (AOR 0.24; 95% CI: 0.06 - 0.92, p = 0.038) (Table 4). The other factors studied like age (p = 0.14), occupation (p = 0.29), and the indication gravidity (p = 0.74 were not associated with abnormal findings at HSG in multivariate analysis (Table 4).

Table 2. Reproductive health characteristics of study population.

Variable	Frequency	Percentage
Gynaecologic history		
Abortion	100	41.3
PID	74	30.6
Previous surgery	9	3.7
None	59	24.4
Total	242	100
Obstetrical history Gravidity		
Nulligravida	99	41
>1	141	58.2
Unknown	2	3.7
Total	242	100
Parity		
Nulliparity	161	66.8
>1	81	33.2
Total	242	100
History of Infertility		
Yes	211	87.2
No	31	12.8
Total	242	100
Type of infertility (N = 211)		
Secondary	116	55
Primary	95	45
Total	211	100

PID: Pelvic inflammatory disease.

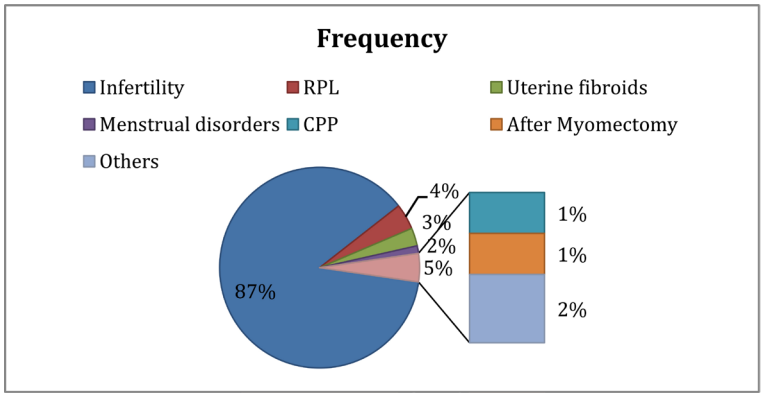

Figure 2. Indications of hysterosalpingography.

Table 3. Abnormal Findings at hysterosalpingography.

Variable	Frequency (N = 232*)	Percentage
Tubal anormalies (N = 133)		
Tubal occlusion	99	42.67
Hydrosalpinges	19	8.19
Peritubal adhesions	7	3.02
Endometriosis	4	1.72
Others	4	1.72
Total	133	57.32
Uterine Anomalies (N = 97)		
Uterine fibroids	57	24.57
Uterine synechiae	30	12.93
Congenital anomalies	6	2.59
Endometrial polyps	3	1.29
Air bubbles	1	0.43
Total	97	40.59
Cervical anomalies (N = 2)		
Cervical incompetence	1	0.43
Cervical adhesions	1	0.43
Total	2	0.86
Grand Total [133 + 97 + 2] =	232	100

*For this category, we had 232 responses in the files.

Table 4. Factors associated with abnormal HSG findings (multivariate analysis).

Variable	Adjusted odd ratio	95% Confidence Interval	p-value
Age	1.69	0.85 - 3.67	0.135
History of recurrent pregnancy loss	2.95	1.19 - 7.32	0.02
Infertility	0.24	0.06 - 0.92	0.038
Occupation	1.56	0.70 - 3.24	0.294
Indication gravidity	0.86	0.36 - 2.07	0.742

4. Discussion

We conducted a study that evaluated the indications and findings of hysterosalpingography among women presenting for gynaecologic imaging at the Douala General Hospital. HSG is still the most common first-line diagnostic test to evaluate tubal patency and uterine cavity but laparoscopy remains the goal standard in the diagnosis of tubal diseases [12] [16]. This study revealed that the age group most often undergoing HSG is middle-age women 30 - 40 years; the mean age was 33.16 ± 5.45 years. This is consistent with the study in Ngaoundere, Cameroon in 2014 that reported the age bracket 33 - 37 years as the most common age group that HSG is performed [14]. In Cameroon, this is the peak reproductive age of women. Most women who have not had children by this age bracket seek medical attention for fertility desire. Furthermore, 41.3% of files studied had a history of induced abortion, while pelvic inflammatory disease occurred in 30.9% and pelvic surgery in 3.9%. This is consistent with the study reported by Naamp *et al.* in Cote d'Ivoire who reported a history of recurrent abortion and PID as the most common reproductive health history [17] [18]. This is probably because recurrent pregnancy loss is associated with anatomical defects (septate uterus or uterine fibroids) on the uterus that could easily be diagnosed with HSG. Furthermore, PID usually has the capacity of destroying the tubal mucosa with loss of cilia and scaring leading to tubal occlusion.

