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Hysterosalpingography and Coelioscopy in the Exploration of Tubal Patency during Infertility Assessment

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Abstract **Original Research Article**

Introduction*:** Infertility can have serious psychological and social repercussions on the life of a couple. Hysterosalpingography and laparoscopy are necessary exams for the exploration of tubal infertility. The aim of this study was to determine the concordance between these two exams in our daily practice. ***Patients and Methods**:* Our study was retrospective, cross-sectional, descriptive and comparative. It took place from January 2020 to August 2022 at the 'GRACE' medical clinic. Data were collected using a survey form and obtained from the patients' records, hysterosalpingography results and operative reports. Data were analyzed with SPSS version 20.0 software. ***Results: A total of 33 patients met our inclusion criteria. They had a mean age of 29.61+/-6.11 years with a minimum age of 18 years and a maximum of 42 years. Pelvic adhesions were the most common lesions found at laparoscopy. Hysterosalpingography was more specific (Sp=83.33%) than sensitive (Se=60%) in the diagnosis of proximal tubal obstructions. The sensitivity of hysterosalpingography was higher (Se=72.22%) than its specificity (Sp=20%) in the diagnosis of distal tubal obstructions. The concordance rate between the two exams (kappa) was 44% in the diagnosis of proximal tubal obstructions and 8.1% in the case of distal tubal obstructions. ***Conclusion*:** Our results corroborate those of the literature. Rather than substituting one for the other, hysterosalpingography and laparoscopy remain complementary examinations in the diagnosis of tubal infertility.

Keywords: Hysterosalpingography, laparoscopy, concordance, infertility, tubal.

INTRODUCTION

Infertility can be defined as the inability to have a clinic pregnancy after 12 months of regular sex without contraception (Zegers-Hochschild *et al*., 2017).

From a demographer's perspective, infertility is defined as the absence of a live birth in a woman of reproductive age (15-49 years) having regular unprotected sex(Larsen, 2005). It can be primary or secondary

The etiology of infertility can be either male or female or both. In developing countries, infectious diseases are the most common cause. The majority of infertility in African women is due to infectious causes (Cates *et al*., 1985) and approximately 46% of men in sub-Saharan Africa have infertility related to sexually transmitted diseases (Gerais & Rushwan, 1992).

In women, bilateral tubal obstruction is the most common cause of infertility (Chigumadzi *et al*., 1998). Fallopian tube obstruction is primarily due to pelvic inflammatory disease (PID) which is caused by post-abortal and postpartum infections (Ericksen & Brunette, 1996).

In many African countries, the success of a marriage depends on a woman's ability to procreate. Infertility causes severe psychological trauma and social stigma. In some cases, it can lead to social disgrace and exclusion, verbal and physical abuse, violence, and marriage breakdown. For women in particular, infertility significantly reduces their quality of life, exposing them to multiple sexual partners,

sexually transmitted diseases, increased sexual dysfunction, and poor parenting (Monga *et al*., 2004). It is therefore a real personal, social and public health problem, mainly in developing countries.

Hysterosalpingography is the recommended first-line imaging test for initial tubal exploration in the management of infertility (Chen *et al*., 2020; Roest *et al*., 2021). While laparoscopy is the gold standard examination for tubal patency assessment (Lee *et al*., 2017; Lőrincz *et al*., 2017). Proponents of routine laparoscopy argue that hysterosalpingography is not as reliable an examination as laparoscopy for tubal and peritoneal assessment (Merviel *et al*., 2006). Indeed, it appears that the performance and reading of hysterosalpingography can vary from one operator to another and this variability is estimated at 20% (Glatstein *et al*., 1997). Furthermore, it has been described that there are false negatives (2 to 50%) and false positives (15 to 32%) for this examination (Merviel *et al*., 2006). All these arguments advocate replacing hysterosalpingography by laparoscopy as a first-line procedure. Several studies have compared the data from hysterosalpingography with that from laparoscopy in patients explored for infertility. Some authors conclude that laparoscopy should be performed in infertile patients with suspected tubal pathology revealed by hysterosalpingography (Tsuji *et al*., 2012). Others believe that the results of these two examinations are complementary (Kehila *et al*., 2014).

Faced with this, we therefore felt it would be interesting to review the degree of correlation between HSG and laparoscopic findings to determine the hysterosalpingography-laparoscopy concordance in the tubal evaluation of patients treated for infertility in our setting.

