الانسداد البوقي الأحادي والثنائي في العقم الأنثوي: دراسة مقارنة بين نتائج الصورة الظليلة للرحم والبوقين وتنظير البطن

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ملخص

خلفية البحث وهدفه: دُرسَ انسداد البوق أحادي وثنائي الجانب في عقم النساء على 60 امرأة، بهدف مقارنة نتائج الصورة الظليلة للرحم والبوقين وتنظير الرحم. وقد كان متوسط عمر المشاركات 29.67 ± 6.78، وتراوحت مدة العقم لديهن بين 1–11 سنة. وقد تناقصت النسبة المئوية للعقم البدئي مع ازدياد الفئة العمرية إذ بلغت 63.16%، 48.15%، 28.57% للفئات الثلاث 15–25 ، 26–35، 36–45 على التوالي، في حين تزايدت النسبة المئوية للعقم الثانوي مع تقدم الفئات بالعمر إذ بلغت 36.84%، 51.85%، 71.43% للفئات 15–25 ، 26–35، 36–45 على التوالي. وأظهرت الصورة الظليلة انسداد بوقين ثنائي الجانب في 11 مريضة (18,33%)، وانسداد أحادي الجانب في 8 مرضى (13,33%)، بينما أظهر التنظير الانسداد ثنائي الجانب وأحادي الجانب في 8 مريضات (13,33%) و 9 مريضات (15%) على التوالي. كانت القيم التشخيصية لصورة الرحم والبوقين الظليلة المدروسة مقارنة بتنظير البطن عند دراسة انسداد البوقين معاً 87.5 و 92.3 و 63.64 و 97.96 و 7.7 و 12.5 (%) لكل من الحساسية والنوعية والقيمة التنبئية الإيجابية والقيمة التنبئية السلبية، ومعدل الإيجابية الكاذبة ومعدل السلبية الكاذبة على الترتيب. بينما كانت هذه النسب 55.56 و 94.12 و 62.5 و 92.3 و 5.88 و 44.44 (%) لكل من الحساسية والنوعية والقيمة التنبئية الإيجابية والقيمة التنبئية السلبية ومعدل الإيجابية الكاذبة ومعدل السلبية الكاذبة على الترتيب عند دراسة انسداد بوق واحد. في حين بلغت هذه النسب 70.59 و 83.72 و 63.16 و 87.81 و 16.28 و 29.41 (%) لكل من الحساسية والنوعية والقيمة التنبئية الإيجابية والقيمة التنبئية السلبية، ومعدل الإيجابية الكاذبة ومعدل السلبية الكاذبة على الترتيب عند دراسة الانسداد البوقي الأحادي والثنائي معاً. وكانت الدلالة الاحتمالية لموجودات الصورة الظليلة مقارنة بتنظير البطن أكبر من 0.05 عند دراسة انسداد البوقين معاً، وانسداد بوق واحد، والانسداد البوقي، أي إن النتائج لم تكن ذات قيمة إحصائية.

الكلمات المفتاحية: الصورة الظليلة، تنظير البطن، انسداد بوقي أحادي الجانب، انسداد بوقي ثنائي الجانب، الانسداد البوقي، القيم التشخيصية، الدلالة الاحتمالية.

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Unilateral and bilateral tubal obstruction in female infertility: Comparison study between Hysterosalpingography and laparoscopy.

