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ORIGINAL ARTICLE

Correlation of Hysterosalpingography and Laparoscopy in the Detection of Tubal Infertility Factor

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Abstract

Background/Aim: Around 15-20 % of couples worldwide struggle with infertility, a difficult and aggravating gynaecological issue. Conception occurs in both partners, male and female, as they are both responsible for conception. This study aimed to evaluate the diagnostic accuracy of hysterosalpingography (HSG) in the detection of tubal infertility factors, by comparing the findings of HSG with the findings of laparoscopy (LPSC).
Methods: A retrospective study from 1st January 2018, to 31st December 2019, is presented. Infertile patients who underwent LPSC, HSG and ultrasound to evaluate sterility during this timeframe were included in the research.
Results: The study involved 63 infertile patients with a mean lifespan of 33.3 ± 4.7 years. The conclusions of LPSC and HSG, in general, were in good correlation and the percentage of agreement among the diagnostic procedures was 77.8 %. In the case of dichotomous categories, there is a good alignment between LPSC and HSG results with a percentage of 85.7 %. Hydrosalpinx: The findings of LPSC and HSG are quite similar. The percentage of agreement among the diagnostic techniques used was 79.2 %. Canal obturation: LPSC and HSG results are in good correlation with a percentage of 78.6 %. Terminal obturation: LPSC and HSG results are also in good agreement with the calculated percentage of 82.1 %.
Conclusion: In determining tubal sterility factors, there is considerable consistency between LPSC and HSG results ($\kappa = 0.68$; 95 % CI 0.54-0.83). There is a good correlation between LPSC and HSG findings of dichotomous categories ($\chi^2 = 0.63$; 95 % CI: 0.41-0.86). 86.2 % of subjects with peritubular appendages and 8.8 % of subjects without peritubular appendages had hydrosalpinx, which is a statistically significant difference ($\chi^2 = 37.957$; $p < 0.001$). Between LPSC and HSG data, there is a good agreement in the diagnosis of hydrosalpinx ($\kappa = 0.64$; 95 % CI: 0.38-0.91).

Key words: Infertility; Hysterosalpingography; Laparoscopy; Hydrosalpinx.

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Introduction

Infertility is a serious and rapidly increasing gynaecological issue that affects 15-20 % of couples worldwide and is defined as the inability to conceive within 12 months of regular unprotected intercourse.[1] Infertility always unites the problem of two people[2] because conception is the responsibility of both, the male and female partners. 48.5-72.4 million couples globally suffer from primary or secondary infertility. Meta-analysis calculated the percentage of infertility for different countries and cultures which ranges from 5-30 %, but most often is 15-20 %.[3]

Many factors affect fertility. The most common causes of infertility are changes in lifestyle, environmental pollution, delayed birth of the first

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child at an advanced age of a female partner, separation of partners due to professional reasons, anovulation, reduced ovarian reserve, sexually transmitted diseases, male partner problems, anxiety and stress.[4] The causes are almost equal in male and female partners. The male partner is a cause of infertility in 30-40 % of cases, female in 40-55 % of cases and both are responsible for 10 % of cases. The remaining 10 % of the causes stay unexplained.[5] According to FIGO classification, causes of infertility in women are divided into several groups: the problem with the fallopian tube and pelvic peritoneum (25-35 %), anovulation or infrequent ovulation (30-40 %), endometriosis (1-12 %), uterine abnormalities (6 %) and unexplained infertility (14 %). Examining tubal factors of infertility, or to be precise, fallopian tube patency is the initial step in discovering female infertility factors. They are detected using some or all of the following methods: hysterosalpingography (HSG), laparoscopy (LPSC), and ultrasound.[6] Each method of diagnosis has its advantages and disadvantages, while the combination of these methods gives the most accurate and most reliable diagnosis. This is why the degree of their correlation is extremely important and is leading us to a decision on which patients should expect pregnancy by natural conception or when is necessary to apply one of the methods of assisted reproductive technology. Of all infertility causes in women, the tubal factor accounts for about 30 %.[5, 7] The aetiological factors of tubal pathology are usually infections with bacteria and viruses, the existence of intrauterine devices, endometriosis, tuberculosis of the genital organs and previous surgery.[8]

