

## Tubal Abnormalities on Hysterosalpingography and Select Risk Factors in Women Undergoing Infertility Evaluation in Makurdi, Nigeria

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Received: 20 May 2020; Accepted: 19 June 2020

**Citation:** Utoo BT, Mohammad H. Tubal Abnormalities on Hysterosalpingography and Select Risk Factors in Women Undergoing Infertility Evaluation in Makurdi, Nigeria. *Gynecol Reprod Health*. 2020; 4(3):1-6.

### ABSTRACT

**Background:** Hysterosalpingography (HSG) is an important procedure in the evaluation of female factor infertility. Morphological abnormalities of the Fallopian tubes are detected through this radiological test.

**Objective:** This study was designed to assess the pattern of tubal abnormalities on HSG and the relationship between tubal abnormalities and select risk factors in women that were undergoing evaluation for infertility in Makurdi.

**Material and Methods:** This was a prospective study conducted at a private radiology imaging diagnostic center in Makurdi. Data and radiology reports from 239 women who presented to the facility for HSG with infertility as indication for the procedure were entered into a well-structured researcher administered proforma. The data was analyzed using SPSS version 25.0. Chi-square was used to test statistical significance at 95% CI with P-value set at <0.05.

**Results:** HSG findings of the 239 patients studied showed that, 53.7% had normal tubes bilaterally while 46.4% had one defect or the other. Among the various degrees of tubal anomalies; bilateral non patent tubes was commonest (15.5%). Then right hydrosalpinx (8.4%), left hydrosalpinx (7.5%), unilateral left tubal occlusion (5%), unilateral right tubal occlusion (3.3%) and other minor but combined degrees of abnormalities. Women who had multiple sexual partners had more tubal abnormalities (10.1%) compare with those that had single sexual partners (5.4%). This was statistically significant ( $P=0.014$ ). There was also a statistically significant relationship between prior sexually transmitted disease (STD) and tubal abnormalities on HSG (STD > 6 months,  $P=0.004$ ; STD < 6 months,  $P<0.001$ ). Similarly, those who did not use barrier contraceptives during their sexual relationships had more tubal abnormalities ( $P=0.005$ ).

**Conclusion:** Abnormalities of the tube were 46.4%. Tubal abnormalities were significantly related to unprotected sex, multiple sex partners and history of STD. Sex education and modification of sexual lifestyle will help protect fertility of women.

### Keywords

Acute pelvic inflammatory disease (PID), Hysterosalpingography, Hysteroscopy, Infertility, STD, Tubal blockade.

### Introduction

Infertility is a global problem affecting 15 % of couples; with either one or both partners and in some cases unknown factors being responsible for the difficulty in conception [1,2]. A couple

is said to be infertile if after 12 months of regular, adequate and unprotected intercourse they are unable to achieve pregnancy [2-5]. In Nigeria the incidence is said to be as high as up to 45% in some reports [6]. Female factor infertility is commonly due to tubal disease, ovulatory, uterine and cervical factors and it accounts for 20-35% of infertility challenges [4].

The prevalence of tubal disease is high because of genital tract

infections that are common among women of reproductive age especially the single, younger people with multiple sexual partners [4]. Chlamydia trachomatis and Neisseria gonorrhoea infection are monoetiologic agents in acute pelvic inflammatory disease that are known to damage the Fallopian tubes with consequent severe pelvic adhesions that could lead to tubal blockade [2-4]. Other offending polymicrobial infections include; streptococcus, bacteriodes, Escherichia coli, etc.

It is thought that peritubal adhesions from Acute PID is responsible for as much as 30%-50% of female factor infertility [2,4]. Several imaging modalities exist for evaluating tubal factor infertility with various degree of accuracy [4]. Transvaginal ultrasonography (TVUS), Magnetic resonance imaging (MRI), Hysterosalpingography (HSG) and hysterosalpingo-contrast sonography (HyCoSy) [3,4,7]. In many cases in our environment HSG is used as a screening test to select cases that may require laparoscopy for diagnosis and treatment of cases that can be handled through minimal access procedures. Hence laparoscopy is viewed to be superior to HSG, but in the actual sense the two are complimentary [8].

