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ORIGINAL ARTICLE

HYDROSONOSALPINGOGRAPHY: A NOVEL, LESS INVASIVE OUTDOOR PROCEDURE

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ABSTRACT: OBJECTIVE: To find out whether hydrosonosalpingography, which is a less invasive method, can be used for assessment of tubal factor in cases of primary and secondary infertility initially instead of the invasive methods like hysterosalpingography and diagnostic laparoscopy with chromopertubation. **METHODS:** A total of 100 patients, 72 with primary infertility and 28 with secondary infertility, attending our clinic were studied from June 2014 to January 2015. All patients underwent sonosalpingography, hysterosalpingography, and laparoscopic chromopertubation. **RESULTS:** Hydrosonosalpingography has 97.3% sensitivity and 92% specificity in comparison to hysterosalpingography which has 94.6% sensitivity and 84% specificity. Also endovaginal ultrasound with hydrosonosalpingography was more efficient in detecting pelvic pathologies in contrast to hysterosalpingography. **CONCLUSION:** As sonosalpingogrpahy has high sensitivity and specificity and is less invasive. It should be used initially to assess tubal patency in cases of infertility.
KEYWORDS: Endometrium, Endovaginal sonography, fallopian tube, infertility, oligospermia.

INTRODUCTION: With the increasing incidence of sexually transmitted diseases and other pelvic inflammatory disease (PID), incidence of tubal factor of infertility is on the rise. Amongst all the causes of infertility, the tubal factor is responsible for almost 25-30% of female related factors. But its incidence varies from country to country. In India it has been estimated to be about 40%.[1] Because of prevalence of PID (due to poverty, non-hygienic practice, illiteracy) and tuberculosis in our country, incidence of tubal factor is high in both primary and secondary infertility cases. People were in search of a method to know tubal patency, since quiet a long time. It was Sir Rubin (1920), who used for the first time CO_2 to know patency of tubes. Latter on more and more accurate method[2] like hysterosalpingography (HSG) and Laparoscopic Chromopertubation (LCPT) came in picture with their own merits and demerits.

But one point is very important to consider, while treating an infertile couple. We should always make an effort to make the "infertility investigation protocol" simple, cost effective and at the same time more compliant to the patient (to reduce the number of visits to infertility clinic). Endovaginal sonography (EVS) + hydrosonosalpingography (HSSG) is an efficient step in that direction.

In "first round" along with other noninvasive investigations (seminal fluid examination, routine tests and some clinically concerned hormonal analysis) with the help of endovaginal sonography and HSSG we can get a lot of information in a single sitting like tubal patency, pelvic anatomy other associated pelvic and ovarian pathologies. If planned appropriately around 12th day of cycle we can know about ovulation by visualizing dominant follicle.

So here in this study we evaluate the efficacy of HSSG with other two established methods, HSG and LCPT. LCPT has been taken as a reference method.

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OBJECTIVE: To find out whether hydrosonosalpingography, which is a less invasive method, can be used for assessment of tubal factor in cases of primary and secondary infertility initially instead of the invasive methods like hysterosalpingography and diagnostic laparoscopy chromopertubation.

MATERIAL AND METHODS: This study was conducted over 100 patients of primary or secondary infertility between October 2013 to 15th February 2015. All patients were subjected to very detailed history and clinical examination. All routine investigations along with ECG and chest X-Ray was done. Semen analysis and concerned hormonal estimations were also carried out in all patients. Patients with clinical evidence of PID and/or male partner with oligospermia (sperm count < 15 million/ml) were not included in the study.

All women underwent HSG, HSSG and diagnostic laparoscopy. The tests were conducted over a period of two months during follicular phase. Subsequent analysis of collected data was done to compare the three methods of tubal patency.

PROCEDURE FOR HYDROSONOSALPINGOGRAPHY: The procedure was explained to patient and informed consent obtained. Injection drotavertine hydrochloride 1 amp (40mg) i.m. given 30 minutes before procedure (To avoid cornual spasm. Also given before HSG, in all cases)

Initially a routine endovaginal examination was done to study detailed pelvic anatomy including study of endometrium (thickness and pattern) and ovaries. This also excludes any fluid in the cul-de-sac already present. All endovaginal sonograms were done by Siemens G50 color doppler scanner. 7.5Mz phased array endovaginal transducer was used.

