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Research Article

Concordance Between Hysterosalpingography and Laparoscopy in the Investigation of Female Infertility: A Prospective Study of 131 Patients at the Nouar Fadela Specialized Hospital in Oran

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Abstract

Objective: To evaluate the diagnostic value and degree of concordance between hysterosalpingography (HSG) and laparoscopy in the exploration of the tuboperitoneal factor in women suffering from infertility.

Materials and Methods: A prospective study was conducted at the Nouar Fadela Specialized Hospital in Oran, including 131 infertile patients over two years from March 2022 to July 2024. All patients underwent preoperative hysterosalpingography (HSG) followed by diagnostic and surgical laparoscopy with methylene blue staining (gold standard). Tubal patency, phimosis, and pelvic adhesions were analyzed. Concordance was assessed using Cohen's kappa coefficient.

Results: Hysterosalpingography (HSG) has shown good sensitivity for overall tubal patency, but limited specificity in detecting peritoneal adhesions and fine fimbriae. Laparoscopy corrected the diagnosis in a significant number of cases, revealing periapical adhesions not suspected on HSG (HSG false negatives) and resolving false diagnoses of proximal tubal obstruction related to tubal spasms (HSG false positives).

Conclusion: While hysterosalpingography (HSG) remains the first-line examination for evaluating the uterine cavity and tubal lumen, laparoscopy remains irreplaceable as the gold standard. It allows for a precise diagnosis of peritoneal lesions and offers the advantage of immediate surgical treatment.

Introduction

Infertility is a major public health problem affecting approximately 10 to 15% of couples of reproductive age [1]. The tubo-peritoneal factor represents one of the most frequent female etiologies, implicated in 25 to 40% of cases. It includes tubal obstruction (proximal or distal), tubal phimosis, hydrosalpinx, and pelvic adhesions of infectious or endometriotic origin [2].

In the standard diagnostic approach:

- **Hysterosalpingography (HSG)** is traditionally the first-line examination. Minimally invasive and accessible, it studies the uterine cavity and the permeability of

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the tubal lumen. However, HSG has limitations for exploring the peri-adnexal environment and suffers from errors in interpretation: false obstructions (false positives of tubal involvement) secondary to ostial spasms or myometrial hypertonia, as well as false permeabilities (false negatives of tubal involvement) related to vascular extravasation of the contrast agent or to reflux. [3]

- **Laparoscopy is** considered the gold standard examination. It offers a direct view of the internal genital tract, allows a methylene blue test under strict visual control, and offers the possibility of immediate therapeutic intervention (adhesiolysis, neosalpingostomy, fimbrioplasty) [4].

The objective of this work from our thesis is to compare the concordance between HSG and laparoscopy in order to define the optimal place of each examination in the exploration of infertility at the EHS Nouar Fadela in Oran.

Materials and methods

Study population

This is a prospective study over two years from March 2022 to July 2024 conducted at the gynecology-obstetrics hospital of the EHS Nouar Fadela in Oran, involving 131 patients with primary or secondary infertility that had been progressing for more than 12 months and 6 months for patients over 35 years of age.

Exploration Protocol

- **Preoperative HSG:** Performed in the first part of the cycle (Days 8-10). The images studied the framing, the filling of the uterine cavity, the opacification of the fallopian tubes, and the peritoneal mixing on the late image.

- **Laparoscopy:** The procedure was performed under general anesthesia. The examination allowed for the evaluation of tubal mobility, the condition of the fimbriae, and the presence of adhesions and endometriosis lesions. A chromotubation test (methylene blue) was systematically performed to test tubal patency.

Statistical analysis

Qualitative variables were expressed as counts and percentages. Sensitivity (Se), specificity (Sp), positive predictive value (PPV), and negative predictive value (NPV) of hysterosalpingography (HSG) were calculated using laparoscopy as the reference standard. Inter-examination agreement was measured using Cohen's kappa coefficient.

Results

Characteristics of the population

Among the 131 patients included, infertility was predominantly primary. Laparoscopic exploration revealed major tuboperitoneal abnormalities in a significant proportion of the cohort.

Concordance between hysterosalpingography and laparoscopy

The concordance between hysterosalpingography and laparoscopy in the diagnosis of tubal patency

Concordance between hysterosalpingography and laparoscopy in right tubal patency: The sensitivity rate of hysterosalpingography compared to laparoscopy in right tubal proximal obstruction was 71.4%, and the specificity rate was 90%; the sensitivity rate in the diagnosis of right tubal distal obstruction was 90.35%, and the specificity rate was 64.7% with a significant p-value in concordance analysis. (Table 1) Kappa 0.53 moderate, confidence interval moderate [0.42-0.65].

Concordance between hysterosalpingography and laparoscopy in left tubal patency: The sensitivity rate of hysterosalpingography compared to laparoscopy in left proximal tubal obstruction was 85.5%, and the specificity rate was 81.8%; the sensitivity rate in left distal tubal obstruction was 80.95%, and the specificity rate was 90.90%, with a significant P 0.001, kappa 0.54, moderate confidence interval [0.42, 0.65] (Table 2).