While HyCoSy is painless, very sensitive, specific and accurate in diagnosing uterine anomalies such as polyps, endometrial atrophy and adhesion, MRI is useful in diagnosing adenomyosis, uterine fibroids and endometriosis. However, the role of these two tools is limited in detecting tubal disease [3]. In most centers in Nigeria these procedures are not feasible due to non-availability, high cost or lack of skill of clinicians to carry them out [9].

HSG evaluates the morphology of the tube, patency and functionality [3]. Some of the common pathological appearances of the tube on HSG will be peritubular adhesions in varying severity, beading, masses, spasm, polyps, blockade and congenital anomalies which may be unilateral or bilateral [1,4]. It is important to mention that HSG also detects uterine pathologies [1,3,9]. Uterine fibroids may be demonstrated by uterine enlargement, uterine contour distortion and intrauterine filling defects; uterine polyps, uterine synechiae, adenomyosis and various forms of septa are among other pathologies that could be detected through this procedure, although hysteroscopy may be better in intra- uterine assessment of these conditions [1,3,7,5].

This study was design to determine the prevalence of tubal abnormalities on HSG and the relationship of tubal pathology with select risk factors which predisposes women to acquiring pelvic infections leading to tubal disease and consequently female infertility. It is pertinent to mention that this kind of study has not been done in our environment before and findings will go a long way in developing policies that could promote the reproductive health of the women and create baseline data for further research work in this area.

## Materials and Methods

### Study area and population

The study was carried out at Musafaha Imaging Diagnostic Center in Makurdi, Benue State, North-Central, Nigeria. It is a private

facility with a high density of patients who are usually referred by physicians for various radiological investigations. Two hundred and thirty-nine (239) women who were referred for HSG during infertility evaluation and consented for the study were recruited. Those who declined were exempted. A proforma was used to gather information on social demographic characteristics, sexual activities and history of STDs.

### Inclusion and exclusion criteria

In accordance with the 10-day rule, HSG is done during the proliferative phase of the menstrual cycle. In women with regular 28-day menstrual cycle, this falls between days 6-10. For convenience and ease of remembrance by our patients, they are instructed to come for the procedure on day 8 of the cycle with first day of menstrual flow being day 1. However, those with irregular menses or prolonged amenorrhea, early morning urine pregnancy test and a transvaginal ultrasound are done on the day of the procedure so as to rule out pregnancy. As part of the preparation in our center, patients are instructed to abstain from coitus on the eve of the procedure.

### Procedure for HSG

Few minutes prior to the procedure, patients were given 2mls of intravenous injection of Hyoscine Butyrbromide to prevent spasm of the fallopian tube. Patient were placed in a lithotomy position on the X-ray couch and the exposure for the scout film was done in order to set the correct radiographic factors and also to screen for intra pelvic abnormal masses or bony abnormalities. 10 mls of water-soluble iodinated contrast medium (75% Urografin) was diluted with an equal amount of normal saline and drawn into a 20 ml syringe. Air was expelled and the syringe was firmly attached to a Jarcho self-retaining cannula. A clean sterile sponge was picked with a Rampley sponge holding forceps and dipped in a solution of Chlorhexidine Gluconate and this was used to clean the vulva of the patients. A Cusco speculum was inserted into the introitus to expose the cervix. A volsellum forceps was used to grip the anterior lip of the cervix and gently pulled to steady it. The self-retaining cannula was introduced into the external cervical os and fixed. In cases of patulous cervix, a Foley's catheter was used in the place of a cannula. 3 mls of the contrast was introduced into the uterus and the first film was taken. More of the contrast was subsequently introduced & more exposures were done. A delayed film was done after 30 minutes. The patients were instructed to take paracetamol tablet in case they experienced pains. The exposed X-ray cassettes were slotted into Fuji Computed Radiography CR-IR 362 XG 5000 ~ R899x and processed. All the films were reported by a senior radiologist of 10 years post fellowship.