Cervix was visualized with speculum and cleaned by an antiseptic solution. Under aseptic precaution no.8 foley's catheter was inserted transcervically just beyond the internal os and 3 ml of normal saline was injected into the foley's bulb, thus stabilizing the catheter within the uterine cavity. Speculum was removed and endovaginal probe (Covered with endovaginal probe cover and ultrasonic gel) was reinserted with marker pointing anteriorly towards pubic symphysis. The uterus was scanned systematically in sagittal and coronal plane to delineate the entire endometrial cavity once again. Then we concentrated on area between right cornua of uterus and right ovary. Normal saline, ciprofloxacin and hydrocortisone mixture was pushed through the foley's catheter (Fig. 1). In case of patent tube, saline mixture gushed past the ovary to give rise to "water fall" sign with accumulation of fluid around ipsilateral adnexa. On color flow map rainbow like colorful flow was observed, around ipsilateral adnexa, simultaneously with injection of saline. On stopping the instillation of saline the rainbow pattern vanished.

Procedure was repeated on the other side.

INTERPRETATION:

1. Positive water fall sign (rainbow pattern) on both sides indicates patency of both tubes. (Fig. 2)
2. Unilateral positive waterfall sign (rainbow pattern) suggests that at least this particular tube is patent. (Fig. 3, 4)
3. Even if we cannot see waterfall sign on either side, presence of fluid in the cul de sac on injection of saline indicates, patency of at least one of the tubes. (Fig. 5)

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4. Bilateral absence of waterfall sign (rainbow pattern) and no collection in POD almost always indicates bilateral tubal block. (Fig. 6)

Post-procedure analgesia (Injection Diclofenac l amp i.m.) was needed in all cases of bilateral/unilateral tubal blockade. A course of prophylactic antibiotic was given (Doxycylin 100 mg b. d. for 10 days) following the procedure.

Procedure for Hysterosalpingography: HSG was performed using a water soluble contrast medium (76% urograffin). Photographs were taken at the instant when the uterine cavity and tubes were filled with opaque material and when overflow was seen at both sides of the tubes or when maximal filling was observed without any overflow. After 30 minutes a late film was also taken. HSG findings were classified as having no tubal occlusion (by visualising peritoneal spillage from both tubes), one sided tubal occlusion or both sided tubal occlusion. Additional abnormalities of the uterine cavity was noted as well.

Procedure for Laparoscopy: This was done for each case, under general anaesthesia. Twenty ml of 0.5% methylene blue were injected using cervical cannula to test tubal patency by visualizing the bluish fluid staining the uterine cavity and tubes and dye coming out from the fimbrial end of both tubes.

RESULT: In our study, maximum patients (42%) were between the age group 26-30 yrs (Table1/ Fig. 7) and maximum, 72% of patients were of primary infertility (Table2/ Fig. 8).

Out of 75 patients with bilateral patent tubes (detected by LCPT) HSSG detected 73 patients and HSG detected 71 patients. Six patients had bilateral tubal blockage as detected on laparoscopy. Three patients were falsely diagnosed to have bilateral tubal blockage by HSG and one patient was falsely diagnosed by HSSG (Table 4/ Fig. 9).

HSSG has 97.3 % sensitivity, 92% specificity for the diagnosis of patent tubes while HSG has 94.6% sensitivity and 84% specificity (Table 4/ Fig. 10)

Table 5 shows that EVS with HSSG was more efficient in diagnosis of associated pelvic pathologies than HSG. Also, LCPT, of course a gold standard method, but we can't evaluate endometrium, endometrial cavity by LCPT, which we can do by HSSG.

DISCUSSION: Result of HSSG and HSG when compared with LCPT it was found that sensitivity and specificity of HSSG was more than HSG. In their study Kore et al[1] found that when results of HSSG were compared with those of laparoscopy 97% correlation was noted whereas there was 93% correlation between the results of HSSG and HSG.

Ultrasound visualization of the internal genital tract using exogenous contrast medium was first described by Nannini et al,[3] Richman et al[4] and Randolph et al[5] who performed abdominal sonography after intracervical injection of fluid.

