Evaluation Of Hysterosalpingoscintigraphy (HSSG) As A Tool For Tubal Patency Test

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Abstracts: Aim: To evaluate the role of hysterosalpingoscintigraphy (HSSG) as a tubal patency test and compare it with hysterosalpingography (HSG) in infertile patients. Objectives: To determine tubal patency with hysterosalpingoscintigraphy and test its accuracy as compared to hysterosalpingography; compare pain scale between hysterosalpingoscintigraphy and hysterosalpingography; determine time taken for the radiopharmaceutical to ascend up the genital tract during hysterosalpingoscintigraphy. Design: Prospective study Place: The study was conducted in the University Hospital setting. Patients and methods: HSSG was performed on 30 patients with 1 mCi technetium 99m labelled sulphur colloid. Sequential static images were obtained at 0, 15 minutes and 30 minutes. The results were compared to findings of hysterosalpingography. Results: Out of the 30 cases evaluated, 50% had bilateral patent tubes, 33.33% had unilateral patent tube, and 16.67% had bilateral blocked tubes. Time taken for sulphur colloid to reach uterus was 3 minutes 45 seconds; tubes 10 minutes 32 seconds; ovaries 25 minutes 48 seconds. All patients marked 0 on pain scale after HSSG while after HSG, 16 patients marked 3 and 14 patients marked 4 on pain scale. The sensitivity of HSSG was calculated to be 69.64%, specificity 75%, positive predictive value 97.5% and negative predictive value 15%. Conclusion: HSSG is easy to perform, with no premedication requirement and no pain in procedure with high positive predictive value (97.5%), but a poor negative predictive value (15%). This test can be used as compliment to other tubal patency test in the work up of infertility. [Sinha S et al NJIRM 2012; 3(4) : 19-23]

Key Words: Hysterosalpingoscintigraphy, Hysterosalpingography, 1 mCi technetium, 99m labelled sulphur

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Introduction: Pathological tubal factors account for 30 – 40 percent[1] of causes of infertility. Tubal factors include damage or obstruction of the fallopian tubes and usually are associated with previous pelvic inflammatory disease or pelvic or tubal surgery. Fallopian tubes play an important part in sperm and ovum transport. It was understood that for these functions, the tubes need to be patent. Hence tubal patency test found a definite place in the algorithm of infertility evaluation.

Fallopian tube dysfunction is a major cause of infertility and the physician can use multiple modalities to assess the tubes. As tubal insufflation test gave way to hysterosalpingography (HSG), hysterosalpingography itself saw a sea change in its methodology. Laparoscopic chromotubation gave a direct visualisation of pelvic anatomy along with tubal patency. Sonosalpingography was introduced as alternative test to hysterosalpingography. Hysteroscopy, transcervicalfallopscopy, ampullary and fimbrialsalpingoscopy have all been tried to help determine tubal patency.

However with all these tests, the diagnostic evaluation of fallopian tubes hitherto remained limited to evaluation of anatomic tubal patency only. A mere patency of the tubal lumen is not adequate to affect fertility. The confirmation of tubal patency does not necessarily mean that there is normal function[2].

Successful transportation of sperms and fertilisation to form an embryo Evaluation of hysterosalpingoscintigraphy (HSSG) as a tool for tubal patency test fallopian tubes are under the influence of oestrogen, progesterone and prostaglandins and synchronised movements help in propulsion of sperms and the fertilised egg in either direction. The loss of any of these functions could prevent conception. The sperm tail helps it only to remain suspended and prevents it from adhering to uterine walls[3].

HSSG uses the spontaneous migration and imaging of particulate radioactive tracer, 1 mCitechnetium-99m human albumin microspheres (Tc^{99m} – HAM) from the vagina to the peritoneal cavity and ovaries[4]. This opened the gates for tracing the

physiology of sperm ascent to and through the tubes in a non invasivemanner[2].

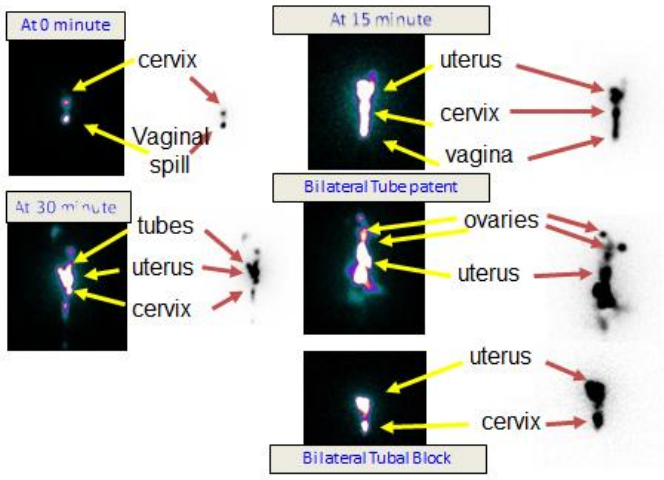
The aim of this study was to assess the role of hysterosalpingoscintigraphy as a tubal patency test and compare it with hysterosalpingography in infertile patients.

