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# Concordance and contribution of hysterosalpingography and laparoscopy in tubal exploration in cases of infertility at the Ebolowa Regional Hospital Centre (ERHC)

## Concordance et apports de l'hystérosalpingographie et de la cœlioscopie dans l'exploration tubaire et pelvienne en cas d'infertilité au CHR d'Ebolowa

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## Article Original

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## ABSTRACT

**Introduction**: The aim of our study was to evaluate the concordance between hysterosalpingography (HSG) and laparoscopy in the diagnosis of tubal lesions at the Ebolowa Regional Hospital Centre (CHRE).

**Methodology**: We conducted a descriptive cross-sectional study with an analytical component, at the CHRE from January 2022 to January 2025, including the records of patients who had undergone HSG showing a tubal lesion and benefited from operative laparoscopy for this diagnosis within 6 months. To assess concordance between the 2 procedures, the Kappa concordance coefficient (K) was used and the sensitivity and specificity, of HSG were calculated with a 95% confidence interval (CI) and a significance threshold of $p<0.05$.

**Results**: We included 140 cases. The mean age was 30.47 ± 4.86 years. A good agreement (k=0.67;95% CI 0.55-0.72) between hysterosalpingography and laparoscopy in the diagnosis of bilateral proximal tubal obstruction was found with good specificity (80.5%; CI 65.5-80.2) and sensitivity (87.5%; CI 75.5-90.2). Agreement between the 2 tests was was poor for bilateral distal tubal obstruction (K=0.32; 95% CI 0.25-0.43), and a discordance in the diagnosis of mixed tubal obstruction (K=0).

**Conclusion**: In the absence of technical and interpretation problems with HSG and laparoscopy, HSG can be a reliable examination in the diagnosis of certain tubal lesions such as bilateral proximal tubal obstruction.

## RESUME

**Introduction** : Le but de l'étude était d'évaluer la concordance entre l'hystérosalpingographie (HSG) et la coelioscopie dans le diagnostic des lésions tubaires au Centre Hospitalier Régional d'Ebolowa (CHRE).

**Méthodologie** : Il s'agissait d'une étude transversale descriptive avec un volet analytique, au CHRE de janvier 2022 à janvier 2025. Etaient inclues les dossiers des patientes ayant réalisé une HSG montrant une lésion tubaire et ayant bénéficié d'une cœlioscopie opératoire pour ce diagnostic dans les 6 mois. Pour évaluer la concordance entre les 2 procédures le coefficient de concordance de Kappa (K) a été utilisé. La sensibilité et spécificité ont été calculées avec un intervalle de confiance (IC) à 95% et un seuil de significativité de $p<0,05$.

**Résultat** : Nous avons inclus 140 dossiers. L'âge moyen était de 30,47ans ± 4,86ans. Une bonne concordance (k=0,67; IC 95% 0,55-0,72) entre l'hystérosalpingographie et la cœlioscopie dans le diagnostic des obstructions tubaires proximales bilatérales a été trouvé avec une bonne spécificité (80,5% ; IC 65,5-80,2) et une bonne sensibilité (87,5% ; IC 75,5-90,2). La concordance entre les 2 examens était médiocre pour l'obstruction tubaire distale bilatérale (K=0.32; IC 95% 0,25-0,43), et une discordance dans le diagnostic d'obstruction tubaire mixte (K=0).

**Conclusion** : En absence de problèmes techniques et d'interprétation de l'HSG et de la coelioscopie, L'HSG peut être un examen fiable dans le diagnostic de certaines lésions tubaires telles que l'obstruction tubaire proximale bilatérale.





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## Introduction

Infertility in couples is defined as the inability to achieve clinical pregnancy after 12 months of regular sexual intercourse without contraception or therapeutic insemination with a donor in women under 35 years of age, or within 6 months in women over 35 years of age [1,2]. Infertility remains a major public health issue, affecting 186 million people worldwide [1]. Female infertility is a major issue in reproductive health in Africa [2], with tubal damage being the most common cause in 25% to 35% of cases [3]. In Cameroon, in a study conducted by Egbe et al in Douala in 2020, 19% of couples suffered from infertility [4].