In our study we performed HSSG with high frequency endovaginal probe (7.5 MHz). Because of closeness to target organ and high frequency probe, EVS gives superb resolution and detail of soft tissue. We have used color doppler in our study, which had created "Rainbow pattern" simultaneously with injection of saline, due to turbulence of fluid. Sometimes turbulence of fluid content inside the gut lumen, nearby adjacent ovary creates the false picture of positive water fall sign on gray scale.

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But on color doppler this will not produce "rainbow pattern" simultaneous with injection of saline mixture. So color doppler helps in the differentiation between two. However HSSG can be performed on gray scale only USG machine. Individual variation in the result, sometimes depends on expertise of the person performing study and resolution of machine also. Sharma[6] also did abdominal sonography for detection of tubal pathology with limited success. In transabdominal ultrasound, resolution always remain less in comparison to EVS. Abdominal sonography requires full bladder which is sometimes troublesome for the patient.

HSSG was very accurate in the diagnosis of bilateral block. In cases of bilateral block, during instillation of medicated saline, distension of the uterine cavity was noted above the foley's bulb with simultaneous complain of sharp acute pain in the lower abdomen by the patient and reflux was seen very clearly within the stem of foley's catheter with slight withdrawal of the probe. With further instillation of saline in such a case of bilateral block, no water fall sign on either side was noted nor any collection in cul-de sac was seen and foley's bulb was found collapsed due to pressure created by collected saline in the uterine cavity. In some cases the bulb slipped down from internal os in to the vagina.

At this moment, dilated uterine cavity (Sonohysterography[7]) gives a clear, contrast view of uterine cavity and endometrial lining and any submmcous fibroid or polyp can be easily diagnosed against anechoic saline media. In our study also, we diagnosed submucous fibroid in 5 cases and endometrial polyp in 4 cases.

HSSG diagnosed bilateral patent tubes in 73cases, whereas by LCPT, bilateral patency was found in 75 cases. In one case, in HSSG, no waterfall sign was noted on the left side. In laparoscopy it was found that on the left side, ovarian ligament was very short and ovary was found adhered with posterior surface of the uterus with surrounding flimsy peritubal adhesions. And this was the reason that in HSSG, we could not visualize waterfall sign on the left side. But collection in cul de sac and right sided waterfall sign was noted on HSSG.

In HSSG bilateral waterfall sign confirms patency of tubes bilaterally and investigation for tubal patency ends here. Bilateral absence of waterfall sign and absence of collection in cul de sac almost always confirms bilateral tubal block. After diagnosis of bilateral tubal block by HSSG, we should then confirm it by more invasive method like LCPT. Even unilateral water fall sign and/or presence of fluid in cul de sac confirms at least unilateral patent tube and for time being we can concentrate on other causes of infertility. And as per study by Kore et al[1] other tubal patency test should be deferred for at least 6 month in patient with at least one patent fallopian tube.

In HSG bilateral block was noted in 9 cases, whereas it was in 6 cases in LCPT. This could be probably due to cornual spasm. But resulting discrepancy due to cornual spasm was not noted in HSSG. Exact explanation is not possible but probably could be contrast (urograffin) induced. It could be possible that effect of spasm in HSSG is less as saline was probably injected under relatively high pressure. In HSG right side of tube was patent in 11 cases, whereas in LCPT it was in 12 cases. Left side was patent in 9 cases in HSG, whereas it was in 7 cases in LCPT. This non-correlation was probably due to extravasation of dye in HSG and misinterpretation.

HSG has certain disadvantages like 1) it exposes the patient to radiation ii) some-times dye causes allergic manifestations iii) detects only the endotubal pathology. Acute PID or cervicitis, known hydrosalpinx and adnexal mass palpable on bimanual examination, all constituted contraindications to HSG. However HSG has the advantage of detecting the site of blockage, benign polyp, isthmic nodosa, congenital anomaly of uterus associated.

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Laparoscopy is the gold standard in diagnosing tubal and peritoneal diseases. It has the advantage of direct visualization of tubes, detection of peritubal adhesions and fimbrial pathology. But exact site of tubal block may not be diagnosed and there are anesthetic and operative hazards involved. It is also not a cost effective method.

Whereas HSSG has certain advantages like:

i) An outdoor procedure, less time consuming and cost effective.
ii) Non-invasive procedure.
iii) No anesthesia is required.
iv) It carries no radiation hazard and allergic reaction seen in HSG.
v) It helps in simultaneous visualization of pelvic organs and diagnosis of other pelvic pathologies and uterine anomalies.
vi) Patency of tube can be shown to the patient in real time.
vii) A reliable and reproducible method to know tubal patency.