### Results

Out of the 239 patients studied, most (31.8%) were aged 31-35 years with the average age of  $32.6 \pm 6.0$ . Majority had tertiary level of education (64.0%), married (91.7%), Christians (97.0%), Unemployed (66.5%) and were Tiv (68.2%) by ethnicity (Table 1). On HSG findings, 53.6% had normal tubes bilaterally while 46.4% had one defect or the other (Table 2). Among the various degree of tubal anomalies were; bilateral non patent tubes (15.5%), right hydrosalpinx (8.4%), left hydrosalpinx (7.5%), left tubal occlusion

(5%), right tubal occlusion (3.3%), bilateral tubal occlusion and right hydrosalpinx (2.1%), right tubal occlusion/bilateral hydrosalpinx and right hydrosalpinx (1.3% each) and 0.4% for left tubal occlusion/bilateral hydrosalpinx, bilateral tubal occlusion/left hydrosalpinx, bilateral tubal occlusion/bilateral hydrosalpinx (Table 3). Women who had multiple sexual partners had more tubal abnormalities (10.1%) compare with those that had single sexual partners (5.4%). This was statistically significant (P=0.014). There was also a statistically significant relationship between prior STD and tubal abnormalities on HSG (STD > 6 months, P=0.004; STD <6 months, P<0.001). Similarly, those who did not use barrier contraceptives during their sexual relationships had more tubal abnormalities (P=0.005) (Table 4).

Variable	Frequency (N=239)	Percentage (100%)	
Age	20-25	25	10.5
	26-30	68	28.5
	31-35	76	31.8
	36-40	46	19.2
	41-45	20	8.4
	46-50	3	1.3
	Above 50	1	0.4
Education	None	16	6.7
	Primary	29	12.1
	Secondary	41	17.2
	Tertiary	153	64.0
Religion	Christianity	232	97.0
	Islam	3	1.3
	Others	4	1.7
Occupation	Trading	9	3.8
	Farming	37	15.5
	Worker	34	14.2
	*Others	159	66.5
Tribe	Igede	5	2.1
	Idoma	32	13.4
	Tiv	163	68.2
	Hausa/Fulani	12	5.0
	Igbo	22	9.2
	Yoruba	4	1.7
Marital Status	Single	17	7.1
	Married	219	91.7
	Cohabiting	1	0.4
	Divorced	2	0.8

**Table 1:** Social-demographic features of the patients.

\*Artisans, applicants, housewives, students.

HSG Finding	Frequency	Percentage (%)
Bilateral patent Tube (Normal)	128	53.6
Non-Patent Tubes (Abnormal)	111	46.4
Total	239	100.0

**Table 2:** Distribution of HSG findings into normal and abnormal.

HSG Finding	Frequency	Percentage (%)
Left Hydrosalpinx	18	7.5
Right Hydrosalpinx	20	8.4
Bil. Tubal Occlusion +RHS	5	2.1
Bil. Tubal Occlusion + LHS	1	0.4
Bil. Tubal Occlusion + BHS	1	0.4
Let Tubal Occlusion +RHS	2	0.8
Left Tubal Occlusion + BHS	1	0.4
Left Tubal Occlusion	12	5.0
Bilateral Hydrosalpinx	3	1.3
Right Tubal Occlusion + BHS	3	1.3
Right tubal Occlusion	8	3.3
Bilateral Patent Tube (normal)	128	53.6
Bilateral Non-Patent Tube	37	15.5
Total	239	100.0

**Table 3:** Frequency of the various HSG findings.

Key: RHS-Right Hydrosalpinx, LHS: Left Hydrosalpinx, BHS: Bilateral Hydrosalpinx.

Risk Factor	Normal Tubes N=128	Abnormal Tubes N=111	Total N=239	X <sup>2</sup> P-Value	
Sexual Partners	Single	115 (48.1%)	87 (36.4%)	212 (84.5%)	X <sup>2</sup> =5.13 P=0.014
	Multiple	13 (5.4%)	24 (10.1%)	27 (15.5%)	
	Total	128 (53.5%)	111 (46.5%)	239 (100.0%)	
STD (> 6 months)	No	7 (2.9%)	20 (8.4%)	27 (11.3%)	X <sup>2</sup> =8.13 P=0.004
	Yes	121 (50.6%)	91 (38.1%)	212 (88.7%)	
	Total	128 (53.5%)	111 (46.5%)	239 (100.0%)	
STD (< 6 months)	No	105 (43.9%)	55 (23.1%)	160 (67.0%)	X <sup>2</sup> =26.90 P=0.00001
	Yes	23 (9.6%)	56 (23.4%)	79 (33.0%)	
	Total	128 (53.5%)	111 (46.5%)	239 (100.0%)	
Barrier contraceptive use	No	59 (24.7%)	72 (30.1%)	131 (54.8%)	X <sup>2</sup> =7.72 P=0.005
	Yes	69 (28.9%)	39 (16.3%)	108 (45.2%)	
	Total	128 (53.6%)	111 (46.4%)	239 (100.0%)	

