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ORIGINAL

Hysterosalpingography Investigation Versus Patients' Radiation Dose Risk

Investigación de la histerosalpingografía frente al riesgo de dosis de radiación de las pacientes

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ABSTRACT

Background: Hysterosalpingography (HSG) is a useful radiographic investigation involving the use of contrast medium for the management of infertility in females. It is however, not only a costly procedure but it is also a semi-invasive procedure and carries some radiation risks. One principle of radiation protection is justification of practice which means that the overall benefit of the procedure should outweigh the radiation risks. The aim of this study was to determine justification of HSG procedure by assessing the rate and pattern of pregnancy success among infertile women who underwent HSG procedures at a tertiary hospital in South Eastern Nigeria between 2016 and 2020.
Methods: a retrospective cross-sectional study of a sample of 222 women, aged 20-46years (mean 32,55 ±8,16years) who underwent HSG examination at the hospital between 2016 and 2020 was made. The data of eligible subjects were collected from the archives of radiology department of the hospital.
Results: The result showed that 121 (54,5 %) out of 222 of the patients achieved pregnancy with proper follow up infertility management. Of the 121, 48(39,67 %) were in the 25-29 years age group and 35(28,93 %) in the 30-34years age group. The commonest pathology found was uterine fibroid 71(32,0 %), followed by tubal blockage, 42(18,92 %) while the least occurring pathology was salpingitis isthmica nodosa 1(0,45 %).
Conclusion: there was a strong positive correlation between the age of patient, the HSG findings and the rate of pregnancy success. The procedure is justified in all the age groups except for the >45years group.

Key words: Hysterosalpingography; Infertile Women; Pregnancy; Radiation Dose; Radiation Risk; Tertiary Hospital; Southeast; Nigeria.

RESUMEN

Antecedentes: la histerosalpingografía (HSG) es una investigación radiográfica útil que implica el uso de un medio de contraste para el tratamiento de la infertilidad en las mujeres. Sin embargo, no sólo es un procedimiento costoso, sino que también es un procedimiento semiinvasivo y conlleva algunos riesgos de radiación. Uno de los principios de la protección radiológica es la justificación de la práctica, lo que significa que el beneficio global del procedimiento debe superar los riesgos de la radiación. El objetivo de este estudio fue determinar la justificación del procedimiento de HSG mediante la evaluación de la tasa y el patrón de éxito del embarazo entre las mujeres infértiles que se sometieron a procedimientos de HSG en un hospital terciario en el sudeste de Nigeria entre 2016 y 2020.

Métodos: se realizó un estudio transversal retrospectivo de una muestra de 222 mujeres, con edades comprendidas entre 20 y 46 años (media de 32,55 ± 8,16 años) que se sometieron a un examen HSG en el hospital entre 2016 y 2020. Los datos de los sujetos elegibles se recogieron de los archivos del departamento de radiología del hospital.
Resultados: el resultado mostró que 121 (54,5 %) de 222 de las pacientes lograron el embarazo con un seguimiento adecuado de la gestión de la infertilidad. De las 121, 48 (39,67 %) pertenecían al grupo de edad de 25-29 años y 35 (28,93 %) al de 30-34 años. La patología más frecuente fue el mioma uterino 71 (32,0 %), seguido de la obstrucción tubárica 42 (18,92 %), mientras que la patología menos frecuente fue la salpingitis ístmica nodosa 1 (0,45 %).
Conclusiones: existe una fuerte correlación positiva entre la edad de la paciente, los resultados de la HSG y la tasa de éxito del embarazo. El procedimiento está justificado en todos los grupos de edad excepto en el de >45 años.

Palabras clave: Histerosalpingografía; Mujeres Infértiles; Embarazo; Dosis de Radiación; Riesgo de Radiación; Hospital Terciario; Sudeste; Nigeria.

INTRODUCTION

Hysterosalpingography (HSG) is a vital radiographic examination of the uterine cavity, fallopian tubes, and adjacent peritoneal cavity in the management of female infertility.

Infertility is defined as the inability of a woman to achieve pregnancy after a year (12months) of regular unprotected sexual intercourse. Infertility affects about 15 % of couples world over while about 30 % of women in sub-Sahara Africa are affected by infertility.[1,2] Both male and female factors can cause infertility. In females the factors could be due to uterine, ovarian or tubal pathology. The primary role of HSG is to evaluate the morphology of the uterine cavity and the patency of the fallopian tubes in infertile women.