As said, one of the first stages in determining a woman's infertility is to examine her fallopian tube function by HSG, LPSC, and ultrasound.[6] HSG is indicated in the diagnosis of marital infertility, or female infertility, especially after previous surgeries or anamnesis indicating previous inflammatory diseases of the genital organs, a clinical finding that indicates the presence of endometriosis or suspicion of uterine anomalies. Indications for HSG are also a history of tubal pregnancy, corrective surgery on the fallopian tubes and a ruptured appendix. There are diagnostic and therapeutic indications for performing HSG, and among them, infertility is the most important. Diagnostic indications for HSG are an examination of infertility suspicion of congenital anomaly of the internal genital organs of a woman, examination of the condition of the uterine cavity, examination of defects in the uterine wall, examination of tubal structure, intrauterine localisation insert, repeated abortions and abnormal uterine bleeding. Therapeutic indications for the use of HSG are intrauterine adhesions and tubular occlusions. Contraindications for HSG are bleeding and allergy to contrast agents, while the absolute contraindications are intrauterine pregnancy and acute pelvic inflammatory disease.

Reasons to perform LPSC include infertility, ectopic pregnancy, endometriosis, chronic pain in the lower abdomen, acute and subacute problems in the pelvis and malformations of the internal genital organs. Indications for extended LPSC are infertility, endometriosis, neoplastic and non-neoplastic ovarian tumours, genital and intra-abdominal tuberculosis and sterilisation of tubes. Since LPSC is conducted under general anaesthesia, most cases in which LPSC is contraindicated are due to anaesthesia, mainly diseases of the cardiovascular and respiratory systems. The absolute contraindication for LPSC is haemorrhagic diathesis. The greatest danger is posed by puncture of the abdomen "blindly". The tip of the needle can penetrate layers of the anterior abdominal wall where various forms of emphysema and injuries to blood vessels can occur during insufflation. Complications of LPSC can be divided into intraoperative complications (emphysema, injuries of blood vessels, intestines, etc.) and postoperative complications (pain, bleeding, infections and the occurrence of postoperative adhesion).

This study aimed to evaluate the diagnostic efficacy of HSG in identifying tubal infertility causes.

Methods

The results of a retrospective study conducted at the Department of Sterility at Obstetrics and Gynaecology Clinic "Narodni Front", Belgrade, the Republic of Serbia, between 1st January 2018 and 31st December 2019 were recorded. An ultrasound, HSG, and LPSC were performed on 63 patients as part of the study's sterility assessment. The patient's age, sterility type, length, laparoscopic findings, past pregnancies and abortions, patency of the fallopian tubes, location of obstruction of the fallopian tubes and kind of corrective surgical procedures performed on the fallopian tubes during LPSC were examined.

Depending on the kind of variables and the normality of the distribution, the data is shown as n (%), arithmetic means ± standard deviation, or median (range, min-max). The techniques applied for statistical hypothesis testing are the exact probability Fishers test and the Chi-square test. Weighted Kappa coefficient and Kappa coefficient were taken for measurement agreement and the SPSS program was used for the statistical analysis. Statistical hypotheses were tested at the level of statistical significance (alpha level) of 0.05.

Results

The average age of all researched participants was 33.3 ± 4.7 years. The youngest participant was 23 years old, while the oldest was 41. The majority of those who participated in the research had no prior pregnancies (87.3 %) or abortions (87.3 %). Ectopic pregnancies were reported by 3 (4.8 %) respondents. The study's participants were more likely to suffer from primary sterility (81.0 %). The average length of sterility was two years. In the subjects with fallopian tube obstruction, the most common place was found to be a terminal obstruction (63.6 %). Of all respondents included in the study, 29 (48.3 %) had peritubular adhesions. The most common corrective surgery was bilateral salpingoneostomy (42.9 %). 22.2 % of participants had a good HSG result and 30.2 % of participants had a good result at the LPSC (Figure 1 and 2).