**Table 4:** Relationship between HSG findings and history of select risk factors.

## Discussion

The study found the prevalence of 53.6% for morphologically normal and patent tubes at HSG. This is comparable with the reports of 55.0% by Schankath et al. in Switzerland, 55.0% by Lawan et al. in Zaria, but higher than 45.2% in Sagamu by Olatunji et al. and 29.4% in Maiduguri by Bukar et al. [2,6,9]. The value of HSG as a tool in evaluating for uterine and tubal architecture during infertility treatment is not in doubt [3]. The specificity of HSG in diagnosing tubal abnormalities is said to be 83% [8].



**Figure 1:** Hysterosalpingography showing normal sized uterine cavity with associated bilateral patent tubes.



**Figure 2:** Hysterosalpingography showing bilateral contrast loculations in both tubes in keeping with bilateral hydrosalpinges.



**Figure 3:** Hysterosalpingography showing complete bilateral tubal block.



**Figure 4:** Hysterosalpingography showing contrast loculations in the distal parts of both tubes in keeping with perifimbrial adhesion.



**Figure 5:** Hysterosalpingography showing a capacious uterine cavity with bilateral non patent tubes. Complementary pelvic ultrasound confirmed the presence of myoma.

The study showed that 46.4% had abnormal fallopian tubes with one defect or the other. This is higher than reports of 38.5% in Thailand, 36.1% in Nepal and 33.6% in Sokoto north western Nigeria. It is however comparable with 45.0% reported in Zaria north central Nigeria, but lower than 54.8% reported in Sagamu, south western Nigeria and 70.6% in Maiduguri north eastern Nigeria [2,6, 9-11]. Similar to what have been reported in other studies, tubal occlusion and hydrosalpinx are the commonest pathology [6,11,12].

Bilateral tubal blockade (15.5%) was the commonest tubal pathology. This is similar to the findings of Mgbor and Adinma who reported 23.3% and 17.5% respectively [13]. Similarly, 17.7% and 18.7% were reported in Sagamu and Nnewi respectively for bilateral tubal blockade as the commonest pathology [18]. Mohammed et al. in Sokoto and Lawan et al. in Zaria however found right tubal blockade as the commonest pathology [11].

Right hydrosalpinx (8.4%) was commoner than left hydrosalpinx (7.5%) in our study. Bukar et al. also reported that right hydrosalpinx was commoner than the left in the study done in Maiduguri [9]. However, the study by Lawan et al. in Zaria reported that left hydrosalpinx was commoner. The finding in which the right is more affected than the left is in keeping with those of several other studies and may probably be due to the presence of the appendix on this side of the pelvis thereby increasing its predisposition to infections [6,9,11]. It is important to mention here that our study found various patterns of tubal pathology, in some cases, both tubal occlusion and hydrosalpinx occurring at the same time either unilaterally or bilaterally.

In this study, history of risky sexual behavior by the women was significantly related to tubal pathology. Women with multiple sexual partners (MSP) had more cases of tubal abnormalities ( $p=0.014$ ). Similarly, those who had STDs either several years ago or few months prior to the study were also more likely to have abnormalities of the tubes ( $p=0.004$  and  $0.00001$ ). Unprotected sexual intercourse which is absence of barrier method of contraceptive was also significantly related to tubal pathology. Igoh et al. in their study in Jos reported similar findings in which

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MSP, history of pelvic infection, delayed age at marriage, pelvic surgery and history of dilatation and curettage were related to tubal disease [4].

This is in agreement with previous studies which sufficiently demonstrated the link between sexually transmitted infections and tubal damage [1,7,12,14]. Pelvic inflammatory disease (PID) is said to be the leading cause of tubal scarring and subsequent blockade thereby making the woman infertile [4]. Although a lot of infertile women do not report histories suggestive of PID [4]. Studies have reported that peritubular adhesions are responsible for 30-50% of female factor infertility [4,12].