METHODS AND PATIENTS

The study took place at the 'Grace' medical clinic in Bamako, a clinic run by an obstetrician-gynecologist with a radiology unit and a laparoscopy equipment. The study was a cross-sectional, comparative and retrospective study that took place from January 2020 to August 2022. The study involved women of childbearing age who consulted at the "GRACE" medical clinic for primary or secondary infertility.

To be included in this study, patients had to have a tubal obstruction diagnosed by hysterosalpingography, to have undergone diagnostic and/or therapeutic laparoscopy and to have a complete and exploitable medical record.

Patients with a normal hysterosalpingography, patients treated for infertility other than tubal infertility, and patients who had not undergone laparoscopy or who had undergone laparoscopy without prior hysterosalpingography were not included in this study.

The data were collected using a survey form from the patients' files, the results of hysterosalpingography and the operative reports. The items explored were mainly:

- Age of the patients
- Type and location of tubal obstruction at hysterosalpingography
- Tubal lesions found at laparoscopy
- Hysterosalpingography-laparoscopy concordance in tubal obstructions.

The data were entered and processed using SPSS 20.0 and Excel (Microsoft office) version 2013.

Sensitivity, specificity, positive and negative predictive values of hysterosalpingography versus laparoscopy were calculated.

The Kappa concordance coefficient (k) was also calculated. Its interpretation is as follows:

- Kappa > 80%: a very good agreement
- Kappa between 60 and 80% indicates a good agreement
- Kappa between 40 and 60% indicates a moderate agreement
- Kappa between 0 and 40% indicates poor agreement
- Kappa of 0% indicates a definite discordance

Performing and Interpretation of the HSG

The HSG was performed in the radiology unit of the facility and the results were interpreted by a radiologist.

Performing and interpretation of laparoscopy. Tubal patency was studied by performing the methylene blue test, which consisted of injecting a methylene blue solution into the patient's genital tract via an intrauterine device that had previously been inserted. The test was said to be positive if the methylene blue solution injected via the intrauterine device flowed into the peritoneal cavity through the abdominal ostium of the tube.

If there was no flow, the test was said to be negative.
Compliance with ethical rules and principles was an integral part of this study:

- Confidentiality and anonymity of the patients' data were guaranteed by restrictive access.

RESULTS

A total of 33 patients met our inclusion criteria. They had a mean age of 29.61+/-6.11 years with a minimum age of 18 years and a maximum of 42 years. The age group 27-34 years was the most represented with 54.5% of cases (n=18) (Table 1).

Table 1: Distribution of patients by age

Age group (in years)	Percentage (%)
18-26	27,3
27-34	54,5
35-42	18,2

Hysterosalpingography

All patients had a prior hysterography which showed bilateral tubal obstruction in 63.6% (n=21) of cases. This obstruction was preferentially proximal in 63.6% (n=21) of cases (Table 2).

Table 2: Type and position of tubal obstruction on hysterosalpingography

Variables	Percentage (%)
Type of tubal obstruction on hysterosalpingography	
UTO (unilateral tubal obstruction)	36,4
BTO (bilateral tubal obstruction)	63,6
Position of tubal obstruction on hysterosalpingography	
DO (Distal Obstruction)	63,6
PO (Proximal Obstruction)	24,2
DO et PO	12,1

Laparoscopy

Pelvic adhesions were the most common lesion found at laparoscopy (48.5%) (Figure 1).

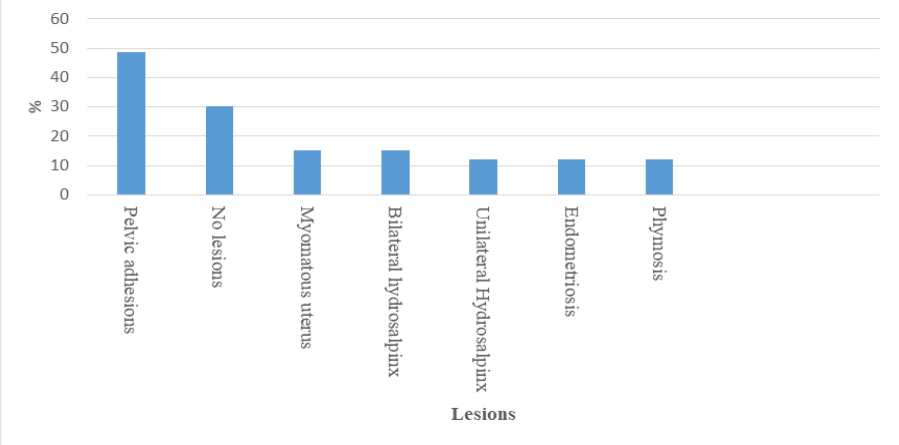

Figure 1: Lesions detected at laparoscopy

At laparoscopy, the tubal obstruction was mainly unilateral (42.4%) and mostly heterogeneous (33.3%). We noted tubal permeability in 33.3% of cases (Table 3).