DISADVANTAGES OF HSSG:

i) Site of tubal block cannot be determined.
ii) Intratubal pathology cannot be visualized.
iii) There are false +ve result in cases of massive hydrosalpinx.
iv) Peritubal adhesion and motility of the tube cannot be properly assessed properly.
v) Findings are subjective.
vi) It requires a degree of technical competence.

But HSSG is an excellent screening method to detect tubal patency because of its high sensitivity and specificity, very close to that of LCPT[8]. It can be done in a patient who are temporarily unfit for LCPT due to bronchial asthma or cardiac diseases.

But here we like to stress that HSSG in not a substitute for established method like HSG or LCPT. But it can be done as a screening test in the initial work up of infertile patients. In patients with negative or suspicious findings on HSSG, established method like LCPT can be done to confirm the diagnosis.

CONCLUSION: Hydrosonosalpingography (HSSG) is a simple, less invasive, easy to perform, cost effective, method without radiation hazard with very high sensitivity and specificity. So it should be considered as first line screening method to know tubal patency.

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Fig. 1: Uterus with Foleys catheter (EVS- Preinjection)

Fig. 2: Collection around ovary (EVS- Postinjection)

Fig. 3: collection around right fallopian tube (EVS- post injection)

Fig. 4: Collection around left fallopian tube (EVS- post injection)

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Fig. 5: Collection in pouch of douglas (EVS- postinjection)

Fig. 6: EVS-Dilated endometrial cavity and collapsed foleys bulb due to bilateral tubal block

Age (years)	n=100	%
20-25	18	18%
26-30	42	42%
31-35	36	36%
>35	4	4%

Table 1: Age distribution

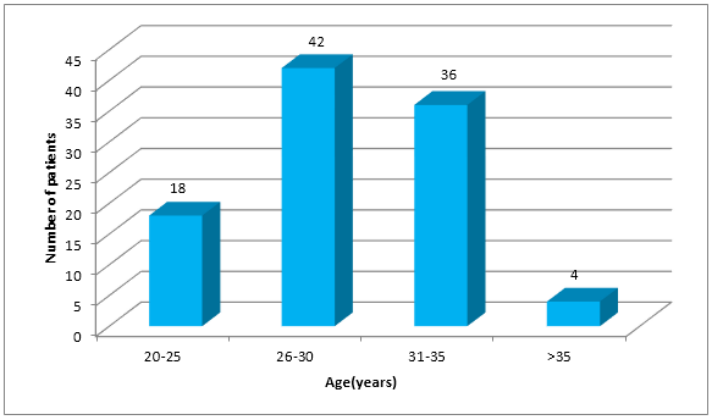

Fig. 7: Age distribution

Type of infertility	N=100	%
Primary	72	72%
Secondary	28	28%

Table 2: Distribution of patients according to type of infertility

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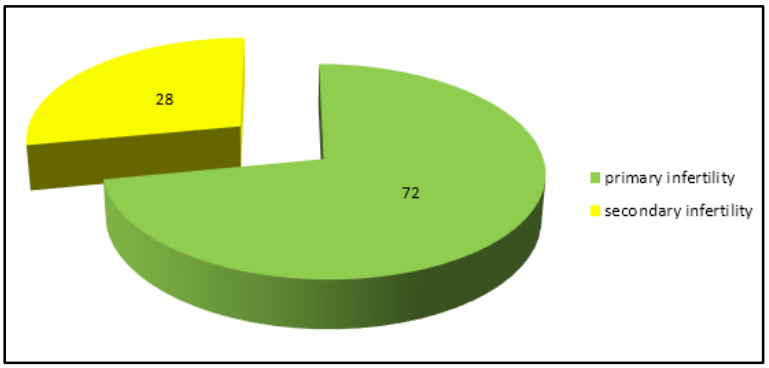

Fig. 8: Distribution of patients according to type of infertility

	Bilateral patent	Bilateral block	Rt. Side patent	Lt. side patent	Total
HSSG	73	7	10	10	100
HSG	71	9	11	9	100
LPCT	75	6	12	7	100