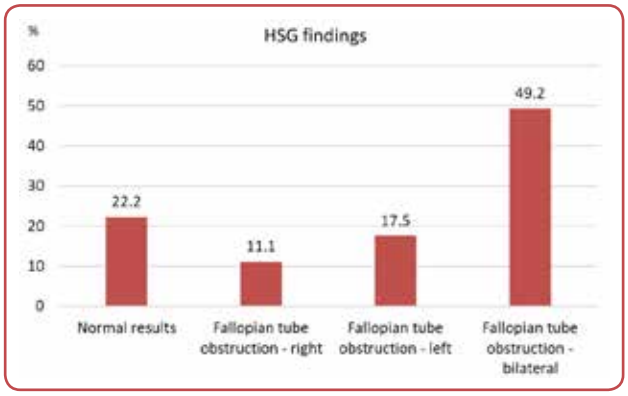

Figure 1: Distribution of respondents according to hysterosalpingography (HSG) findings

There is good agreement between LPSC and HSG findings (κ = 0.68; 95 % CI: 0.54-0.83). The proportion of agreement with the applied diagnostic procedures was 77.8 % (Table 1).

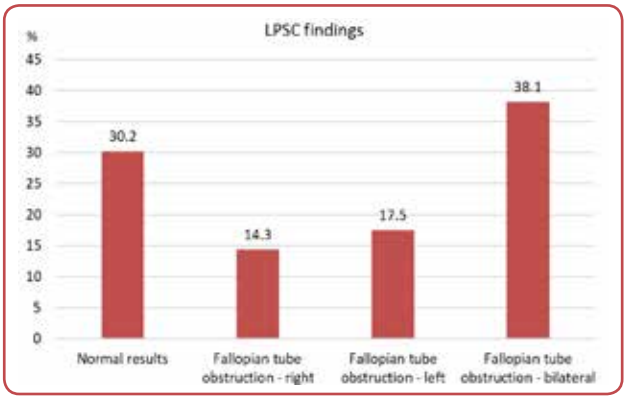

Figure 2: Distribution of respondents according to laparoscopy (LPSC) findings

Table 1: Absolute frequencies of laparoscopy (LPSC) and hysterosalpingography (HSG) category findings

HSG Result	LPSC Result				
	Normal result	Fallopian tube obstruction right	Fallopian tube obstruction left	Fallopian tube obstruction bilateral	In total
Normal result	12	1	1	0	14
Fallopian tube obstruction right	1	6	0	0	7
Fallopian tube obstruction left	4	0	7	0	11
Fallopian tube obstruction bilateral	2	2	3	24	31
In total	**19**	**9**	**11**	**24**	**63**

There is good agreement between LPSC and HSG findings of dichotomous categories (κ = 0.63; 95 % CI: 0.41-0.86). The proportion of agreement between applied diagnostic procedures of dichotomous categories was 85.7 % (Table 2).

Table 2: Absolute frequencies of laparoscopy (LPSC) and hysterosalpingography (HSG) findings of dichotomous categories

HSG Result	LPSC Result		
	Regular	Obstruction	In total
Regular	12	2	14
Obstruction	7	42	49
In total	**19**	**44**	**63**

86.2 % of subjects with peritubular appendages and 8.8 % of subjects had hydrosalpinx without peritubular appendages, which is a statistically significant difference (χ^2 = 37,957; p < 0.001) (Table 3).

There is good agreement between LPSC and HSG findings (κ = 0.64; 95 % CI: 0.38-0.91). The proportion of agreement of the applied diagnostic procedures was 79.2 % (Table 4).

Table 3: Distribution of subjects by hydrosalpinx - the presence of peritubular growths

	The presence of peritubular appendages			
	Yes		No	
Hydrosalpinx	n	%	n	%
Yes	25	86.2	3	8.8
No	4	13.8	31	91.2
In total	**29**	**100.0**	**34**	**100.0**

Table 4: Absolute frequencies of LPSC and HSG finding categories (hydrosalpinx)

HSG Result	LPSC Result			
	Hydrosalpinx right	Hydrosalpinx left	Hydrosalpinx bilateral	In total
Hydrosalpinx right	1	0	1	2
Hydrosalpinx left	0	9	1	10
Hydrosalpinx bilateral	2	1	9	12
In total	**3**	**10**	**11**	**24**

Table 5: Distribution of subjects according to fallopian tube obstruction – the presence of peritubular adhesions

	Fallopian tube obstruction			
	Yes		No	
Peritubular appendages	n	%	n	%
Yes	28	63.6	0	0.0
No	16	36.4	19	100.0
In total	**44**	**100.0**	**34**	**100.0**

Peritubular adhesions were found in 63.6 % of subjects with tubal obstruction and none (0.0 %) subjects without fallopian tube obstruction, which is a statistically significant difference (χ^2 = 21,764; p < 0.001) (Table 5).