Ideally HSG is a fluoroscopy procedure but in many hospitals and radiodiagnostic centres in Nigeria, it is carried out blind (ie without fluoroscopy), because of absence of fluoroscopy equipment in many centres and frequent equipment breakdown in the few centres that have.

Despite the advent of other diagnostic tools such as magnetic resonance imaging (MRI), hysteroscopy and laparoscopy, HSG has still gained wide acceptance as the next line procedure for evaluation of female fertility after ultrasonography. This is because HSG can give useful information for the detection of factors affecting fertility such as tubal patency, polyps, submucosal leiomyoma, synaechiae, Mullerian anomalies, salpingitis, isthmica nodosum and peritubal adhesions.[3] It also plays vital roles in the diagnosis of uterine cavity abnormalities and in the planning of treatments for gynaecological conditions such as intrauterine adhesions and congenital anomalies. It has been claimed that the chance of pregnancy increases after HSG has been performed especially with the water soluble contrast agents.[4] In a study of 411 infertile women Adrian et al.[2] reported that HSG was pathological in 86. Follow-up revealed that among the 86 patients there were 27 pregnancies resulting in 19 healthy children and eight miscarriages. In another study of 294 infertile women by Rasmussen et al.[5] 21 % achieved pregnancy six months after HSG with eight percent (8 %) having spontaneous pregnancy.

Although HSG is very useful in the management of female infertility, it has some risks that go with it. Such risks include radiations risks, risk of infection, risks of extravasation of contrat medium used and the possibility of embolism especially with the oil-contrast medium, risk of uterine perforation, haemorrhage, and severe allergic reactions to contrast agents and so on. The procedure is also costly, invasive and interferes with the woman's privacy. Of these risks the radiation risk appeared to receive more studies. In a study of patients' radiation doses during HSG procedures in four radiology centres in South-West Nigeria, Achuka et al.[1] reported mean entrance skin doses (ESD) of 18,58± 6,31mGy, 15,18± 2,27mGy, 17,44 ± 3,43mGy and 34,24 ± 11,98mGy respectively with corresponding effective doses of 1,54 ± 0,63mSv, 1,24 ± 0,28mSv, 1,41 ± 0,30mSv and 2,53 ± 0,94mSv. Each of the reported effective doses here is higher than the recommended annual effective dose of 1mSv ICRP.[6] In same study Achuka et al[1] reported respective mean organ doses for the centres as: ovary(3,51mGy, 2,81mGy, 2,96mGy, 5,54mGy), uterus (4,35mGy, 3,49mGy, 3,87mGy, 6,95mGy) and urinary bladder (8,98mGy, 7,23mGy, 8,31mGy, 14,46mGy). Other studies also showed that ESD ranging from 3-28,9mGy, organ doses ranging from 1,7- 2,8mGy with cancer risks of 2,4 -5,5 x 10^{-5} were received by HSG patients.[7,8,9] Because of these, it becomes pertinent to assess the pregnancy success rate and the pattern so as to ascertain the rationale for the procedure and determine which group of women benefits most from the procedure.

Therefore, this study assessed the pregnancy success following HSG procedures in tertiary hospital in South-Eastern Nigeria and the pattern of pregnancy success among the women. This is important because HSG procedures have been going on in the hospital but there was no known study that accessed whether the benefits

from the procedure actually outweigh the possible radiation risks to the patients.

MATERIALS AND METHODS

This is a retrospective cross-sectional survey involving data from a sample of 222 patients who underwent HSG at the radiology unit of the hospital between 2016 and 2020. The sample size was drawn from a population of 498 patients who underwent HSG examinations in the hospital within the period using Taro Yamane formula. [10]

A convenience sampling technique was used to enlist patients whose records met the inclusion criteria which include either primary or secondary infertility, HSG results of patients with complete data (patient's age, hospital number, x-ray number, provisional diagnosis, date of investigation, radiologist report). With the patients' hospital numbers, their folders were traced at the Medical Records Unit and Antenatal Unit of the hospital to ascertain the treatment outcome. Institutional Ethical Approval (NAUTH/CS/66/VOL.15/VER.3/02/2022/349) was obtained. Data was analyzed using the Statistical Package for Social Science (SPSS) version 23.0(IBM Corp. Armonk, NY, USA, 2015). Descriptive statistics of mean, standard deviation, frequencies and percentages were used. The study lasted from March to May, 2022.