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Abstract

Unilateral and bilateral tubal obstruction in female infertility where studied on 60 women in the aim of comparing hysterosalpingography and laparoscopy results. The participants average age was 29.67 ± 6.78, with infertility duration between 1-11 years. The results showed that the primary infertility percentage decreased with the increase in the age group, reaching 63.16%, 48.15%, 28.57% for the three groups 15-25, 26-35 and 36-45 respectively, while the percentage of secondary infertility increased with the advancing age groups, reaching 36.84 %, 51.85%, and 71.43% for groups 15-25, 26-35, 36-45, respectively. The Hysterosalpingography showed bilateral tubal obstruction in 11 patients (18.33%) and unilateral tubal obstruction in 8 patients (13.33%), while laparoscopy showed bilateral and unilateral tubal obstruction in 8 patients (13.33%) and 9 patients (15%), respectively. The diagnostic values of hysterosalpingography compared to laparoscopy were 87.5, 92.3, 63.64, 97.96, 7.7 and 12.5(%) for each of the sensitivity, specificity, positive predictive value, negative predictive value, false positive rate and false negative rate, respectively, when studying the bilateral tubal obstruction, while the diagnostic values were 55.56, 94.12, 62.5, 92.3, 5.88 and 44.44 (%) for each of the sensitivity, specificity, positive predictive value, negative predictive value, false positivity rate, and false negative rate, respectively, when studying the unilateral tubal obstruction, These diagnostic values were 70.59, 83.72, 63.16, 87.81, 16.28 and 29.41 (%) for each of the sensitivity, specificity, positive predictive value, negative predictive value, false positivity rate and false negative rate, respectively, when Unilateral and bilateral tubal obstruction were studied together. The potential value of the hysterosalpingography results compared to laparoscopy were > 0.05 when studying the unilateral tubal obstruction, the bilateral tubal obstruction and the unilateral and bilateral tubal obstruction together, meaning it was insignificant.

Key words: hysterosalpingography, laparoscopy, unilateral tubal obstruction, bilateral tubal obstruction, diagnostic values, p value.

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1. Introduction:

Infertility is defined as the absence of a clinical pregnancy after 12 months of regular, unprotected intercourse (Vander and Christine, 2018, 2-10), despite the remarkable progress in the diagnosis and treatment of infertility in recent years, its prevalence rates are still increasing (Tournaye and Cohlen, 2012, 769–775). Infertility, in the absence of a previous pregnancy at all, is classified as primary infertility, and is classified as secondary infertility when the inability to conceive a year after a previous pregnancy, whether or not it resulted in a live birth (Pundir and Toukhy, 2010, 8–841; Abubakar and Yusuf, 2014, 7–11). For the success of pregnancy, complex sequential events must be present in the female, including the following: ovulation, egg capture by the tubal, fertilization, transfer of the fertilized egg to the uterus and then nesting in the uterine cavity, and in the case of males, its success requires the deposit of sperm with sufficient numbers and good quality near the cervix at the time of ovulation (Werner *et al*, 2016, 427 – 448). About half of infertility cases are attributed to female factors (Briceag *et al*, 2015, 129; Kumar and Singh, 2015, 191), while in 20-30% of cases, males are solely responsible for infertility, but they contribute to half of the cases in general (Vander and Christine, 2018, 2-10), While 20-30% of infertility cases are attributed to factors belonging to both sexes (Kumar and Singh, 2015, 191; Masoumi *et al*, 2015, 513). Hysterosalpingography is a radiographic evaluation of the uterine cavity and the tubules based on the injection of contrast material into the uterine cavity and then X-rays, and it is an old technique that has been used since 1910 and is still very popular today (Kolani *et al*, 2020). Among the most important indications for the Hysterosalpingography: female infertility, frequent abortions, assessment of the permeability of the tubules after ligation and evaluation of the uterine cavity before fibroid removal (Simpson *et al*, 2006, 31-419; Chalazonitis, 2009, 199-205). Hysterosalpingography is the standard, minimally invasive, and most common diagnostic method for detecting tubal permeability in all infertile patients who have not planned laparoscopy (Roest *et al*, 2020; Papaioannou *et al*, 2004, 1313-1321). Studies confirm that Hysterosalpingography has a therapeutic effect, where in a systematic review of 12 randomized studies, infertile women who underwent hysterosalpingography showed significantly higher pregnancy rates than those who did not (Luttjeboer *et al*, 2007). Laparoscopy is a procedure that involves creating an artificial Brettwane pneumothorax through the abdominal wall and imaging the abdomen and pelvis through a lighted endoscope, and it is traditionally performed in the operating room under general anaesthesia, and is a short-term procedure that often takes 20-30 minutes (Akintobi *et al*, 2015, 824-827; Omokanye *et al*, 2017, 49). During this procedure, a dye is injected through a cannula into the cervix to test the tubal permeability, so-called tubal staining, It determines whether the tubal permeability is determined or not, without providing information on the location of the obstruction, It is generally the final test to evaluate the tubal (Dutta *et al*, 2020, 2278). One of the most important advantages of laparoscopy is that it gives a comprehensive, magnified picture of the anatomy of the pelvis and abdomen and identifies some diseases that the hysterosalpingography cannot identify, such as distal tubal obstruction, pelvic adhesions and appendages, and endometriosis, and most importantly, it provides an opportunity to treat some pathogens at the time of diagnosis such as loosening membrane or focal adhesions and excision of endometriotic foci (Dutta *et al*, 2020, 2278). Laparoscopy and hysterosalpingography are very effective methods for evaluating infertility, especially tubal pathogenesis, and hysterosalpingography should be performed first if necessary, as laparoscopy complements and expands the diagnostic range for hysterosalpingography. Both procedures are important and one cannot be substituted for the other in the diagnosis of tubal factors of infertility (Bijarnia *et al*, 2021, 186-189). Hence the importance of our current study, in knowing the possibility of relying on the

