

## Comparative Study between Hysterosalpingography and Laparoscopy in the Diagnosis of Tubal Factors of Female Infertility in a Reference Hospital in Sub-Saharan Africa' Setting

Theophile Njamen Nana<sup>1,2\*</sup>, Robert Tchounzou<sup>2,6</sup>, Andre Gaetan Simo Wambo<sup>2</sup>, Fulbert Mangala Nkwele<sup>1,5</sup>, Nathalie Ngolile<sup>3</sup>, Cedric Junior Nana Njamen<sup>4</sup>, Sylviane Fomekong Dongmo<sup>7</sup>, Charlotte Tchente Nguetack<sup>1,5</sup>, Gregory Halle Ekane<sup>1,2</sup>, Thomas Egbe Obinchemti<sup>1,2</sup> and Henri Essome<sup>5</sup>

<sup>1</sup>Department of Obstetrics and Gynecology. Douala General Hospital, Cameroon

<sup>2</sup>Department of Obstetrics and Gynecology. Faculty of Health Sciences, University of Buea, Cameroon

<sup>3</sup>Institut des Sciences de la santé, Université des Montagnes, Cameroon

<sup>4</sup>Faculté des sciences de la santé. Université Joseph Kizerbo, Ouagadougou, Burkina Faso

<sup>5</sup>Department Surgery and Specialties, Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Cameroon

<sup>6</sup>Department of Obstetrics and Gynecology. Gyneco-Obstetric and Pediatric Hospital of Douala, Cameroon

<sup>7</sup>Department of Internal Medicine and Pediatrics, Faculty of Health Sciences, University of Buea, Cameroon.

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### ABSTRACT

**Background:** Infertility is a global public health problem, particularly in Africa, where the child is a source of social consideration for the couple.

**Objective:** The main objective of this study was to compare the results of hysterosalpingography (HSG) with those of laparoscopy in the diagnosis of tubal factors of female infertility.

**Methods:** We conducted a cross sectional and analytical study over ten years at the Douala General Hospital (DGH), Central Africa. Women of childbearing age, sexually active and suffering from infertility, who consulted the DGH during the study period and who were diagnosed with tubal infertility on the basis of HSG and laparoscopy were included in our study. We excluded any woman whose cause of infertility was related to the male partners, as well as those who had not undergone HSG or laparoscopy.

**Results:** We recruited 182 patients: the mean age was 32.9±4.7 years; married women were the most represented (65.9%); women working in the public sector represented 40.1%; secondary infertility was the most common type of infertility in 69.8% of cases; the mean duration of infertility was 4 years; the sensitivity (Se), specificity (Sp), Positive Predictive Value (PPV), Negative Predictive Value (NPV) of hysterosalpingography and kappa coefficient were respectively: (Se 66.04%, Sp 61.24%, PPV 48.8%, NPV 84.44, Kappa 0.23) in bilateral tubal obstruction; (Se 41.46%, Sp 81.56%, PPV 39.53%, NPV 82.73%) in unilateral tubal obstruction; (Se 35.71%, Sp 71; 43%, PPV 66.7%, NPV 41.0%, Kappa 0.063) in pelvic adhesions; (Se 46.15%, Sp 98.21%, PPV 66.7%, NPV 95.9%, Kappa 0.517) in endosalpingiosis. Laparoscopy also allowed the diagnosis of 11% of pelvic adhesions (Fitz Hugh Curtis syndrome) and endometriosis lesions that could not be identified by hysterosalpingography. It also helped to define a therapeutic strategy in each case.

**Conclusion:** Although these two examinations are complementary essentially in the evaluation of the tube, laparoscopy should be associated whenever possible.

**Keywords:** Tubal infertility, Hysterosalpingography, Laparoscopy, Sub-Saharan Africa

### INTRODUCTION

Infertility is a global public health problem affecting 8-12% of couples worldwide [1]. Conception and childbearing are important source of social consideration for the couple in general and the woman in particular, especially in Africa. Tubal infertility represents the first anatomical cause of

**Corresponding author:** Nana Njamen Théophile, Associate Professor, Department of Obstetrics and Gynecology, Faculty of Health Sciences, University of Buea, Cameroon, Tel: 237697023916; E-mail: njanatheo@yahoo.fr

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female infertility [2-8], and the evaluation of tubal function in women is a fundamental step in the evaluation of an infertile couple [3-7]. In Africa, bilateral tubal occlusion is three times more frequent than in the rest of the world, 49% compared to 11% [9]. The management of infertility in Africa, as in Cameroon inclusive, remains complex due to the precariousness of the means of prevention and the difficult availability and access to diagnostic and treatment methods [10]. Hysterosalpingography (HSG) and laparoscopy are two methods widely used in our context in cases of infertility; the former is a relatively simple method and most often used as a first line to assess the anatomy of the uterus and tubal patency [11], while the latter is considered the gold standard and the method of choice not only for diagnosis but also for treatment of tubal infertility [12]. The objective of this study was to compare the data from hysterosalpingography with those from laparoscopy in the diagnosis of tubal factors of female infertility at the Douala General Hospital, with the aim of enabling better use of these diagnostic tools, better diagnosis and better management of infertile patients.

