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# ROLE OF IMAGING IN FEMALE INFERTILITY

Radiology

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## ABSTRACT

The major aim of this study was to extensively assess and evaluate the usefulness of various imaging modalities in the diagnosis and its role in management of causes of infertility. The imaging modalities assessed in this study are Pelvic sonography, hysterosalphingography, Sonohysterosalphingography, MR imaging. This study also aims at assessing the incidence of various causes of female Infertility in Surat, Gujarat, *India.*

**Methods:** This study was conducted with study sample of 100 female patients with complaints of infertility. They were assessed by hysterosalpingography, transvaginal and pelvic sonography and MRI

**Results:** There were 14 patients with tubal pathology, 22 patients with uteirne pathology, 36 patients with ovarian pathology diagnosed by gold standard hysteroscopy and laparoscopy. HSG diagnosed 11 patients with tubal pathology and 19 patients with uterine pathology. TVUSG was able to identify 9 patients with tubal pathology, 19 patients with uterine pathology and 30 patients with ovarian pathology. MRI diagnosed all the cases which were diagnosed by hysteroscopy

**Conclusion:** MR imaging is nearly accurate as hysteroscopy in identifying pathologies of female genital tract. TVUSG has shown promising results in diagnosing tubal, uterine and ovarian pathologies. HSG has shown near accurate level in diagnosing tubal diseases

## KEYWORDS

**Aim**

The aim of the study is assess the incidence of causes of female infertility in Surat. Our study correlates the diagnostic accuarcy of various imaging modalities with hysteroscopy

***Methodology***

The protocol was approved by Ethics Committee and written informed consent was obtained from each patient. The present cross sectional study was conducted in New Civil Hospital, Surat on 100 cases who were referred from Obstetrics & Gynecology Out patient department who came with complaints of Female Infertility. These patients were extensively evaluated by above mentioned imaging techniques for identifying the cause of infertility. Patients presenting with both primary and secondary infertility were taken into account in this study

***Inclusion Criteria***

Patients who were not able to conceive despite after a period of twelve months of unprotected sexual intercourse (*definition of Infertility)* presenting to Obstetrics and Gynecology OPD NCHS, Surat.
Patients with normal regular menstrual cycles

***Exclusion Criteria***

Patients with other known medical or multisystem disease related or not related to female infertility were not included in this study.

***Duration of Study*** **:** JULY 2016 TO NOVEMBER 2016

Patients who are evaluated for identifying the cause of Infertility who are willing to participate in this study were well explained and written consent was obtained and then included in this study

***Background***

Infertility is becoming more prevalent in modernized corporate era. Male and female causes of infertility are equal contributing factors. The prevalence of Infertility has been on the rise in the past decade which warrants its importance as a topic of interest.

Primary infertility is defined as inability to conceive after 12 months of unprotected sexual intercourse in a couple who hasn't conceived previously

Secondary infertility is defined as inability to conceive after 12 months of unprotected sexual intercourse in a couple who has conceived previously

Females usually bear the brunt of Infertility in India. The causes of Female Infertility are – Ovarian factors, Uterine factors, cervical factors, Endocrine factors, Peritoneal factors.

The evaluation of ovulation is a core component of female infertility evaluation. Various imaging methodologies to evaluate ovulation, normal morphology of the female genital tract. Each of these modalities have their own advantages and disadvantages and no single modality is necessarily the best.

Uterine causes of Infertility are – Congenital, Infective, Iatrogenic. Congenital uterine causes of Female infertility are classified by American Society of Reproductive Medicine into six types

Class I – Mullerian agenesis

Basic pathology is agenesis of Mullerian ducts. Uterus is absent, rudimentary vagina or absent vagina . This is called Mayer Rokitansky Kuster Hauser syndrome. These patients are primarily amenorrheic

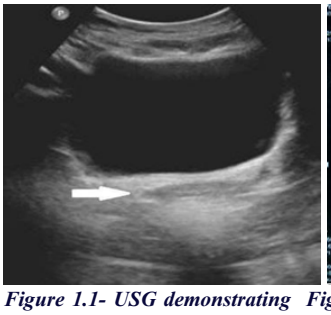


***Figure 1.1- USG demonstrating absent uterus syndrome and vagina Mayer Rokintansky Kuster Hausner syndrome***

***Figure 1.2 MRI showing MRKH***

Class II – Unicornuate Uterus

The pathology is failure of formation of either of Mullerian ducts. The other horn may be rudimentary or absent. It can be Unicornuate unicollis (with one cervix) or Unicornuate bicollis (with two cervix)