hysterosalpingography in determining unilateral and bilateral tubal obstruction without exposing patients to laparoscopy in carefully selected cases during the infertility approach.

2. Research objective:

This research aims to study the role of the hysterosalpingography in evaluating the tubal factor as one of the important causes of infertility, comparing the hysterosalpingography findings related to unilateral and bilateral tubal obstruction with those of laparoscopy, and determining the degree of compatibility between them, by calculating the diagnostic values and probabilistic values.

3. Materials and Methods:

3.1. Place of research: General Authority of the University Hospital of Obstetrics and Gynecology in Damascus, outpatient clinics and operations department.

3.2. Research sample: 60 women suffering from either primary or secondary infertility.

3.3. Entry criteria:

- Infertility patients were referred to outpatient clinics during the study period.
- Previously Subject to hysterosalpingography.

3.4. Exclusion criteria:

- Unavailability of the hysterosalpingography, and if only the radiographic report is available.
- Intervention of the male factor as a factor in infertility.

3.5. Research steps:

1. The necessary approvals to start the research were obtained from the competent councils.
2. The voluntary consents of the patients were taken after ensuring that they met the admission criteria.
3. The study questionnaire for patients was filled out by oral interrogation.
4. The hysterosalpingography was read by the researcher and the questionnaire was completed, and the diagnosis of tubal obstruction was adopted when the tubals are full without the contrast media being spilled, or when the contrast media is retained in the uterine horn without the tubal being drawn.
5. Accepting research participants as inpatients, and the laparoscopy was performed in the operating room under general anesthesia, and after scanning of the pelvic organs, the tubules were stained with a 10 ml injection of 5% diluted methylene blue solution. We say that the laparoscopy is normal when observing the uterus, fallopian tubes, ovaries, douglas diverticulum and uterine vesical sinus, which are normal in appearance without endometriosis, adhesions or tuberculous cysts, Likewise, the blue traverse of methylenes from both tubes should appear simultaneously without any perceptible expansion along the tube. Tubal obstruction was diagnosed either when we need more pressure to push the blue through the cannula into the uterus and then the blueness will pass the tube in a drip, or when a blue expansion occurs in one part of the tubal without blue crossing into the pelvic cavity. This information was recorded in the questionnaires of the participating women.
6. The final stage is data collection, tabulation and statistical analysis.

3.6. Statistical analysis:

By entering the data into a computer base, then analyzing it through the Excel 2010 program using the computer, extracting the results in the form of an arithmetic mean, standard deviation and a percentage, calculating sensitivity, specificity, positive predictive value, negative predictive value, false positives and negatives, and probabilistic value, and finally displaying them as tables and charts, and comparing them with the results Similar studies have been published in the medical literature.