Indications of hysterosalpingography

In this study, the main indication for HSG was infertility. Primary infertility accounted for 45% and secondary infertility in 55% cases. Similarly, Kiguli-Malwadde *et al.* (2004) in Kampala, Uganda reported 59.9%, Botwe *et al.* (2015) in Ghana, (52.4%), Bello *et al.* (2006), in Nigeria (80%) participants with secondary infertility as an indication for HSG [19] [20] [21]. These rates are higher than the findings in this study. However, Okafor *et al.* (2010) in Nnewi Nigeria reported that primary and secondary infertility was found in 44.8% and 38.3% cases, respectively [22]. This difference may be attributed to the fact that the most frequently occurring age group in their study was 24 - 29 years. Besides, infertility studies where the population is young will usually record a higher incidence of primary infertility. In this study the most frequent age group was 30 – 35 years with a mean age of 33.16 ± 5.45. After infertility, recurrent abortions (5%) was the second leading indication of HSG followed by uterine fibroid and menstrual disorders in 3.7% and 1.7%, respectively. Other studies that compared the efficacy of HSG and Hysteroscopy in diagnosing the uterine cavity anomalies have reported that the main radiologic findings in the uterine cavity of recurrent pregnancy loss were uterine septum filling defects and uterine wall irregularity [23]. They also reported that HSG has 74% sensitivity and 60% specificity in revealing uterine pathology and a false-positive and false-negative rate of 38.3 and 28.3%, respectively [23]. Furthermore, another study reported 65.88% rate of diagnosing uterine pathology with HSG. The same study reported a sensitivity, specificity, positive predictive value and negative predictive value of 74.6%, 79.5%, 90.4% and 54.7%, respectively [24]. Both studies concluded that Hysteroscopy is

more accurate than HSG in evaluating the uterine cavity in patients with recurrent pregnancy loss [23] [24]. Besides, Ekwere *et al.* (2007) in Calabar Nigeria reported that about 7.4% of uterine fibroid cases are implicated in infertility [25]. Uterine fibroids are generally more common among the black race compared to Caucasian and other races because of the dense connective tissue present in women of this race. A systematic review revealed that uterine fibroid risk factor with the strongest evidence is black race [26]. Therefore, it is not surprising to find fibroids on HSG in this study. Furthermore, the differential diagnosis of intrauterine filling defects by HSG includes polyps, endometrial hyperplasia, sub mucosal fibroids, intrauterine adhesions and septa. These findings necessitate further investigation with hysteroscopy to confirm and possibly treat the pathology [6] [23] [24] [27]. Menstrual disorders (menorrhagia or menometrorrhagia) may also be associated with uterine fibroids especially if they are in the FIGO class 0 and 1 [27].

Findings of hysterosalpingography

In this study, abnormal hysterosalpingography findings were recorded in 72.3% of cases. Tubal pathologies were the most common abnormalities in 112 (46.3%). Of these, tubal occlusion was the most documented tubal abnormality accounting for 99 (41.0%) of all the cases. This is explained by the fact that 30.9% of files had a history of pelvic inflammatory disease. PID is a common cause of tubal infertility in most countries in sub-Saharan Africa with *Chlamydia trachomatis* being the most commonly occurring culprit [28]. Sixty-two percent of participants had positive findings for unilateral tubal obstruction while 37 (37.4%) had bilateral tubal occlusion. These findings are consistent with the 65.9% and 52.8% of unilateral tubal occlusion reported by Danfulani *et al.* (2014) in Sokoto Nigeria, and Botwe *et al.* (2015) in Korle-Bu Ghana, respectively [20] [29]. But this is contrary to a study done in Nigeria in 2016 where bilateral tubal occlusion was predominant over unilateral tubal occlusion [30]. The uterine fibroid was the second most common abnormalities found on HSG 57 (23.6%) similar to a study done in Sokoto Nigeria (25.5%). Previous reports have shown that uterine fibroids were the main HSG finding 86 (41.9%) in a study done in a tertiary hospital in Nigeria [30]. Six (2.9%) participants presented with congenital malformation. This is consistent with the report of Guena *et al* in Ngaoundéré, Cameroon where they had 5 (4.2%) of cases with congenital malformation [13] but contrary to the study by Danfulani *et al.* in Nigeria who reported 1 (0.3%) congenital malformation [29].

Factors associated with abnormal HSG findings

In multivariate analysis by logistic regression, a history of recurrent pregnancy loss was 3-fold likely to be associated with abnormal HSG findings (AOR 2.95; 95% CI: 1.19 - 7.32, p = 0.02). This is consistent with the reports by Igoh *et al.* in Nigeria in 2016 that reported an association between a history of abortion and abnormal findings on HSG. This factor alone may increase the chances of developing post-abortal sepsis that will lead to uterine synechiae/adhesions or tubal damage/occlusion [18]. Contrarily, normal fertility was protective of abnormal HSG findings (AOR 0.24; 95% CI: 0.06 - 0.92, p = 0.038). This is in accordance with the fact that infertility is the main indication for HSG.

5. Conclusion

Infertility is the leading indication of HSG and the most common structural anomaly was tubal occlusion. Factors independently associated with abnormal findings on HSG were a history of recurrent pregnancy loss and an indication of infertility. We recommend that HSG should be associated with hysteroscopy for uterine cavity pathology and laparoscopy and selective salpingography to reduce the false-positive results of tubal patency.

Limitations of the Study

This was a hospital-based study and as such does not capture the entire population of the study area. Furthermore, being a retrospective study we could not study all the files because some were incomplete (missing data). There was no funding for the study therefore we could not cover other hospitals in Douala and throughout Cameroon.

Acknowledgements

We are thankful to the staff of the Obstetrics and Gynaecology and Radiology Departments for their collaboration during the study.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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