RESULTS

Table 1 shows that there was a decreasing trend in the number of HSG examinations from 2016- 2020. Table II shows that uterine fibroid 71(32 %) was the commonest pathology on HSG, followed by tubal blockage 42(19 %) and uterine adhesions 41(18,5 %) of the total subjects.

From table 3 is seen that greater number of patients in the age 30-34 underwent HSG during the period, followed by patients in the 35 – 44 year age group but more pregnancy was recorded in the 25-29 age group. No pregnancy was achieved by patients in the >45 years age group.

Table 4 below gives the distribution of HSG findings and the number of subjects that achieved pregnancy after proper infertility treatment and follow up ante -natal care management. From the table it can be seen that 46 patients had normal HSG findings (patent fallopian tubes). Out of this, 37(80,43 %) achieved pregnancy. Uterine fibroid was the most frequent pathology diagnosed in 71 patients out of which 40(56,34 %) were able to achieve pregnancy. No pregnancy was achieved in the patients diagnosed of Ashermann's syndrome and salpingitis isthmica nodosa. Of the 41 patients diagnosed of endometrial adhesion, only one patient (2,43 %) achieved pregnancy. Overall 121(54,5 %) of the 222 patients were able to achieve pregnancy after HSG and follow-up treatments.

Table 1. Distribution of number of HSG examinations over the study period

Year	Frequency	Percent %
2016	75	33,8 %
2017	49	22,1 %
2018	45	20,3 %
2019	33	14,9 %
2020	20	8,90 %
Total	222	100

Table 2. Distribution of HSG findings according to age of patients

Findings of HSG	20-24 years	25-29 years	30-34 years	35-39 years	40-44 years	>45years	Total
Tubal blockage	8	8	15	10	1	0	42
Patent fallopian tube	7	11	12	13	0	3	46
Adhesions	5	9	16	11	0	0	41
Asherman's syndrome	0	1	3	2	0	0	6
Uterine fibroid	3	19	25	20	3	1	71
Hydrosalpinx	0		5	1	0	0	8
Adenemyosis	0	2	0	2	0	0	4
Isthmica nodosa	0	0	1	0	0	0	1
Arcuate uterus	0	2	1	1	0	0	4
Bicornuate uterus	0	1	1	0	0	0	2
Total	23	55	79	60	4	4	225

Table 3. Distribution of pregnancy success according to patients' age

Age (years)	Total Number	Number pregnant	Percentage pregnant	
			% of total subjects	% of pregnant group
20- 24	10	7	3,15	5,78
25 - 29	52	48	21,62	39,67
30 -34	80	35	15,77	28,93
35- 39	68	28	12,61	23,14
40- 44	8	3	1,35	2,48
>45	4	0	0	0
Total	222	121	54,5	100

Table 4. Distribution of pregnancy according to HSG findings

HSG findings	Frequency	No pregnant (%)
Adenomyosis	4	1 (25)
Adhesions	41	1 (25)
Arcuate Uterus	4	3 (75)
Asherman's Syndrome	6	0 (0)
Bicornuate uterus	2	2 (100)
Hydrosalpinx	8	7 (87,5)
Patent Fallopian Tube	46	37 (80,43)
Salpingitis IsthmicaNodosa	1	0 (0)
Tubal Blockage	42	30 (71,43)
Uterine Fibroid	71	40 (56,3)
Total	222	121 (54,5 %)

DISCUSSION

The mean age of patients in our study was 32,55 ± 8,16 years (range 20 –46 years). Normal HSG findings were made on 46 patients leaving 176 with abnormal findings. One hundred and twenty one (121) patients representing 54,5 % of the total 222 patients and 68,75 % of the patients with abnormal HSG findings conceived following adequate follow up infertility management and ante-natal care. Pregnancy was more among the 25-29years and 30 – 34 years group despite the pathologies were more in those groups. This suggests some other factors such as hormonal effects play greater role in achieving pregnancy. The rate of pregnancy success in our study was higher that was reported in a study by Adrian et al.[2] where only 25(29,07 %) of the patients with abnormal HSG results achieved pregnancy. Since the patient' ages in our study and theirs was similar (mean/ range,32,55/20-46 years and 32,6/22–42 years respectively) the difference in achieving pregnancy could be due to difference in the mode of management of the patients. The rate of pregnancy in our study was also higher than the 21 % reported by Rasmussen et al.[5] and 26 % reported by Maheux-Lacroix et al.[11] Among the eight patients in the 40 – 44 years age group, HSG showed no patent fallopian tube but follow-up treatment resulted in pregnancy in three of them. The most reasonable explanation is that HSG gave a false negative result possibly as a result of spasm. Of the four patients in the >45 years group, no pregnancy was achieved despite the fact that HSG demonstrated normal patent fallopian tube in three of them and fibroid mass in one. The failure to conceive may be due to other infertility factors such as hormonal, possibly as a result of age. The implication is that radiation exposure of such patients during HSG is not justified. Other means of getting children such as child adoption is an option. The high number of pregnancy among patients with abnormal HSG findings suggests that HSG has therapeutic effects as reported by researchers.[4,5]