3.7. Ethical issues:

After the patient's informed consent and filling out her questionnaire with coded data, and as long as the measures taken during the study are harmless to the patient and will not bear additional financial burdens, there is no ethical or legal problem in conducting the study.

4. Results:

4.1. Characteristics of the studied sample:

Table no. (1) shows the general characteristics of the participating women in the study sample,

which included 60 participating women according to the study conditions.

Table 1. General characteristics of the women in the study sample.

Sample volume	Age		Infertility duration		primary infertility		secondary infertility	
	Average	SD	Average	SD	Number	Percentage (%)	Number	Percentage (%)
60	29,67	6,78	4,84	2,60	29	48,33	31	51,67

The participants ages ranged between 17-41 years, and the average age of the participants was 29.67 ± 6.78 (± standard deviation SD), While the average of infertility duration was 4.84 ± 2.60. The percentage of women who suffered from primary infertility was 48.33% (29 women), while the percentage of women who suffered from secondary infertility reached 51.67% (31 women).

When dividing the study sample into age groups, the sample was organized into three groups, where the first group included women between the ages of 15 and 25 years, while the second group included women between the ages of 26 and 35 years, and the last group included women between the ages of 36 and 45. years.

Table no. (2) shows the characteristics of the study sample according to age groups.

Table 2. Characteristics of the study sample regarding to age categories.

age categories	Number of patients		Age		Infertility duration	
	Number	%	Age average	SD	Average	SD
15-25	19	31,67	21,74	2,84	3,32	1,53
26-35	27	45,00	30,56	2,72	5,59	2,41
36-45	14	23,33	38,71	1,07	5,46	3,29
Total	60	100,00	29,67	6,78	4,84	2,60

In the first category, whose ages range from 15 - 25, the number of women reached 19 (31.67%), with an average age of 21.74 ± 2.84, while in the second group, whose ages ranged between 26 - 35, the number of women reached 27 (45%), with an average age of 30.56 ± 2.72, and the last group, in which the ages of women ranged between 36 and 45, included 14 women (23.33%), With a mean age of 38.71 ± 1.07.

When studying the type of infertility by age groups (Table no.3), the results showed that the percentage of primary infertility within the first group 15-25 years was 63.16% (12 women), and the percentage of secondary infertility within this category was 36.84% (7 women), while the percentage of primary infertility in the second category 26-35 years old, was 48.15% (13 women), and the percentage of secondary infertility reached 51.85% (14 women), and the percentage reached 28.57% (4 women) and 71.43% (10 women) for primary and secondary infertility, respectively, in the category of participants whose ages ranged between 36-45 years.

Table 3. Distribution of the type of infertility regarding to age categories

age categories	primary infertility		secondary infertility	
	Number	%	Number	%
15-25	12	63,16	7	36,84
26-35	13	48,15	14	51,85
36-45	4	28,57	10	71,43

Chart no. (1) shows that the percentage of primary infertility decreased with the increase in the age group, reaching 63.16%, 48.15%, and 28.57% for the three groups 15-25, 26-35, 36-45, respectively, while the percentage of secondary infertility increased with the increase of age groups, reaching 36.84%, 51.85%, and 71.43% for groups 15-25, 26-35, 36-45, respectively.