Hysterosalpingography (HSG) is a medical examination that uses X-rays to visualize the uterus and fallopian tubes after injecting a contrast medium into the uterus. This imaging test is the first-line test recommended for initial tubal exploration in the management of infertility [2,3,4]. Laparoscopy is a minimally invasive surgical procedure that allows the abdominal cavity to be explored and therapeutic procedures to be performed. It is the gold standard for assessing tubal patency according to several authors [5,6,7,8,9,10]. The use of this examination technique is becoming increasingly common in Cameroon, with infertility accounting for approximately 76.3% of laparoscopic surgery cases in the city of Douala [11].

The question of the concordance between these two techniques and the value of systematically combining these two examinations has been the subject of several studies with varying conclusions [12.13, 14, 15]. Advocates of routine laparoscopy argue that hysterosalpingography is not as reliable as laparoscopy for evaluating the fallopian tubes and pelvic cavity [16, 17]. This is especially true given that the performance and interpretation of hysterosalpingography can vary from one operator to another [6]. In line with this, some authors conclude that laparoscopy should be performed systematically in infertile patients suspected of having tubal pathology revealed by hysterosalpingography [18,19]. Nevertheless, laparoscopy remains expensive in Cameroon and is not without risk [17, 18]. Tan et al in China in 2022 demonstrated good concordance between these two examinations if the performance and interpretation of HSG were improved, thus limiting the systematic use of laparoscopy for certain tubal lesions [10]. In light of this, we felt it was appropriate to evaluate the concordance between HSG and laparoscopy in tubal exploration at the CHRE in our context.

## Methods

This was a descriptive cross-sectional study with an analytical component. The study was conducted from May 1, 2022, to May 1, 2025, in the Gynecology and Obstetrics Department of the Ebolowa Regional Hospital Center. Our study included all patients who had undergone HSG followed by operative laparoscopy within six months for tubal obstruction and/or pelvic adhesions. We excluded any incomplete or unusable medical records and any patients who had undergone laparoscopy more than six months after the HSG diagnosis. Our sampling was consecutive and non-probabilistic. After obtaining ethical clearance from the University of Douala and administrative authorization from the director of the ERHC, we reviewed all medical records of patients followed for infertility who had undergone HSG revealing a tubal or pelvic abnormality recquiring laparoscopy,

At the ERHC, HSG is performed and interpreted in the radiology department by a radiologist with 10 years of experience. All HSGs were performed between the 7th and 10th day of the menstrual cycle in accordance with standard procedures. Laparoscopy is performed by a team of gynecologists specialized in endoscopic surgery with 3 to 5 years of experience. During laparoscopy, pelvic and abdominal exploration for structural abnormalities of the uterus, pelvic and perihepatic adhesions, and endometriosis was systematic before assessing tubal patency. Tubal patency was studied by performing a methylene blue test, which involves injecting a methylene blue solution into the patient's genital tract via a previously inserted intrauterine device. . It was performed before and after surgery to assess its effectiveness. The test was considered positive if the methylene blue solution injected via the intrauterine device flowed into the peritoneal cavity through the abdominal ostium of the fallopian tube. If there was no flow, the test was considered negative.

We collected sociodemographic data (age, occupation, marital status, religion), clinical data (procedure and parity, history of previous pregnancies, history of previous surgery, age of last child, history of STIs, use of contraceptive methods, type of infertility) and paraclinical data (unilateral or bilateral tubal obstruction, proximal or distal, hydrosalpinx or other lesions on HSG). Finally, we used operating room records to identify surgical procedures and intraoperative findings. HSG findings were compared with those of laparoscopy, the latter being considered the gold standard. The data collected were analyzed using SPSS (Statistical Package for Social Sciences) version 28.0. The sensitivity, specificity, positive predictive value, and negative predictive value of HSG and laparoscopy were calculated. To determine the concordance between HSG and laparoscopy, we used the Kappa statistical test. Its interpretation is as follows: Kappa > 0.80 indicates very good agreement, Kappa between 0.60 and 0.80 indicates good agreement, Kappa between 0.40 and 0.60 indicates moderate agreement, Kappa between 0 and 0.40



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indicates poor agreement, Kappa at 0% indicates clear disagreement. Our confidence interval was set at 95% for a significance threshold of p< 0.05.