*Figure 2.1 Hysterosalphingography showing Unicornuate uterus*

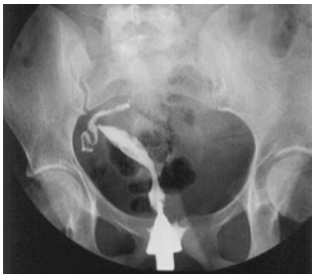


*Figure 2.2 USG showing unicornuate banana shaped uterus*

Class III – Uterus Didelphys

Basic pathology is the failure of fusion of both Mullerian ducts. It is characterized by two cervix, two uterus. Its fascinatingly called Double Uterus.

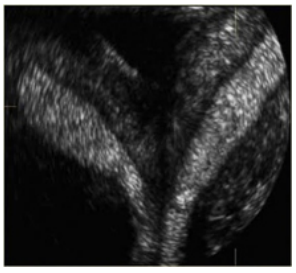


*Figure 3.1 USG showing uterus didelphys*

*fig 3.2 HSG uterus didelphys*

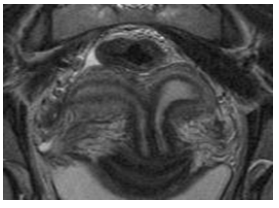


*Fig 3.3MRI showing Uterus didelphys*

Class IV –Bicornuate Uterus ( Heart shaped uterus)

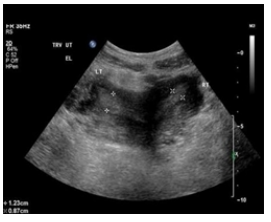


*Fig 4.1 USG showing Bicornuate uterus*

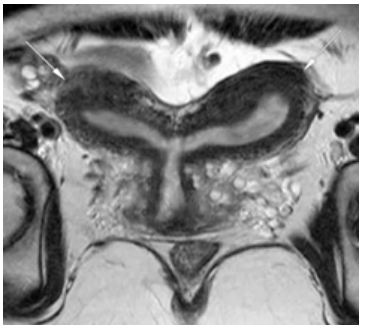


*Fig 4.2 MRI showing Bicornuate unicollis*

Partial failure of fusion of both Mullerian ducts. The caudal part of uterus is normal, the cranial part is bifurcated

Class V – Septate Uterus

Failure of resorption of the septum after fusion of both mullerian ducts. Most common type of Uterine malformation is Septate uterus.


*Fig 5.1 Hysterosalphingography showing septate uterus*

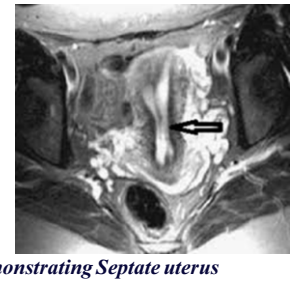


*Fig 5.2 MRI demonstrating Septate uterus*

Class VI – DES uterus/ T shaped uterus.

*Fig 6.1 HSG showing T shaped Uterus*

Arcuate uterus is another normal variant in which there is concave dimple in uterine fundus within cavity.

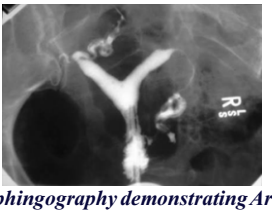


*Fig 7.0 Hysterosalphingography demonstrating Arcuate uterus*

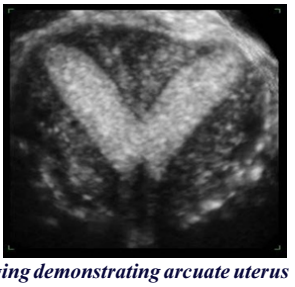


*Fig 7.1 MRI imaging demonstrating arcuate uterus*

Another variant is "Double Vagina" which is because of lack of fusion of caudal part of two ducts that forms Vagina.

Other uterine causes of Female infertility – Leiomyoma, Adenomyosis, Asherman syndrome

***Leiomyoma***

These are beingn tumors of smooth muscle cells of uterus. Types of

fibroids – Intramural, submucous, subserosal.

Submucosal fibroids distort the endometrial cavity and is the most common type of fibroid causing female Infertility. Leiomyoma also undergo various degenerative changes.