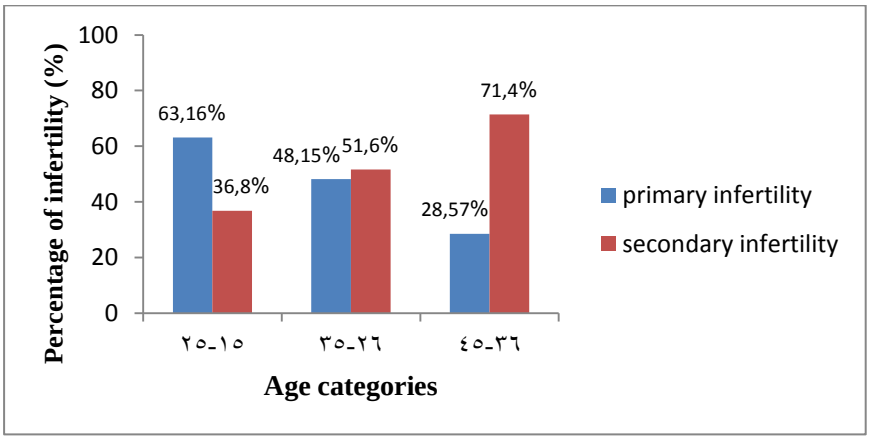

Chart 1. Percentage of primary and secondary infertility regarding to age categories.

4.2. Results of hysterosalpingography and laparoscopy:

The results in table no. (4) refer to the results of diagnosing tubal obstruction in hysterosalpingography and laparoscopy, and their percentage.

Table 4. Comparison of the results of tubal obstruction in hysterosalpingography and laparoscopy.

Description	Hysterosalpingography		Laparoscopy	
	Number	%	Number	%
bilateral tubal obstruction	11	18.33	8	13.33
unilateral tubal obstruction	8	13.33	9	15.00

The hysterosalpingography showed bilateral tubal obstruction in 11 patients (18.33%) and unilateral obstruction in 8 patients (13.33%), while laparoscopy showed bilateral and unilateral obstruction in 8 patients (13.33%) and 9 patients (15%), respectively. Chart no. (2) shows a comparison of the percentages of unilateral and bilateral tubal obstruction.

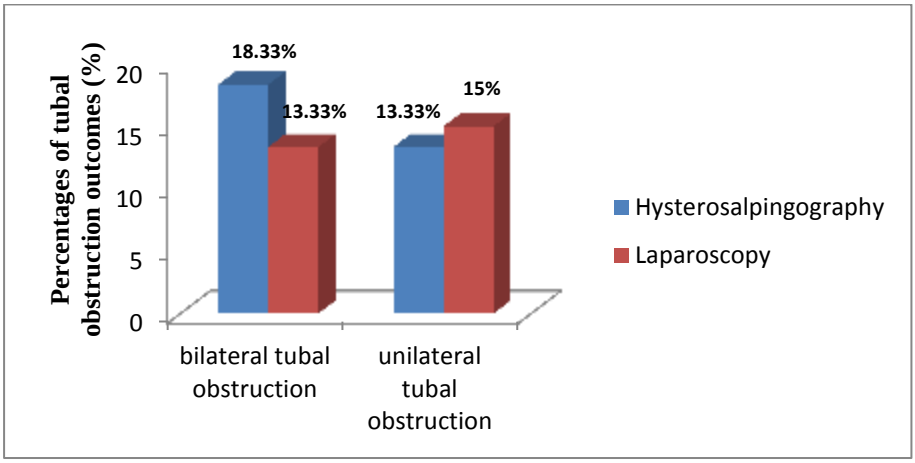

Chart 2. Comparison of the of unilateral and bilateral tubal obstruction percentages in hysterosalpingography and laparoscopy.

4.3. Diagnostic values of hysterosalpingography in screening bilateral tubal obstruction compared to laparoscopy:

The data in table (5) show the results of the study of bilateral tubal obstruction in hysterosalpingography compared to laparoscopy, where the true positives were 7 cases, the false negatives were 1 case, the false positives were 4 cases, while the true negatives were 48 cases.

Table 5. Results of studying bilateral tubal obstruction in hysterosalpingography compared to laparoscopy

Description		Hysterosalpingography		Total
		bilateral tubal obstruction	One permeable tube, or both	
laparoscopy	bilateral tubal obstruction	7	1	8
	One permeable tube, or both	4	48	52
Total		11	49	60

When calculating the diagnostic values of hysterosalpingography in the investigation of bilateral tubal obstruction compared to laparoscopy (Chart no. 3), we found that the sensitivity was 87.5%, the specificity 92.3%, the positive predictive value 63.64% and the negative predictive value 97.96%.