## Results

During the study period, 179 patients who underwent HSG followed by operative laparoscopy for tubal pathology were identified, of which 39 were rejected because 19 had incomplete files and 20 were patients who underwent laparoscopy more than 6 months after HSG. A total of 140 patients were definitively included. The most represented age group was 26 to 35 years (45.7%) with an average age of 30.47 years ± 4.86 years. Primary infertility was found in 45.7% (64/140) of patients, and 54.3% (76/140) suffered from secondary infertility. The sociodemographic and clinical characteristics of the patients are shown in Table 1.

Table 1. General patient characteristics

| Variable | Modalities | Patients ( N=140) | Percentage(%) |
|---|---|---|---|
| **Matrital status** | Single | 64 | 45.7 |
| | Maried | 76 | 54.3 |
| **Education level** | Not scholarized | 10 | 4.4 |
| | Primary | 26 | 11.5 |
| | Secondary | 101 | 44.6 |
| | University | 89 | 39.4 |
| **Profession** | Housewife | 63 | 45 |
| | Student | 15 | 11 |
| | Worker | 62 | 44 |
| **Age** | 15-25 | 19 | 13.6 |
| | 26-35 | 64 | 45.7 |
| | 36- 45 | 55 | 39. 2 |
| | ≥45 | 2 | 1.4 |
| **Type of infertility** | Primary | 64 | 45.7 |
| | Secondary | 76 | 54.3 |

The HSG agreed with laparoscopy in showing that there was tubal obstruction in 50% of cases (70/140). In 14.2% of cases (20/140), HSG showed patent tubes, whereas they were occluded during laparoscopy. Conversely, in 26% of cases (36/140), HSG revealed tubal obstruction, whereas they were patent during laparoscopy.

Table 2. Concordance between Hysterosalpingographie and coelioscopy in the diagnosis of tubal occlusions

| HSG | Obstructed fallopian tubes in laparoscopy | Unobstructed fallopian tubes in laparoscopy | Total |
|---|---|---|---|
| Unilateral proximal obstruction (YES) | 9 | 5 | 14 |
| Unilateral proximal obstruction (NO) | 3 | 7 | 10 |
| Total | 12 | 12 | 24 |
| **Bilateral proximal tubal obstruction** | | | |
| Bilateral proximal obstruction (YES) | 7 | 1 | 8 |
| Bilateral proximal obstruction (NO) | 1 | 4 | 5 |
| Total | 8 | 5 | 13 |
| **Unilateral distal tubal obstruction** | | | |
| Unilateral distal obstruction (YES) | 7 | 3 | 10 |
| Unilateral distal obstruction (NO) | 2 | 6 | 8 |
| Total | 9 | 9 | 18 |
| **Bilateral distal tubal obstruction** | | | |
| Bilateral distal obstruction (YES) | 10 | 7 | 17 |
| Bilateral distal obstruction (NO) | 2 | 7 | 9 |
| Total | 12 | 14 | 26 |
| **Mixed bilateral tubal obstruction** | | | |
| Mixed bilateral obstruction (YES) | 2 | 2 | 4 |
| Mixed bilateral obstruction (NO) | 2 | 2 | 4 |
| Total | 4 | 4 | 8 |
| **Pelvic adhesions** | | | |
| Adhesions (YES) | 32 | 5 | 37 |
| Adhesions (NO) | 4 | 12 | 16 |
| Total | 36 | 17 | 53 |

The Kappa statistical test of agreement between the two examinations ranged from 0 to 0.40 for unilateral proximal tubal obstruction (0.33), bilateral distal tubal obstruction (0.33), and the diagnosis of hydrosalpinx (0.26), indicating poor agreement between HSG and laparoscopy in the diagnosis of these conditions. However, there was good agreement between HSG and laparoscopy in the diagnosis of bilateral proximal



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tubal obstruction (kappa= 0.67) and pelvic adhesions (Kappa= 0.60). When evaluating the concordance for mixed bilateral tubal obstructions, the kappa coefficient was 0, indicating a clear discrepancy between hysterosalpingography and laparoscopy in the diagnosis of this condition. The concordance between HSG and laparoscopy in tubal obstructions is shown in Table 3.