Diagnostic performance of HSG compared to laparoscopy (Tables 3-5)

Concordance for pelvic adhesions and the peritoneal factor

The discrepancy between the two examinations is most pronounced in the evaluation of the peritoneal factor:

Table 1: Painting 1 Concordance between HSG and laparoscopy in assessing tubal patencyRIGHT.

		Laparoscopy					Total
		Permeable	Proximal obstruction	Distal obstruction	Phimosis	Absent fallopian tube	
HSG	Permeable	71	0	0	3	0	74
	Proximal obstruction	5	10	4	0	2	21
	Distal obstruction	4	4	11	3	0	22
	Phimosis	8	0	0	4	0	12
	Absent fallopian tube	0	0	2	0	0	2
Total		88	14	17	10	2	131

Table 2: Concordance between HSG and laparoscopy in left tubal patency.

		Laparoscopy					Total
		Permeable	Proximal obstruction	Distal obstruction	Phimosis	Trunk removed	
HSG	Permeable	69	0	2	1	0	72
	Proximal obstruction	7	9	2	3	3	24
	Distal obstruction	6	2	17	2	0	27
	Phimosis	7	0	0	1	0	8
Total		89	11	21	7	3	131

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- HSG is not very sensitive for the diagnosis of peri-ovarian or peritubal velamentous adhesions when the fallopian tube remains patent with preserved peritoneal mixing.
- Laparoscopy revealed the presence of peritoneal adhesions and endometriosis implants in patients whose HSG was considered strictly normal (Table 6).

Discussion

The results of our prospective study at EHS Nouar Fadela are consistent with data from the international literature regarding the complementarity and divergences between HSG and laparoscopy.

1. **The problem of false positives in HSG (False obstruction):** Proximal tubal obstruction observed on HSG is frequently related to localized sphincter hypertonia or a painful reflex during contrast injection. Laparoscopy under general anesthesia, through muscle relaxation and controlled injection pressure, relieves this spasm and confirms tubal patency [5,6].
2. **False negatives from HSG (Unrecognized peritoneal pathology):** A normal HSG does not exclude pelvic pathology. Fine adhesions and foci of superficial endometriosis often allow passage of contrast fluid into the peritoneal cavity without fixing the radiological image, while they considerably impair oocyte uptake by the fimbriae of the fallopian tube [7].
3. **The immediate therapeutic benefit of laparoscopy:** Unlike HSG, which is purely diagnostic, laparoscopy allows for the treatment of discovered abnormalities

(Adhesiolysis, fimbrioplasty, coagulation of endometriosis foci) during the same surgical procedure, thus restoring pelvic anatomy and improving the prognosis for spontaneous pregnancy at 12 months [8,9].

Table 3: Statistical analysis of right-hand concordance.

Concordance	Kappa	SE	p-value	CI at 95%
(n = 131)	0.53	0.06	< 0.001	[0.42, 0.65]

Table 4: Statistical analysis of left concordance.

Concordance	Kappa	SE	p-value	CI at 95%
(n = 131)	0.54	0.06	< 0.001	[0.42, 0.65]

Table 5: Summarizes the sensitivity and specificity of hysterosalpingography compared to laparoscopy in assessing tubal patency.

	TROMPE DROIT				TROMPE GAUCHE			
	Perméable	OTP	OTD	Phimosis	Perméable	OTP	OTD	Phimosis
Sensibilité	80%	71.40%	90.35%	40%	77.52%	87.50%	80.95%	14.28%
Spécificité	93%	90%	64.70%	93.38%	92.83%	81.81%	90.90%	94.35%

Table 6: Diagnostic performance of HSG compared to laparoscopy.

Pathology being sought	Sensitivity (Se)	Specificity (Sp)	Kappa index (κ)	Level of agreement
Distal Tubal Obstruction / Hydrosalpinx	High > 85%	Good > 80%	0.70 -0.80	Strong Concordance
Proximal Tubal Obstruction	Moderate	Moderate	0.50 - 0.60	Moderate Concordance (Spasms)
Pelvic Adhesions / Endometriosis	Low < 40%	High	< 0.40	Weak Concordance

Conclusion

Hysterosalpingography and laparoscopy should not be opposed but considered as two complementary examinations in the assessment of female infertility [10].

Hysterosalpingography (HSG) remains the essential first-line examination for detecting intracavitary abnormalities and verifying tubal lumen patency. However, due to its low sensitivity for adhesions and the risk of false diagnoses of proximal obstruction by spasm, laparoscopy remains the gold standard. It is indicated as soon as an abnormality is suspected on imaging, in cases of unexplained infertility, or after failure of simple treatments, offering a combined diagnostic and therapeutic approach [11,12].

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