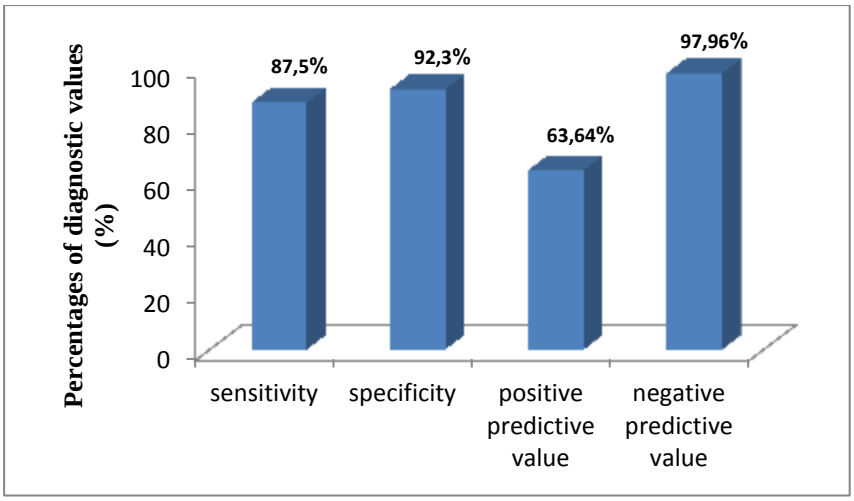

Chart 3. Diagnostic values of Hysterosalpingography in screening bilateral tubal obstruction compared to laparoscopy

4.4. Diagnostic values of hysterosalpingography in screening unilateral tubal obstruction compared to laparoscopy:

The data in Table no. (6) shows the results of the study of unilateral tubal obstruction in Hysterosalpingography compared to laparoscopy. It was found that the true positives were 5 cases, the false negatives were 4 cases, and the false positives were 3 cases, while the true negatives were 48 cases.

Table 6. Results of studying unilateral tubal obstruction in hysterosalpingography compared to laparoscopy

Description		Hysterosalpingography		Total
		unilateral tubal obstruction	The tubes are permeable or obstructive	
laparoscopy	unilateral tubal obstruction	5	4	9
	The tubes are permeable or obstructive	3	48	51
Total		8	52	60

We note in Chart no. (4) that the sensitivity and specificity of the hysterosalpingography in detecting unilateral tubal obstruction compared to laparoscopy were 55.56% and 94.12%, respectively, and its positive and negative predictive value were 62.5% and 92.3%, respectively.

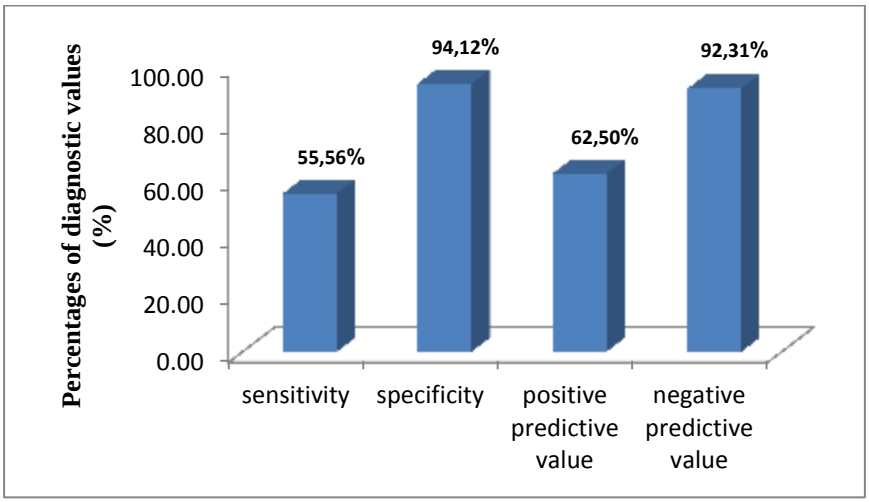

Chart 4. Diagnostic values of Hysterosalpingography in screening unilateral tubal obstruction compared to laparoscopy

4.5. Diagnostic values of hysterosalpingography in screening unilateral and bilateral tubal obstruction compared to laparoscopy:

The data in table no. (7) show the results of studying unilateral and bilateral tubal obstruction in hysterosalpingography compared to laparoscopy.