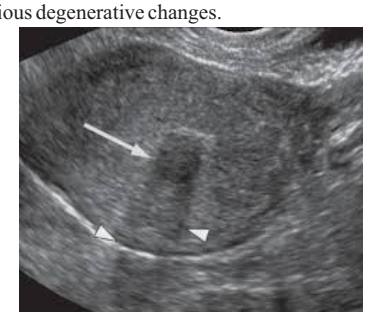


*Fig 8.1 USG showing submucosal fibroid*

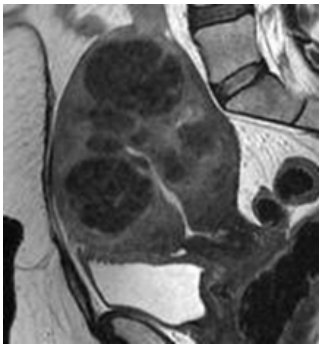


*Fig 8.2 MRI showing multiple fibroids*

***Factor***

Cervical causes of infertility usually include cervical stenosis, cervical amputation and abnormal quality of cervical mucus.This alteration in morphology and quality of cervix is responsible for infertility.

The causes of cervical stenosis include post cone biopsy, post radiation fibrosis, cryosurgery etc. Cervical amputation is usually done in cervical cancer patients.

*Fig 9.1 HSG demonstrating Cervical stenosis as a filling defect*

Tubal causes play an important cause of female infertility.Most common cause include infectious agents like Chlamydia, gonorrhea causing tubal blockage, hydrosalphinx, pyosalphinx and tubo ovarian mass type of lesions

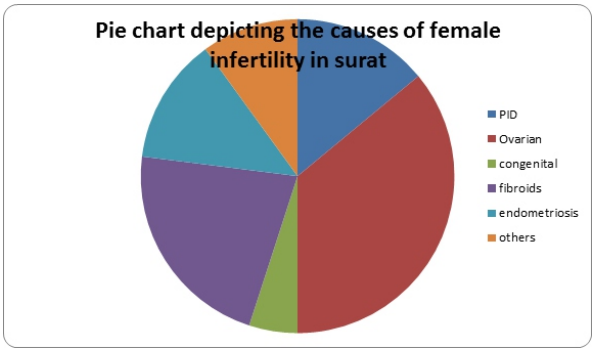
***MR*** can also effectively image cervical cancer

***Results***

Our study concluded that most common cause of female infertility in Surat, Gujarat is ovaran in nature followed by fibroids. They account together for about 60% of the causes of female infertility. The study must be repeated with large sample size so as to reflect the population still more effectively

| Causes | Percentage |
|---|---|
| **Tubal (predominantly PID)** | 14% |
| **Ovarian disorders** | 36% |
| **Congenital** | 5% |
| **Submucosal fibroids** | 22% |
| **Endometriosis** | 13% |
| **Others** | 10% |

***Table 1.1 depicting incidence of causes of female infertility in surat***




***Pie chart 1.1 depicting incidence of causes of female infertility in surat***

The above causes were confirmed by preoperatively or by hysteroscopy. ( gold standard)

HSG was very much useful in evaluation of tubal patency . In evaluation of tubal patency by Hysterosalphingography compared to gold standard hysteroscopy and laparascopy was studied. Among 14 cases of tubal causes of infertility, 11 cases were accurately diagnosed by HSG and 52 cases were completely diagnosed as normal by HSG

***Table 2.1 depicting sensitivity and specificity of HSG in diagnosing tubal pathologies***

| Number of cases with Tubal pathology | Number of cases diagnosed as tubal pathology by HSG | Sensitivity |
|---|---|---|
| 14 | 11 | 96% |
| Number of cases without tubal pathology | Number of cases diagnosed as free of tubal disease by USG | Specificity |
| 86 | 52 | 61% |

***Table 2.2 Sensitivity and specificity of HSG in evaluation of uterine pathologies***

| Number of patients with uterine pathology | Number of patients diagnosed as uterine pathology by HSG | Sensitivity |
|---|---|---|
| 22 | 19 | 90% |
| Number of patients without uterine pathology | Number of patients diagnosed free of uterine pathology | Specificity |
| *78* | 68 | 96% |

***Table 3.1 Sensitivity and specificity of TVUSG in evaluation of tubal pathologies***

| Number of patients with tubal pathology | Number of patients diagnosed as tubal pathology by HSG | Sensitivity |
|---|---|---|
| 14 | 9 | 73.6% |
| Number of patients without tubal pathology | Number of patients diagnosed free of tubal pathology | Specificity |
| *86* | 72 | 86% |