Limitations of the study

1. There was no documentation of radiation dose received by patients at our study hospital. So patient's dose was based on reports by researchers from other hospitals. It is known that patients' dose can vary among hospitals.
2. This study did not classify the ability to conceive in relation to age and pathological findings which would have helped in given better advice to infertile women coming for HSG.

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CONCLUSION

Among the 222 patients that underwent HSG during the period covered by our study, 121(54,5 %) achieved pregnancy after the procedure. Pregnancy occurred in the 25-29 years; 30-34years and 35-39years age groups despite that pathology were seen on the HSG results. This suggests that HSG has some therapeutic effects. The absence of pregnancy in the > 45 year age group when the only pathology in the group was fibroid seen on one patient implies that the radiation exposure to such patients in that age group during HSG is not justified. Such patients should explore other means of getting children, such as child adoption.

REFERENCES

1. Achuka J.A, Aweda M.A, Usikalu M.R, Aborisade C.A. Assessment of Patient Absorbed Radiation Dose during Hysterosalpingography: A Pilot Study in Southwest Nigeria. Journal of Biomedical Physics and Engineering 2020; 10(2);131-140. Doi: 10.31661/jbpe.v0i0.1054

2. Adrian C. Schankath, Nikola Fasching, Cornelia Urech-Ruh, Michael, K. Hohl, Rahel A. Kubik-Huch. Hysterosalpingography in the workup of female infertility: indications, technique and diagnostic findings. Insight Imaging 2012; 3(5): 475 – 483. Doi: 10.1007/s13244-012-0183-y.

3. Simpson, W.l, Beitial G, Mester J. Hysterosalpingography: a reemerging study. Radiographics 2006; 26(2): 419-31.

4. Cundiff G, Carr B.R, Marshbum P.B. Infertile Couples with normal Hysterosalpingography: Reproductive Outcome and its Relationship to Clinical Laparoscopic findings. Journal of Reproductive Medicine 1995; 40(1): 19-24.

5. Rasmussen Finn, Justesen P, Tonner-Nielsen D. Therapeutic Value of Hysterosalpingography with Lipiodol UltraFluid. Acta Radiologica 2010; 28(3): 319-322.

6. ICRP- International Commission on Radiological Protection, 2008, ICRP Publication 103: Recommendations of the ICRP: Annals of the ICRP 37: 2-4.

7. Plejas V.Darko, Zivkovij M. Monika, Ciraj-Bjelac F. Olivera. Radiation Dose and Risk Assessment in Hysterosalpingography. Nuclear Technology and Radiation Protection, 2010; 25(3): 217- 221. DOI:10.2296/NTRP1003217P

8. Yousef Mohamed, Tambul Jamaa, Sulieman Abdelmoneim. Radiation Dose Measurements during Hydrosalpingography. Sudan Medical Monitor 2014;9(1):15-18

9. Sulieman A, Theodorou K, Vlychou M, Topaltzikis T, Roundas C, Fezoulidis I, Kappas C. Radiation Dose Optimization and Risk Estimation to Patients and Staff During Hysterosalpingography. Radiation Protection Dosimetry 2007; 2007:1-10. Doi: 10.1093/rpd/ncm324

10. Uzoagulu A. E. Practical Guide to Writing Research Project Reports in Tertiary Institutions. New edition. Enugu, Cheston Ltd.2011; 57-58.

11. Maheux-Lacroix Sarah, Bergeron Catherine, Moor Lynne, Bergeron Marie-Eve, Lefebvre Jessica, Grenier-Oullette Iseult, Dodin Sylvie. Hysterosalpingosonography Is not as Effective as Hysterosalpingography to increase Chances of Pregnancy. J. Obstet gynaecol Can 2019. 41(5): 593 – 598. Doi: 10. 1016/j-jogc-2018.10.001

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

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