Table 3. Specificity sensibility and Kappa coefficience of HSG in the diagnosis of tubal lesions

| Lesions | Kappa coefficience | Concordance | HSG specificity(%) | HSG sensibility (%) |
|---|---|---|---|---|
| Unilateral proximal tubal obstruction | 0,33 | Moderate | 70 | 64 |
| Bilaterale proximal tubal obstruction | 0,67 | Good | 80 | 87,5 |
| Unilateral distal tubal obstruction | 0,44 | Moderate | 75 | 70 |
| Bilateral distal tubal obstruction | 0,32 | Moderate | 77,8 | 58,8 |
| Mixed bilateral tubal obstruction | 0 | Discordance | 50 | 50 |
| Pelvic adhesions | 0,60 | Good | 75 | 86,4 |

HSG had high sensitivity (87.5%; CI 75.5-90.2) and specificity (80.5%; CI 65.5-80.2) in the diagnosis of bilateral proximal tubal obstructions, with a positive predictive value of 87.5% and a negative predictive value of 80%. For the diagnosis of pelvic adhesions, good sensitivity (86.4%; CI 62.5-92.0) and specificity (75.5%; CI 65.5-79.5) of HSG was also noted. However, the sensitivity of HSG in the diagnosis of bilateral distal obstruction and hydrosalpinx was poor. Finally, HSG was better at predicting the discovery of bilateral proximal tubal obstruction (PPV = 87.5%) and pelvic adhesions (PPV = 88.8%) during laparoscopy. (Table 3)

## Discussion

Infertility remains a major problem in Africa, especially in southern Cameroon. Tubal causes predominate, and examination of the female genital tract, which is an essential part of infertility assessment, is performed using hysterosalpingography (HSG), a technique often used as a first-line test to evaluate uterine anatomy and tubal patency. Nevertheless, several studies highlight laparoscopy as the gold standard in the diagnosis of tubal and especially pelvic pathologies such as pelvic adhesions and pelvic endometriosis, as it allows direct visualisation of the pelvic organs for the purpose of diagnosis but also for therapeutic intervention [8,9]. That being said, the question of the usefulness of HSG as a first-line examination remains, given the widespread use of laparoscopy, and several authors have addressed this issue, such as Mehdi et al. in Tunisia in 2014 [19] and Kemfang et al. in Cameroon in 2015 [8]. These two studies showed that the results of HSG and laparoscopy complement each other in the examination of the female pelvis in cases of infertility and that there is value in combining them whenever possible. We wanted to evaluate the concordance between these two techniques in our context, a hospital with medical imaging and endoscopic surgery facilities that comply with international standards for both procedures.

### Proximal tubal obstruction

The question of how to proceed in cases of bilateral proximal tubal obstruction remains important, as reliable HSG results for this diagnosis would make laparoscopy unnecessary and instead favour in vitro fertilisation or hysteroscopic cannulation. During our study, we obtained a kappa coefficient of 0.67 between hysterosalpingography and laparoscopy, indicating good agreement between these two techniques in the diagnosis of bilateral proximal tubal obstruction. This result is similar to a study conducted in China by J. Tan et al., in which the kappa coefficient was 0.89 between HSG and laparoscopy for the diagnosis of bilateral proximal tubal obstruction [10]. However, several studies, including one conducted in Gabon by Makoyo et al in 2021 (kappa coefficient : 0.49) Moustapha et al. in Douala in 2024 (kappa coefficient : 0.39) have shown moderate and poor agreement between HSG and laparoscopy in the diagnosis of bilateral proximal tubal obstructions [6, 9]. In this series, HSG had a positive predictive value of 87.5% in the diagnosis of bilateral proximal tubal obstructions, a result comparable to that of Kemfang et al. in Cameroon, where HGG had a positive predictive value of 89.3% for this diagnosis [8].