Table 3: Type and position of tubal obstruction on laparoscopy

Variables	Percentage (%)
Type of tubal obs*truction on laparoscopy*	
UTO (Unilateral Tubal Obstruction)	42,4
BTO (Bilateral Tubal Obstruction)	24,2
Perméabilité tubaire	33,3
Position of tubal obs*truction on laparoscopy*	
DO (Distal Obstruction)	21,2
PO (Proximal Obstruction)	12,1
DO and PO	33,3
Tubal patency	33,3

Hysterosalpingography was more specific (Sp=83.33%) than sensitive (Se=60%) in the diagnosis of proximal tubal obstructions. Furthermore, we found a positive predictive value of 75% and a negative predictive value of 62.5% as well as a concordance of 72.72% between the 2 examinations (kappa=44%) (Table 4).

Table 4: HSG-laparoscopy concordance in the diagnosis of proximal tubal obstructions

Hysterosalpingography	Laparoscopy		Total
	Proximal Obstruction (%)	No Proximal Obstruction(%)	
Proximal Obstruction	9(27,3%)	3(9,1%)	12(36,4%)
No proximal Obstruction	6(18,2%)	15(45,5%)	21(63,6%)
Total	15(45,5%)	18(54,5%)	33(100,0)

Se= 9/15 :60% Sp= 15/18 :83,33% VPP= 9/12 :75% VPN=15/21 : 62,5
Concordance=24/33*100 :72,72% Coefficient of agreement kappa (k)=44%.

The sensitivity of hysterosalpingography was higher (Se=72.22%) compared to its specificity (Sp=20%) in the diagnosis of distal tubal obstructions. The predictive values were low (PPV=52%; NPV=37.5%), the concordance also 48.48% (Kappa=8.1%) (Table 5).

Table 5: HSG-laparoscopy concordance in the diagnosis of distal tubal obstructions

Hysterosalpingography	Laparoscopy		Total
	Distal Obstruction(%)	No Distal Obstruction (%)	
Distal Obstruction	13(39,4%)	12(36,4%)	25(75,8%)
No Distal Obstruction	5(15,2%)	3(9,1%)	8(24,2%)
Total	18(54,5%)	15(45,5%)	33(100,0%)

Se=13/18*100 :72,22% Sp=3/15*100 :20% VPP =13/25*100 :52% VPN=3/8*100 :37,5%
Concordance =16/33*100 : 48,48% Coefficient of agreement kappa (k)=8,1%

DISCUSSION

Tubal exploration in the evaluation of infertility is essential. Hysterosalpingography is most often performed as a first-line procedure to assess uterine anatomy and tubal patency, particularly in developing countries. Laparoscopy allows direct visualization of the tubes, uterus and pelvis. It is both diagnostic and therapeutic. Most authors consider it as the "gold standard" before pelvic exploration in cases of infertility. Laparoscopy is considered as the reference examination for tubal evaluation in infertility (Mol *et al*., 1999; Swart *et al*., 1995). The main issue of this study was to know the degree of correlation between the results of hysterosalpingography and laparoscopy.

Age

Our patients were mostly young, with an average age of 29.6 years and extremes of 18 and 42 years. This result is similar to those of other African authors (Opheelia *et al*., 2021; Tshabu-Aguemon *et al*., 2014) but is contrary to what is observed in Western countries where the average age of women who consult for infertility is higher, namely 35 years and more (Cates *et al*., 1985). Indeed, instead of high maternal age, bilateral tubal obstruction, sequelae of pelvic infections contracted at a young age, remains the primary factor implicated in female infertility in our context.

Concordance between hysterosalpingography and laparoscopy in case of proximal tubal obstruction

A definite reliability of HSG would indicate selective salpingography or a passage to in vitro fertilization and would therefore make laparoscopy a futile examination (Lavy *et al*., 2004) we found a moderate correlation (kappa=44%) between HSG and laparoscopy in the detection of PTO. This correlation is close to those found by many authors (Kehila *et al*., 2014; Opheelia *et al*., 2021; Tshabu-Aguemon *et al*., 2014).