Materials And Methods: The study was conducted in the University hospital setting in Department of Obstetrics and Gynaecology, and Nuclear Medicinefor a period of two years. A total of 30 patients (60 tubes) underwent hysterosalpingography (Group 1) followed by hysterosalpingoscintigraphy (Group 2). Patients with or history of pelvic inflammatory disease were excluded from the study.

The procedures were done in the proliferative phase of menstrual cycle, between day 8 and day 11. The procedure was explained and an informed written consent was taken prior to the procedure. Each patient first underwent hysterosalpingography with 3 ml urovideo dye diluted with 15 ml normal saline. The mixture was pushed through a F8 Foley's catheter placed in uterine cavity and peritoneal spillage seen on fluoroscopy. After procedure the catheter was removed and a pain scale was recorded. Hysterosalpingoscintigraphy was done three hours after hysterosalpingography. Technetium- 99m sulphur colloid was always freshly prepared and the radioactivity count checked under a counter. 0.5 ml of the colloid with one milli curie of radioactivity was instilled with an Intrauterine Insemination cannula inserted into the cervix such that the tip of cannula was just within the endocervical canal taking care not to mechanically push the colloid into the uterine cavity. Static images were acquired in anterior and posterior views as 5 minutes per view immediately after instilling the radiolabelled sulphur colloid. Further static images were obtained at 15 minutes and 30 minutes. All the images were acquired in 256 x 256 matrix by a gamma camera (Infinia Hawkeye, GE Healthcare) using a low energy parallel hole collimator.

The ascent of ^{99m}Tc sulphur colloid up the endocervical canal into the uterine cavity, through the fallopian tube upto the fimbrial end was observed. The cervix was seen as a barrel shaped area and the uterus as a triangular area of radioactivity. Small extensions from the uterine area were fallopian tubes and peritoneal spillage at the fimbriae seen as a circular area corresponded to the location of ovaries. (Fig 1)

Figure 1: Appearance of cervix, uterus and tubes by HSSG



Scanning under gamma camera was stopped once a bilateral spill was observed. More scans were undertaken in cases where unilateral spill or no spill was seen in order to look for delayed ascent. When the spillage of radiotracer around the ovaries was not seen at the end of 30 minute, an additional image was taken at 45 minutes. A pain scale was documented at the end of HSSG. Patient was advised not to conceive in the same cycle.

The sensitivity, specificity, and negative predictive values were calculated. Chi square test was used to see the significance of relationship between HSSG and HSG. P values of <0.05 was considered statistically significant.

Results: The mean duration of infertility was 3.5 years (1½ to 5 years) and mean age of the patients was 28.2± 5.6 years. In the Group 1 twenty eight patients had (93.33%) bilateral patent fallopian

tubes and two (6.67%) had bilateral blocked fallopian tubes. In Group2, only fifteen (50%) had bilateral patent fallopian tubes, and five (16.67%) had bilateral blocked tubes, whereas ten (33.33%) were seen to have unilateral patent tubes. Therefore it is seen that though an anatomical test of patency shows 93% bilateral patent tubes; a physiological test demonstrates only 50% bilateral patent tubes (Table 1)

Table 1: Tubal patency by HSG and HSSG

Test (n=30)	Bilateral patent	Unilateral patent	Bilateral block
Group I	28 (93.3%)	0	2(6.67%)
Group II	15(50%)	10(37%)	5(13%)

There were 10 cases where HSSG demonstrated unilateral patency. Since we know that only one ovary ovulates during each cycle, it is possible that the ipsilateral tube shall show physiological motility in that cycle. Hence the 33.33% unilateral patency is actually a physiological phenomenon which has been aptly demonstrated by HSSG. Since this test shows the movement of particles deposited at the external cervical os utilising the propulsive action provided by the genital tract, it is imperative that the genital tract which propulses the sperms shall do it towards an ovulating ovary.

The time taken for the radiopharmaceutical to ascend up from cervix to reach uterine cavity, fallopian tubes and then ovary was calculated. The radiopharmaceutical was seen within the uterine cavity at 4±1.5 minutes, in the fallopian tubes at 10.88 ± 7.02minutes and it reached the ovaries at 25.8 ± 21.2 minutes.The maximum time taken to reach the ovaries was 45 minutes. (Fig 1)

In Group 1, 16 patients (53%) graded 3 and 14 (47%) graded 4 on the comparative pain scale following the procedure. In Group 2 all patients found hysterosalpingoscintigraphy procedure to be having no pain and graded it as 0 on comparative pain scale.