Table 7. Results of studying unilateral and bilateral tubal obstruction in hysterosalpingography compared to laparoscopy

Description		Hysterosalpingography		Total
		unilateral and bilateral tubal obstruction	permeable tubes	
laparoscopy	unilateral and bilateral tubal obstruction	12	5	17
	permeable tubes	7	36	43
Total		19	41	60

We found that the true positives were 12 cases, the false negatives were 5 cases, and the false positives were 7 cases, while the true negatives were 36 cases. When calculating the diagnostic values, we found that the sensitivity for unilateral and bilateral tubal obstruction was 70.59%, specificity 83.72%, positive predictive value 63.16%, and negative predictive value 87.81%. (Chart no. 5).

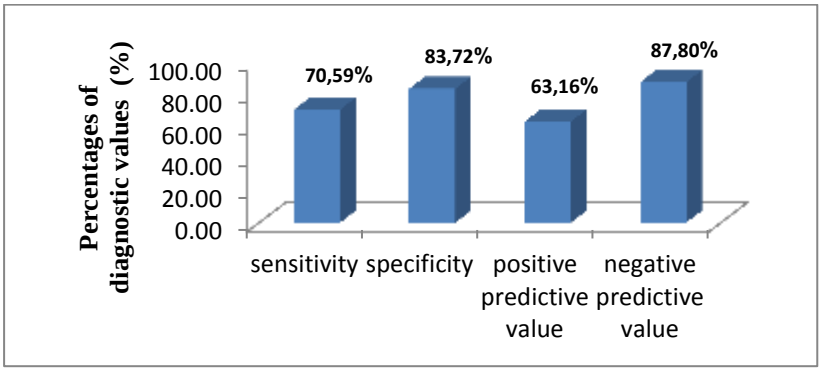

Chart 5. Diagnostic values of Hysterosalpingography in screening unilateral and bilateral tubal obstruction compared to laparoscopy

4.6. False positive rate and false negative rate of hysterosalpingography findings for tubal obstruction diagnosis compared to laparoscopy:

The results in table no. (8) show the false positive and false negative rates of hysterosalpingography findings compared to laparoscopy.

Table 8. False negative rate and false positive rate of hysterosalpingography findings for tubal obstruction diagnosis compared to laparoscopy

Description	False positive rate (%)	False negative rate (%)
Bilateral tubal obstruction	7,7	12,5
Unilateral tubal obstruction.	5,88	44,44
Bilateral and unilateral tubal obstruction	16,28	29,41

The false positive rate and false negative rate were 7.7 and 12.5 (%) respectively when studying the bilateral tubal obstruction, while the false positive rate and false negative rate were 5.88 and 44.44 (%) respectively when studying unilateral tubal obstruction. When studying bilateral and unilateral tubal obstruction, the false positive rate and false negative rate were 16.28 and 29.41 (%) respectively.

4.7. Probable values of tubal obstruction in hysterosalpingography compared to laparoscopy:

The results in table no. (9) show the probable values of tubal obstruction in hysterosalpingography compared to laparoscopy when studying Bilateral tubal obstruction, Unilateral tubal obstruction, and also bilateral and unilateral tubal obstruction, which were > 0.05, meaning that the results were insignificant.

Table 9. Probable values of tubal obstruction in hysterosalpingography compared to laparoscopy.