It is estimated that 11% of women with tubal factor infertility would have had an episode of PID in the past. This chance will increase to 23% for two episodes and 54% for three episodes of PID [4]. Offending pathogens such as chlamydia trachomatis, trichomonas vaginalis, bacterial vaginosis, candida albicans, and a host of micro-organisms have been implicated as causative agents for tubal damage [3,15].

Although majority (70.8%) of the women were 35 years or less with the age group of 31-35 years having the highest number of women (31.8%), it was interesting to note that 10.5% were as young as 20-25 years in age. With decreasing age at sexual debut, reducing morals, cultural modifications, liberal theologies, influence of social media, poverty, illiteracy, polygamy among several other reasons, young people particularly indulge in risky sexual behaviours that can endanger their reproductive potentials [6,17,18]. Sexual intercourse at an early age, unprotected sex and multiple sex partners are known factors that exposes women to acquiring STDs including HIV/AIDS, unwanted pregnancies and subsequent induced abortions with its attendant complications [18,19].

Unfortunately, in Africa marriages are contracted early and for the sole purpose of childbearing [1]. Once this expectation of childbirth is not met, marital disharmony with its attendant complications sets in. Again, for these women to have presented in their thirties and even above, suggests that they would have tried in so many ways to overcome the challenge of fertility and were still desperate to get solution before it becomes absolutely late to conceive naturally [1]. It is with this backdrop that every effort must be made to protect the reproductive capacity of women within the reproductive age [20].

It is therefore important that campaigns for sexual purity such as abstinence before marriage and faithfulness to one's sexual partner in a marital relationship should be sustained. Availability, accessibility and affordability of youth friendly reproductive services should be pursued with vigor. The government, non-governmental organizations (NGO), parents, religious bodies and traditional leaders have a crucial role to play in this matter [19,21].

The usefulness of HSG in assessing tubal patency and abnormalities of the tube in infertility evaluation cannot be overemphasized [7].

Among several other imaging modalities to tubal examination, HSG stands out for its simplicity, availability, cost effectiveness, safety and rapidity of results [22]. It has been reported that HSG has a sensitivity of 85-100% in identifying tubal blockade [13]. It is used as a screening test in most countries before laparoscopy though the two are complimentary [23,24]. The draw backs against HSG are the use of ionizing radiation, reaction to contrast media, bleeding, discomfort to patients which in some cases maybe severe especially if analgesics and antispasmodic drugs are not administered [12].

### **Conclusion**

Abnormalities of the tube were 42.3%. Tubal abnormalities were significantly related to unprotected sex, multiple sex partners and history of STD. Sex education and modification of sexual lifestyle will help protect fertility of women.

### **Limitation of the Study**

Microbiological tests would have been conducted on the women to ascertain their claim of STDs to be sure what they treated in the past was pelvic infections. We are not sure whether the use of condoms during sex was regular and correctly done by those who were in unstable relationships.

### **Recommendations**

The government should ensure availability, accessibility and affordability of reproductive health commodities to the populace. There should be sustained collaboration with NGOs and other Stakeholders in the campaign and provision of reproductive health services. Deliberate efforts should be made by health experts to educate the masses on healthy sexual behaviours. Pelvic infections should be diagnosed and treated quickly to avoid infertility.

### **Ethical consideration**

Ethical clearance was obtained from the ethical committee and due diligence was done to ensure confidentiality, privacy and safety of all subjects who participated in the study.

### **References**

1. Botwe BO, Bamfo-Quaicoe K, Hunu E, et al. Hysterosalpingographic findings among Ghanaian women undergoing infertility work-up: A study at the Korle-Bu teaching Hospital. *Fertility Research and Practice*. 2015; 1: 9.
2. Lawan RO, Ibinaiye PO, Onwuhafua P, et al. Evaluation of Pattern of Tubo-peritoneal Abnormalities Potentially Responsible for Infertility in Zaria, Nigeria: Hysterosalpingographic Assessment. *Afr J Med*. 2015; 2: 110-116.
3. Schankath AC, Fasching N, Urech-Ruth C, et al. Hysterosalpingography in the workup of female infertility: Indications, technique and diagnostic findings. *Insight Imaging*. 2012; 3: 475-483.
4. Igoh EO, Chom ND, Pam SD, et al. Risk factors for abnormal tubal hysterosalpingographic findings in women presenting with infertility in Jos. *Jos J Med*. 2015; 9: 47-52.