Discussion

Some authors have found in their research a slightly higher incidence of primary than secondary infertility. The percentage of primary infertility ranged from 60–72 % and secondary from 28–40 %.[9] When resizing groups according to inclusion criteria, a 2001 research included 328 infertile women who were subjected to diagnostic LPSC to investigate infertility, including 191 unexplained infertile patients. There were 106 (55.5 %) primarily infertile and 85 (44.5 %) secondary infertile patients. The mean age of infertile patients was 28 ± 5 years, respectively.[10] In this research which included 63 participants 81 % were primary infertile, while 19 % were secondary infertile.

The tubal factor is responsible for infertility in 25-35 % of cases. HSG and LPSC are the two most important and most widely used diagnostic methods for examining fallopian tube patency. Tubal obstruction diagnosed by HSG in this study was 77.8 %, of which unilateral obstruction was found in 28.6 % and bilateral obstruction in 49.2 % of cases. Tubal obstruction diagnosed laparoscopically was 69.8 %, of which unilateral obstruction was present in 17.5 % and bilateral obstruction in 38.1 % of cases. Left fallopian tube obstruction was diagnosed more often both by HSG and LPSC than right fallopian tube obstruction and was 17.5 %. The agreement of HSG and LPSC findings in diagnostics fallopian tube obturation in this study was 77.8 %, based on which it can be concluded that there is a good correlation between LPSC and HSG findings.

In a study that was done and which consists of a reviewed series of 200 consecutive hysterosalpingograms to assess infertility in patients attending the clinic at Hillbrow Hospital in Johannesburg, fallopian tube anomaly was found in 81.8 % cases and terminal hydrosalpinx present in 64.4 %. After completing the research, it was found that there is a good correlation between HSG and laparoscopic findings, the degree of correlation in this study was 75 %.[8]

Routine HSG and LPSC have been performed at a certain time for any patient who has had primary infertility for more than two years. The clinical aspects of 433 such patients' findings were reviewed retrospectively. An agreement between the two diagnostic methods was found in 70.9 %. Almost half of the population experienced HSG or LPSC abnormalities.[11] In a two-year prospective study comparing the diagnostic accuracy of HSG and LPSC, 143 infertile women were evaluated. The agreement between these two methodologies' results was 66.4 %.[12] In a prospective cohort study including 11 Canadian centres, unilateral fallopian tube obstruction was detected in 14 % of infertile patients and bilateral obstruction in 24 %, whereas laparoscopic unilateral and bilateral fallopian tube obstruction was diagnosed in 12 % of each.[13] Comparing the presented results with the previously mentioned, it was concluded that there is a good alignment between them.

HSG and LPSC are complementary methods of examination of infertile patients. As mentioned, there is a high correlation between HSG and LPSC

findings in the diagnosis of hydrosalpinx in this study. In 2019 research involving 102 operated women, obstruction of the fallopian tubes was found in 94 (92.1 %) patients. One-sided hydrosalpinx was found in HSG in 16 (15.7 %) subjects and bilateral hydrosalpinx in 30 (29.4 %) women. Unilateral hydrosalpinx was found by LPSC in 17 (16.1 %) patients and bilateral hydrosalpinx in 32 (31.4 %) subjects. Matching between findings obtained by HSG and LPSC in the diagnosis of unilateral hydrosalpinx was 76.5 % and bilateral 70.4 %. This difference was not statistically significant.[14]

The most significant distinctions between ultrasonography, HSG, and LPSC are evident in the diagnosis of peritubular appendages, which LPSC is the most accurate at diagnosing. Peritubular appendages are considerably more common in patients with tubal obstruction (63.6 %), while peritubular 76.5 % of respondents with past surgical operations and 34.8 % of respondents without previous surgery had increments pelvis. It may be assumed that pelvic surgery causes the creation of peritubular adhesions, which are most reliably identified by LPSC and that the same adhesions are the cause of fallopian tube occlusion in the majority of cases. The level of fallopian tube destruction can be assessed more precisely laparoscopically than with ultrasound and HSG, which is important in deciding whether to perform surgery on the fallopian tubes as well as which infertile patients can expect natural conception and which require treatment with IVF procedures.