Table 3: Comparative evaluation of HSSG and HSG with LCPT

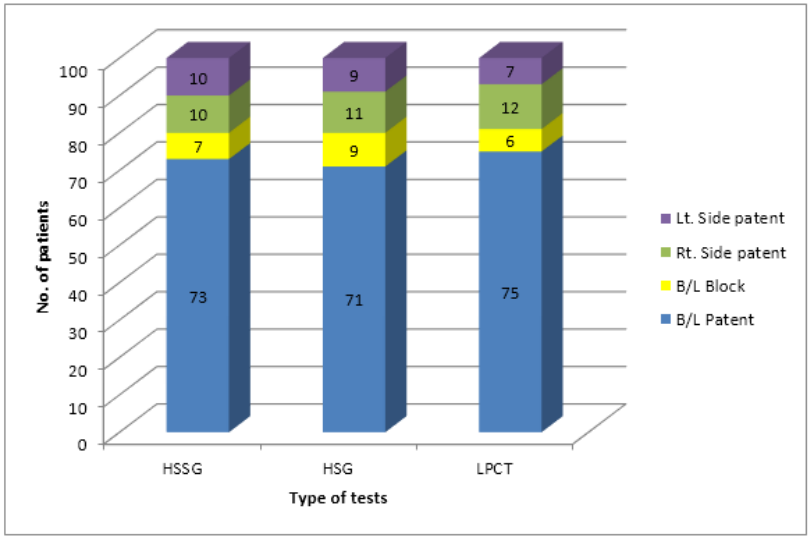

Fig. 9: Comparative evaluation of HSSG and HSG with LCPT

Tests	Sensitivity	Specificity
HSSG	97.3%	92%
HSG	94.6%	84%

Table 4: Sensitivity and specificity of HSSG and HSG

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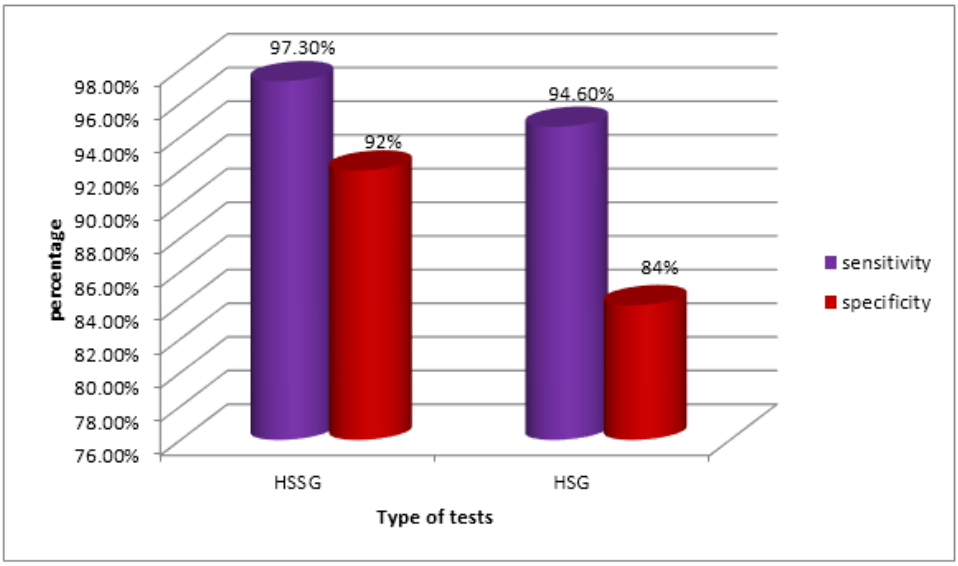

Fig. 10: Sensitivity and specificity of HSSG and HSG

Pelvic pathologies	HSSG	HSG	LCPT
Ovarian cysts/ polycystic ovaries	12	-	12
Tuboovarian mass	5	-	5
Endometriosis	3	-	5
Peritubal adhesion	-	-	4
Fibroid uterus			
a) intramural	8	-	6
b) submucous	2	Filling defect detected in 3 patients	2
c) subserous	1	-	1
Endometrial polyp	1	Filling defect detected in 3 patients	1
Hydrosalpinx	4	-	5
Bicornuate uterus	2		2

Table 5: Associated pelvic pathologies detected

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