5. Bhattarai M, Ghimire SP. Hysterosalpingographic Evaluation of Uterus and Fallopian Tubes of Infertile Women. *Journal of Nobel Medical College*. 2017; 6: 63-71.
6. Olatunji AA, Jagun OE, Toyobo OO, et al. Hysterosalpingogram findings among women with infertility in Ogun State, Nigeria. *Ann of Health Res*. 2017; 3: 75-81.
7. Simpson WL, Beitia LG, Mester J. Hysterosalpingography: A Reemerging Study. *Radio Graphics* 2006; 26: 419-431.
8. Ahmed SA, Abo-taleb H. The validity of HSG in infertility work up. *Egyptian Journal of Radiology and Nuclear Medicine*. 2019; 50: 63.
9. Bukar M, Mustapha Z, Takai UI, et al. Hysterosalpingographic findings in infertile women: A seven year review. *Nig J Clin Pract*. 2011; 14: 168-170.
10. Nampakdianan K, Kietpeerakool C, Chongpensuklert Y. Abnormal Hysterosalpingographic Findings in Infertile Women. *Thai J Obstet Gynaecol*. 2016; 24: 209-215.
11. Danfulani M, Mohammed MS, Ahmed SS, et al. Hysterosalpingographic findings in women with infertility in Sokoto, North Western Nigeria. *Afr J Med Health Sci*. 2014; 13: 19-23.
12. Taskin EA, Berker B, Ozmen B, et al. Comparism of hysterosalpingography and hysteroscopy in the evaluation of uterine cavity in patients undergoing assisted reproductive techniques. *Fertility and Sterility*. 2011; 96: 349-352e.
13. Kumari TM, Swetha A, Sangabathula H. A Study on Role of Hysterosalpingogram (HSG) in Evaluation of Female Infertility. *Int J Contemp Med Surg Rad*. 2017; 2: 164-166.
14. Le MT, Nguyen TLN, Le DD, et al. Is genital tract infection related to tubal diseases in infertile Vietnamese women? *J Infect Dev Ctries*. 2019; 13: 906-913.
15. den Hartog JE, Lardenoije CMJG, Severens JL, et al. Screening strategies for tubal factor subfertility. *Human Reproduction*. 2008; 23: 1840-1848.
16. Asante KO, Nketiah-Amponsah E, Andoh-Arthur J, et al. Correlates of Early Sexual Debut Among Sexually Active Youth in Ghana. *International Quarterly of Community Health Education*. 2018; 39: 9-17.
17. Yaya S, Bishwajid G. Age at first sexual intercourse and multiple sexual partnerships among women in Nigeria. A cross-sectional analysis. *Front Med*. 2018; 5: 171.
18. Isiugo-Abanihe UC, Erinosh O, Ushie B, et al. Age of Sexual Debut and Patterns of Sexual Behaviour in Two Local Government Areas in Southern Nigeria. *Afr J Reprod Health*. 2012; 16: 81-94.
19. Fetene N, Mekonnen W. The prevalence of risky sexual behaviors among youth center reproductive health clinics users and non-users in Addis Ababa, Ethiopia: A comparative cross-sectional study. *PLoS ONE*. 2018; 13: e0198657.
20. Perera AUP, Abeysena C. Prevalence and associated factors of risky sexual behaviors among undergraduate students in state universities of Western Province in Sri Lanka: a descriptive cross sectional study. *Perera and Abeysena Reprod Health*. 2018; 15: 105.
21. Tarkang E, Pencille L, Amu H, et al. Risky sexual behaviours among young people in sub-Saharan Africa: how can parents use the Ottawa Charter for Health Promotion for change? *Journal of Social Aspects of HIV/ AIDS*. 2019; 16: 77-80.
22. Khetmalas SM, Kathaley MH. A Study Evaluation of Tubal Factors of Infertility by Hysterosalpingography and Diagnostic Laparoscopy. *MVP Journal of Medical Sciences*. 2016; 3: 11-17.
23. Verhoeve HR, Steures P, Flierman PA, et al. History of induced abortion and the risk of tubal pathology. *Reproductive Bio Medicine Online*. 2008; 16: 304-307.
24. Aziz MU, Anwar S, Mahmood S. Hysterosalpingographic evaluation of primary and secondary infertility. *Pak J Med Sci*. 2015; 31: 1188-1191.