## METHODS

We conducted a cross-sectional analytical study over a period of 10 years with retrospective data collected from 1 January 2008 to 31 December 2017 and prospective data from 3 February to 30 May 2018. This study took place in the Gynecology and Obstetrics Department of the Douala General Hospital (DGH). All patients or records of patients suffering from infertility who consulted the DGH during the study period and in whom the diagnosis of tubal infertility had been made on the basis of laparoscopy and HSG were included. All patients had undergone HSG followed by laparoscopy.

Administrative authorization to conduct the study was obtained from the DGH and informed consent was obtained from each patient at the time of prospective collection. Interpretation of HSG images was done in a collegial manner in the radiology department to minimize inter-observer bias. The data collected at HSG were documented: normal tubal patency, bilateral or unilateral proximal or distal tubal obstruction, tubal phimosis, hydrosalpinx, endosalpingiosis lesions, pelvic adhesions and uterine anomalies. The patients then underwent diagnostic and possibly therapeutic laparoscopy in the operating theatre of the DGH after a conclusive pre-operative work-up. All the pathologies were noted during laparoscopy and hysterosalpingography; tubal patency was assessed on laparoscopy by methylene blue test.

Data were recorded and analyzed with SPSS version 20.0 software; illustrations of the results were designed using Microsoft Office Excel 2016 software; HSG results were compared with laparoscopy results. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of HSG were determined considering

laparoscopy as the 'gold standard'; the Kappa statistical test was used to determine the degree of agreement between the results of hysterosalpingography and laparoscopy.

## RESULTS

A total of 182 patients were recruited. All were suffering from infertility and had undergone HSG and laparoscopy for the etiological investigation of infertility. The characteristics of the population are shown in **Table 1**. The average age of the population was 32.9±4.7 years; women working in the public sector were the most represented (40.1%) as well as married women (65.9%); secondary infertility was the most common (69.8%); the average duration of infertility was 4 ±1.6 years. 70.3% of the patients had a tubal obstruction at HSG compared to 51.6% at laparoscopy. **Table 2** compares the results of HSG with those of laparoscopy: HSG had moderate sensitivity (66.04%), moderate specificity (61.24%), low PPV (41.8%), good NPV (84.44%) in the diagnosis of bilateral tubal obstruction which means that 66% of the patients with bilateral tubal obstruction could be diagnosed on hysterosalpingography and 61% of the patients with bilateral tubal patency could be diagnosed on HSG; when HSG revealed bilateral tubal obstruction there was a 42% chance that both tubes were truly occluded and when HSG revealed bilateral tubal patency there was an 84% chance that both tubes were truly patent cy (41,46%); HSG had a high specificity (81.56%), a low PPV (39.53%), a good NPV (82.73%) in the diagnosis of unilateral tubal obstruction which means that only 41% of the patients with unilateral obstruction could be diagnosed by HSG, and 82% of the patients with unilateral tubal patency could be diagnosed by HSG; when the HSG revealed unilateral tubal obstruction, there was a 39% chance that the tube was truly occluded and when it revealed tubal patency there was an 83% chance that the tube was patulous. In the diagnosis of pelvic adhesions, HSG had a low sensitivity (35.7%), moderate specificity (71.43%), moderate PPV (66.7%) and a low NPV (41%). In the diagnosis of endosalpingiosis HSG had low sensitivity (46.15%), high specificity (98.21%), moderate PPV (66.7%) and good NPV (95.9%) (**Table 3**).

The concordance (matching) between HSG and laparoscopy was very poor for pelvic adhesions, it was also poor in the diagnosis of bilateral tubal obstruction and unilateral tubal obstruction and at least moderate for endosalpingiosis.

## DISCUSSION

Exploration of tubal function is an important step in the investigation of an infertile woman. HSG is the most commonly used method and allows assessment of tubal patency and uterine anatomy. Laparoscopy is the gold standard in infertility and provides a comprehensive view of the female pelvis and abdominal cavity, it is both a diagnostic and therapeutic method. Its important role in the diagnosis and management of tubal infertility is well established.