***Table 3.2 Sensitivity and specificity of TVUSG in evaluation of uterine pathologies***

| Number of patients with uterine pathology | Number of patients diagnosed as uterine pathology by HSG | Sensitivity |
|---|---|---|
| 22 | 19 | 88.8% |
| Number of patients without uterine pathology | Number of patients diagnosed free of uterine pathology | Specificity |
| *78* | 70 | 90.6% |

Sensitivity of TVUSG in diagnosing ovarian pathology was found to be 85.71% and specificity of TVUSG for diagnosing ovarian pathologies was found to be 94.11%

***Table 4.1 correlating sensitivity of various imaging modalities in different conditions***

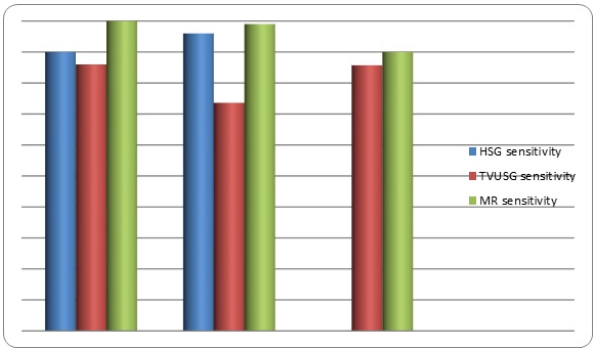
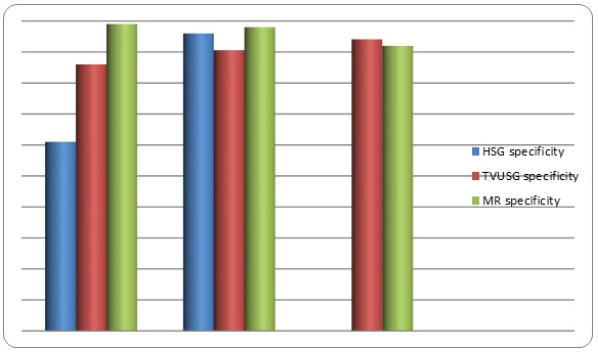



***Table 4.2 depicting specificity of various imaging modalities in various causes of female infertility***




Sensitivity and specificity of tubal, uterine, pelvic, cervical , ovarian causes of female infertility diagnosed by MRI correlated with hysteroscopy and laparoscopy was found to be 99%

## Conclusion

Our study reveals that Imaging studies greatly contribute to the diagnosis and manangement of female infertility.Role of each of the imaging modality is important as they are complementary to each other HSG remains the first line investigation of choice for evaluation of female infertility. HSG is very much effective for diagnosing synechia, submucosal myomas, endometrial polyps, abnormal morphology of fallopes as in salphingitis isthmica nodosa etc. Though HSG can demonstrate uterine leiomyoma, congenital anomlies, other modalities outwit it in many ways. According to our study, sensitivity of HSG in diagnosing Tubal disease was found to be 96% and for uterine causes to be 90%. Specificity of HSG in diagnosing Tubal and uterine causes were found to be 61% and 90% respectively.

Transvaginal ultrasonography (or) saline sonohystrography have been increasingly used to assess the normal anatomy & pathology of female reproductive tract. TVUSG can identify the stage of menstrual cycle by carious appearances. Only advantage of TVUSG is that it cannot assess the functionality and receptivity of endometrium.

Sensitivity of TVUSG in diagnosing Tubal and uterine pathologies was found to be 73.6% and 86% respectively and specificity of TVUSG in diagnosing tubal and uterine pathologies were found to be 88.8% and 90.6% respectively.

MR remain the investigation of choice for congenital anomalies, tumors and fibroids because of its propensity to delineate extension.

MR is an expensive modality because of which usg can be used to effectively differentiate between various types of lesions.

Our study concludes that MRI despite being a costly investigation found to be 99% in accuracy correlated to laproscopy and hysteroscopy

Our study further establishes ovarian causes as the most important cause of female infertility followed only by fibroids. The ovarian causes include polycystic ovarian disease, chocolate cyst of ovary, premature ovarian failure etc Among these causes polycystic ovarian disease turns out to be main culprit

All causes of female infertility can be effectively diagnosed because of the high quality of imaging modalities available nowadays .

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