Conclusion

In determining tubal sterility factors, there is considerable consistency between LPSC and HSG results. There is a good correlation between LPSC and HSG findings of dichotomous categories. 86.2 % of subjects with peritubular appendages and 8.8 % of subjects without peritubular appendages had hydrosalpinx, which is a statistically significant difference. Between LPSC and HSG data, there is a good agreement in the diagnosis of hydrosalpinx. The most significant distinctions between ultrasonography, HSG, and LPSC are evident in the diagnosis of peritubular appendages, which LPSC is the most accurate at diagnosing.

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None.

Conflict of interest

None.

References

1. Beyuo T, Oppong SA, Samba A, Beyuo VM. Chlamydia trachomatis infection among Ghanaian women undergoing hysterosalpingography for suspected tubal factor infertility.Int J Gynaecol Obstet 2019;146(2):200-5.
2. Maheshwari A, Hamilton M, Bhattacharya S. Effect of female age on the diagnostic categories of infertility. Hum Reprod 2008;23(3):538-42.
3. Namaver Jahromi B, Persanezhad ME, Shomali Z, Bakhshai P, Alborzi M, Vaziri MN, et al. Ovarian hyperstimulation syndrome: a narrative review of its pathophysiology, risk factors, prevention, classification, and management. Iran J Mes Sci 2018;43(3):248-60.
4. Leijdekkers JA, Eijkemans MJC, van Tilborg TC, Oudshoorn SC, van Golde RJT, Hoek A. et al. Cumulative live birth rates in low-prognosis women. Hum Reprod 2019 Jun 4;34(6):1030-41.
5. Briceag I, Costache A, Purcarea VL, Cergan R, Dumitru M, Briceag I, et al. Fallopian tubes–literature review of anatomy and etiology in female infertility. J Med Life 2015;8(2):129-31.
6. de Ziegler D, Streuli I, Vasilopoulos I, Decanter C, This P, Chapron C. Cancer, and fecundity y issues mandate a multidisciplinary approach. FertilSteril 2010;93(3):691-6.
7. Aleksandrovych V, Sajewicz M, Walocha JA, Gil K. Tubal telocytes: factor infertility reason? Folia Med Cracov 2016;56(2):17-23.
8. Torre A, Pouly JL, Wainer B. [Anatomic evaluation of the female of the infertile couple]. J Gynecol Obstet Biol Reprod (Paris) 2010 Dec;39(8 Suppl 2):S34-44. French.
9. Mureşan D, Stamatian F, Ona D, Cruciat G, Caracostea G, Rotar I, Cucu R. Tendinţe actuale în tratamentul sarcinii extrauterine [Current trends in the treatment of ectopic pregnancy]. Chirurgia (Bucur) 2008 Jan-Feb;103(1):73-8. Romanian.
10. Kahyaoglu S, Kahyaoglu I, Yilmaz B, Var T, Ertas IE, Mollamahmutoglu L, et al. Should diagnostic laparoscopy be performed initially or not, during infertility management of primary and secondary infertile women? A cross-sectional study. Obstet Gynaecol Res 2009;35(1):139-44.
11. Portuondo JA, Peña Irala J, Ibañez E, Echanojuaregui AD. Clinical selection of infertile patients for laparoscopy. Int J Fertil 1984;29(2):85-90.
12. Tsankova M, Nalbanski B, Borisov I, Borisov S. A comparative study between hysterosalpingography and laparoscopy in evaluating female infertility. Akush Ginekol (Sofiia) 2000;39(1):20-2.
13. Mol BW, Collins JA, Burrows EA, van der Veen F, Bossuyt PM. Comparison of hysterosalpingography and laparoscopy in predicting fertility outcome; HumReprod 1999;14(5):1237-42.
14. Ng KYB, Cheong Y. Hydrosalpinx - Salpingostomy, salpingectomy or tubal occlusion Best Pract Res Clin Obstet Gynaecol 2019;59:41-7.