**Table 1.** General characteristics of the population.

Variables	n (%)
Mean age: 32.93±4.7 years	
Average duration of infertility: 4±1.6 years	
Profession	
Housewife	47 (25.8%)
Public sector	73 (40.1%)
Private sector	49 (26.9%)
Marital status	
Married	120 (65.9%)
Single	62 (34.1%)
Type of infertility	
Primary	55 (30.2%)
Secondary	127 (69.8%)
Past History	
Planned Abortion (Voluntary)	54 (29.7%)
Sexually Transmitted Infection	77 (42.3%)
Chlamydia trachomatis	47 (25.8%)
Manuel Vacuum Aspiration (Curettage)	32 (17.6%)
Myomectomy	20 (11%)

**Table 2.** Hysterosalpingography and laparoscopy data.

Variables	Hysterosalpingography	Laparoscopy
	n (%)	n (%)
OTG (Left tubal obstruction)	128 (70,3)	94 (51,6)
Bilateral tubal obstruction	83 (64,8)	53 (56,4)
Unilateral tubal obstruction	45 (35,2)	41 (43,6)
Hydrosalpinx	48 (26,4)	35 (19,2)
Phimosi	40 (22)	21 (11,5)
Endosalpingiosis	9 (4,9)	13 (7,1)
Pelvic Endometriosis	0	56 (30,8)
Pelvic adhesion	60 (33)	114 (61,5)
Fitz Hugh Curtis	0	20 (11)

**Table 3.** Sensitivity, specificity, PPV and NPV of hysterosalpingography.

Variables	TP	FP	TN	FN	Se	Sp	PPV	NPV	Kappa	P
Bilateral tubal obstruction	35	50	79	18	66,04	61,24	41,8	84,44	0,232	0,001
Unilateral tubal obstruction	17	26	115	24	41,46	81,56	39,53	82,73	0,226	0,002
Hydrosalpinx	23	25	122	12	65,71	83	47,9	91	0,427	0,000
Phimosis	4	36	125	17	19,05	32,07	10	97,7	0,024	0,730
Pelvic adhesions	40	20	50	72	35,71	71,43	66,7	41,0	0,063	0,319
Endosalpingiosis	6	3	165	7	46,15	98,21	66,7	95,9	0,517	0,000

TP: True positive; FP: False positive; TN: True negative; FN: False negative; Se: Sensitivity; Sp: Specificity; PPV: Positive predictive value; NPV: Negative predictive value; p: p value

HSG had moderate sensitivity, moderate specificity, low PPV and good NPV for the diagnosis of bilateral tubal obstruction; low sensitivity, high specificity, low PPV and good NPV for the diagnosis of unilateral tubal obstruction. These results differ from the literature [13,14]; the false positives observed could be explained firstly by the tubal spasm caused by pain when HSG was performed without analgesia, secondly when the contrast medium was weakly injected, protein debris and/or mucus could also obstruct the tube [15], and thirdly when the cervical cannula was poorly placed, this could lead to reflux of the contrast medium into the vagina and make it appear to be a tubal obstruction [15]. The presence of pelvic adhesions could also lead to a false positive. False negatives could be explained by a long period between the HSG and laparoscopy, laparoscopy would therefore reveal lesions that were not present when the HSG was performed.

In this study, HSG had a low sensitivity (46.15%), high specificity (98.21%), moderate PPV (66.7%) and good NPV (95.9%) in the diagnosis of endosalpingiosis. We found 4.9% of cases of endosalpingiosis on HSG versus 7.1% on laparoscopy. This differs from the literature which found no endosalpingiosis on HSG and laparoscopy [13,16-17]. HSG is the only imaging test to determine the existence of proximal tubal involvement in endometriosis (mistletoe ball diverticular image or proximal tubal obstruction) and laparoscopy is the gold standard for accurate diagnosis of endosalpingiosis. Endosalpingiosis can cause tubal infertility by obstructing the tube but also by promoting the secretion of biological factors that can lead to infertility [18]. In the diagnosis of pelvic adhesions, HSG had a low sensitivity (35.7%), moderate specificity (71.43%), moderate PPV (66.7%) and low NPV (41%); 29.7% of patients had pelvic adhesions at HSG compared to 48.4% at laparoscopy, the false negatives observed here can be explained by the presence of fine endoluminal adhesions not identified at

HSG but which may compromise fertility [19-21]. Laparoscopy allowed the diagnosis of 30.8% of cases of pelvic endometriosis compared to zero at HSG, these cases not identified at HSG could be the cause of infertility most often labelled as unexplained [22-24]. In this study, the tubal mucosa could not be assessed due to the absence of data. Neither HSG nor laparoscopy reports were specific about the condition of the tubal mucosa.

## CONCLUSION

The study revealed limitations of HSG in the diagnosis of endosalpingiosis, pelvic endometriosis and pelvic adhesions; it has a good negative predictive value in the diagnosis of bilateral or unilateral tubal obstruction. We believe that although these two examinations are complementary, essentially in the evaluation of the tube, for which the assessment of the mucosa by HSG is the examination of choice, laparoscopy should be associated whenever possible.

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