Description	P value	significance
Bilateral tubal obstruction	> 0.05	insignificant
Unilateral tubal obstruction.	> 0.05	insignificant
Bilateral and unilateral tubal obstruction	> 0.05	insignificant

5. Discussion:

Several studies have proven our need for both hysterosalpingography and laparoscopy at the same time for infertility investigations (Siristatidis and Bhattacharya, 2007, 2084; Mol *et al*, 1999, 1237-1242). In our study, the diagnostic values when investigating the unilateral and bilateral tubal obstruction, the sensitivity was 70.59% and the specificity was 83.72%, while these percentages in the study of Foroozanfard and Sadat, 2013 (Foroozanfard and Zohreh Sadat, 2013, 188-192), were 77.8% and 52.9 % for sensitivity and specificity respectively. To investigate bilateral tubal obstruction, we found in our current study that the sensitivity and specificity were 87.5% and 92.3%, respectively, similar to the results obtained in the study of Foroozanfard and Sadat (Foroozanfard and Zohreh Sadat, 2013, 188-192), with sensitivity and specificity of 92.1% and 86.7%. respectively.

Therefore, according to the diagnostic values of our study and the study of Foroozanfard and Sadat in 2013 (Foroozanfard and Zohreh Sadat, 2013, 188-192), it can be said that the hysterosalpingography is more accurate in detecting bilateral tubal obstruction, while in the study of Bijarnia and colleagues 2021, the sensitivity of bilateral tubal obstruction was 100% (Bijarnia *et al*, 2021, 186-189), clearly higher than our study, but the specificity was 85.71%, very close to our results. This differences can be explained by the different characteristics of the studied sample, the degree of accuracy of the tests, and also by the difference in the time interval between the two tests.

In our current study, the false positive rate for tubal obstruction was 16.28% similar to what was found by Bijarnia and colleagues 2021, reaching 14.28% (Bijarnia *et al*, 2021, 186-189). This can be explained by one of the following reasons:

- Tubal spasm during contrast medium injection which does not occur in laparoscopy due to general anesthesia.
- The small mucous plug that can be pushed in during laparoscopy with repeated injections of methylene blue.
- Laparoscopy procedures such as releasing adhesions and releasing the obstruction site.
- Inadequate entry of the cannula into the cervix and, consequently, leakage of the contrast media into the vagina.
- The absence of a late radiograph to detect the late spread within the pelvis (Jean Dupont Kemfang, 2015, 1-7; Risquez and Confino, 1993, 26 – 211).

The false negative rate for tubal obstruction was 29.41%, while there were no false-negative results in the study of Bijarnia and colleagues 2021(Bijarnia *et al*, 2021, 186-189). The high rate in our study can be explained by the following:

- Entry of the shadow material into the uterine and ovarian veins, giving a false impression of the permeability of the tubes.
- The time period between the two procedures during which a pathological event that leads to blockage may occur.
- The diffusion of the shadow material from the tube to the other side is interpreted as the permeability of the tube in the event of a distant obstruction (Jean Dupont Kemfang, 2015, 1-7; Siegler, 1983, 58 – 139).

The potential values of the hysterosalpingography findings compared to laparoscopy were > 0.05 when studying bilateral tubal obstruction, unilateral tubal obstruction, unilateral and bilateral tubal obstruction, meaning that the results were insignificant, and this is consistent with the findings of Bijarnia and colleagues 2021 (Bijarnia *et al*, 2021, 186-189).

As a result, it can be said that it is possible to rely to a large extent on the hysterosalpingography in the investigation of tubal obstruction, and to spare the patient general anesthesia and laparoscopic surgery. This, of course, is conditional on the absence of other clinical findings of the patient that suggest pathologies that can only be diagnosed with laparoscopy.

6. Conclusions and Recommendations:

We conclude that laparoscopy can be dispensed with when the hysterosalpingography is normal, and when we exclude, through the clinical history and clinical examination, any pathological event that can only be diagnosed and treated with laparoscopy. Otherwise, it is necessary to follow the hysterosalpingography with laparoscopy for a definitive diagnosis.

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