Hysterosalpingography was more specific (Sp=83.33%) than sensitive (Se=60%) compared to laparoscopy in the diagnosis of proximal tubal obstructions. The positive and negative predictive values were respectively 75% and 62.5%.

The existence of false positives was also mentioned by Mol *et al*., (Mol *et al*., 1999) who found 40% of laparoscopies showing patent tubes in case of proximal obstruction at HSG.

Proximal tubal obstruction at HSG is therefore an indication for laparoscopy in order to confirm or refute this diagnosis. The existence of false positive HSG in this case can be explained by spasms related to pain and mucosal plugs [19]. False-positive proximal tubal occlusion may also be due to a failed cervical cannula blocking system that leaks contrast material into the vagina, reducing the intra-cavity pressure needed for opacification of the reproductive tract. Certain measures help to reduce the false positive rate of HSG, including the use of analgesics, prior information of the patient, gentle traction on the cervix, and expert reading of the HSG (Tshabu-Aguemon *et al*., 2014). Laparoscopy has thus made it possible to rectify certain diagnoses on the HSG, hence the usefulness of performing laparoscopy in the presence of proximal tubal obstruction. This practice would have a double interest:

- To confirm a diagnosis of obstruction but also to establish a therapeutic management adapted to the patient;

- To identify the radiology departments that have mastered the performance and reading of the HSG. Indeed, the HSG has an inter-operator variability estimated at 20% (Glatstein *et al*., 1997).

The false-negative result, on the other hand, can be explained by the fact that intravasation of contrast medium into the uterine and ovarian veins during HSG can sometimes be mistaken for tubal filling (Lőrincz *et al*., 2017). The high time difference between performing HSG and laparoscopy may also explain false negatives. Indeed, in the presence of risk factors the size of this gap may be responsible for the appearance of tubal pathology at laparoscopy although it is non-existent at HSG. The factors that may explain the long delay between the HSG and laparoscopy in our study are the small number of health personnel who are trained in laparoscopy, the high cost of maintaining the equipment and also the cost of this procedure which, it should be remembered, is not covered by insurance. This is a major handicap for early etiological diagnosis of infertility in our country.

Concordance between hysterosalpingography and laparoscopy in case of distal tubal obstruction

Distal tubal obstructions are accessible to surgical therapeutic manoeuvres (Canis *et al*., 1991). This treatment can sometimes avoid referring the patient to in vitro fertilization (IVF) (Maget V & Belaish- Allart J, 2015; Taylor *et al*., 2001). However, the extent of the lesions of the tubal mucosa may lead to salpingectomy or to the placement of a cornual clip, despite an initially programmed discharge salpingotomy. This is with a view to performing intrauterine fertilization (IVF) (Maget V & Belaish-Allart J, 2015).

In this study, both procedures showed poor agreement (Kappa=8.1%) in assessing distal tubal patency with lower predictive values and specificity. These results are lower than those reported by some authors who found moderate concordance (Kehila *et al*., 2014; Tshabu-Aguemon *et al*., 2014). This difference could be explained by the small size of our series.

Laparoscopy makes it possible to confirm the diagnosis of distal tubal occlusion, to detect associated lesions but also to perform surgical procedures, in particular bilateral salpingectomy and clip placement for IVF (Taylor *et al*., 2001). As it is not commonly performed in our facilities, our patients are reluctant to undergo this salpingectomy. In addition, the majority of patients who need to undergo medically assisted reproduction are referred to other countries due to the lack of equipment, as is the case in several neighboring countries (Moungala *et al*., 2019; Opheelia *et al*., 2021).

Our study, which is the first of its kind in our country, suffered from some shortcomings due to its retrospective nature, which limited the information available for collection, and also the small size of our sample. Other large-scale studies can be conducted on this subject by focusing on the fertility of the patients after these explorations have been performed.

CONCLUSION

Our results corroborate those of the literature. HSG and laparoscopy remain complementary examinations in the diagnosis of tubal infertility. HSG is an easy to perform examination, less expensive and interpretable by several practitioners, but with a significant inter-operator variability when reading it. Although laparoscopy is more expensive and even potentially risky, it has the undeniable advantage of direct visualization of the lesion. Consequently, hysterography should remain the first step in the exploration of female infertility. Laparoscopy will make it possible to confirm and treat in certain cases the abnormal findings on hysterography.

Conflicts of Interest: The authors declare no conflict of interest.

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