The main reasons put forward in these studies to explain this discrepancy were: the existence of functional spasm in the uterine horns linked to pain during the HSG, a faulty cervical cannula blocking system that allows contrast medium to leak into the vagina, thereby reducing the intra-cavitary pressure necessary for opacification of the genital tract, and the higher viscosity of the radiological contrast medium [2,6]. Our results, which contrast with theirs, can be attributed to the technical facilities at our hospital and the HSG procedure. In our facility, premedication is systematically administered 30 minutes before the procedure to reduce pain associated with the procedure and thus avoid reflex spasms in the uterine horn that can lead to false positives. During



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the procedure, a Rubin catheter specially designed for HSG and equipped with a balloon is used to occlude the cervix and limit leakage of the water-soluble iodine contrast medium. These precautions may explain the reliability of HSG in our context. We also excluded from our study any patient who had undergone laparoscopy more than 6 months after the HSG, as this relatively long interval between the two examinations may lead to discordance between the two results.

### Distal tubal obstruction

We obtained a kappa coefficient of 0.32 between hysterosalpingography and laparoscopy in the diagnosis of bilateral distal tubal obstruction, indicating poor agreement between the two. Our result is similar to a study conducted in Dakar, Senegal, by Diouf et al., in which the kappa coefficient was 0.40 for this diagnosis [14]. Mehdi et al. in Tunisia obtained an almost similar results in 2014 with a kappa coefficient of 0.53 [19]. The discord between the two examinations in the diagnosis of distal tubal obstruction is mainly related to the difficulty of distinguishing between unilateral distal obstruction and bilateral tubal patency. When interpreting HSG, visualising the passage of the contrast medium in a tube to its distal part associated with peritoneal mixing from this permeable tube can be confused with permeability of the contralateral tube.

### Pelvic adhesions

With regard to pelvic adhesions, the Kappa coefficient obtained was 0.60 in favour of good agreement between hysterosalpingography and laparoscopy in the diagnosis of pelvic adhesions. This result contrasts with that obtained by Diouf et al., who found a Kappa coefficient of 0.08, indicating a discord [14]. However, Makoyo et al. obtained a Kappa coefficient of 0.47 [9] , which is closer to our results . It is clear that most studies support the superiority of laparoscopy in this indication. We explain this difference by the compliance with the standards for performing and interpreting HSG in our context, making this examination more sensitive and specific for this diagnosis.

## Conclusion

It appears that complying with the standards for performing and interpreting HSG and laparoscopy could improve their concordance in the diagnosis of certain tubal lesions and thus limit the use of laparoscopy for certain diagnoses such as bilateral proximal tubal obstruction, which is not without risk and, above all, costly in an already precarious context. Laparoscopy nevertheless remains a gold standard to be associated to HSG because it is more likely to diagnose and perform therapeutic procedures on the fallopian tubes and pelvic lesions such as endometriosis and pelvic adhesions are better seen through laparoscopy. For bilateral proximal obstructions diagnosed by HSG, futur studies could focus on hysteroscopic proximal tubal cannulation which seems interesting if associated to coelioscopy prior to indicating in vitro fecondation.

**Conflict of interest:** The authors declare no conflict of interest

**Authors' contribution**

**Data design and acquisition:** Messakop M.Y, Essama N.Y, **Data analysis and interpretation:** Messakop M.Y, Moaffo N.Y, Mboua N.V, Bisay S.U, Bilo'o L, Atangana E.H,Yann CM, Edzimbi A, Mapina M, **Editing of the article**: Messakop M.Y, **Critical review of intellectual content:** Ekono G.M, Bengono R, Foumane P

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