The sensitivity of HSSG was 69.6%, specificity 75% and the positive predictive value was 97.5% and negative predictive value was 15% and for HSG the sensitivity, specificity, positive predictive value and negative predictive value are 97.5%, 15%, 69.64% and 75% respectively.

Discussion: HSSG is a simple and accurate method for evaluating fallopian tubal patency. It is less invasive than Laparoscopy and Xray HSG. Rapid ascent of spermatozoa within the female genital tract to the site of fertilisation is not dependent upon motility of the spermatozoa and is determined by directed uterine peristalisis and myometrial contractions towards the ovary bearing the dominant follicle.

Mario Iturralde and Pieter Ferdinand Venter[3] described migration of human albumin microspheres from the posterior fornices to reach the peritoneal cavity. A functional test for tubal patency was thus established. In the present study we observed the migration of sulphur colloid particles from the external cervical os to the ovaries in the peritoneal cavity. Technetium- 99 m tagged to the sulphur colloid particles made the dynamic visualisation of sulphur colloid movement up the genital tract by scintigraphy possible. Thus we were able to appreciate the functional nature of HSSG.

This particle was however immotile as opposed to sperms which are motile. Since this immotile particle was able to migrate through the genital tract including fallopian tubes, it is concluded that the fallopian tubes have inherent muscular activity which was able to propel the sulphur colloid. Fanchin R Righiniet al[4] had suggested that the sperm tail helps it only to remain suspended and prevents it from adhering to the uterine walls. Helmut W Ottet al[5] by demonstrating positive hysterosalpingoscintigraphy in a case of Kartagener's syndrome proved that the migration of labelled albumin particles was a consequence of myometrial activity, resulting in cervico fundal peristaltic waves. The myosalpinx is arranged in sheets that tend to form in the isthmus an inner circular layer and an outer longitudinal layer [6].

Spontaneous muscle activity in the primate tube is oestradiol dependent. Propagation is slow because only simple contacts and not gap junctions form between adjacent smooth muscle cells. During ovulation which is generally a unilateral event,

disproportionately ipsilateral steroid effects have been revealed in fallopian tube epithelial[7] and myosalpingeal[8] function. The active ovary thus creates around itself a steroid milieu different to the steroid environment provided by the adenexal arterial blood supply. This might be the reason behind seeing a large number of unilateral patent tubes (33.33%) by HSSG in our study.

The reported results in this study is in concordance to that by Brundin[9]et al, who had reported a sensitivity of 46.14%, specificity 55.55%, positive predictive value 75% and negative predictive value 26.31%. In a study using radiolabeled spermatozoa, Kemal Ozger[10] et al reported sensitivity of 72% and specificity 73%, which are very close to the present study.

In a study by Allan and Uszler[11] in 1993, the time taken to demonstrate tubal patency was determined. In their study it was seen that in most cases function is visualized within 20 minutes and those non functional do not visualize even when imaged for more than one and half hours. Our study is in concordance with their finding, however we found that patency could be observed at maximum of 45 minutes. In three cases where patency was not seen at 30 minutes, a scintigraph at 45 minutes showed patency.

Hysterosalpingographyhowever has superiority over hysterosalpingoscintigraphy in the diagnosis of anatomical anomaly of the genital tract. Hysterosalpingoscintigraphy is able to define the functional capability of uterus and fallopian tubes in spermatozoa migration but is unable to clearly define anatomical abnormality.

No patient found hysterosalpingoscintigraphy painful. All were satisfied with the ease and painlessness of the procedure. All agreed that the procedure of hysterosalpingoscintigraphy per se caused no pain.

The difference between the studies conducted earlier and the present study was the use of sulphur colloid. Till date studies have used human albumin micro aggregates as the carrier molecule for technetium- 99m. Sulphur colloid has the advantage of being non allergenic as well as inexpensive when compared to human albumin aggregates.

Conclusion: Hysterosalpingoscintigraphy can play a role in evaluation of infertility due to tubal factor. This test can be used as a compliment to other tubal patency test in the work up of infertility. HSSG provides additional information about the function and motility of fallopian tube and is thus may be superior to HSG in selected cases. HSSG is easy to perform, with no premedication and no pain in procedure.

HSSG is feasible only in a tertiary centre where facilities are available and the limitation of this study is that we have not analysed the pregnancy rates following HSG and HSSG.

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