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Original Article

Infertility due to fallopian tube affections

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Introduction

Reproductive failure has been recognized today as one of the most serious problem affecting economy of the Dairy Cattle Industry. Complete sterility is probably less important than sub-fertility or infertility, because sterile animals are few and easily identified in comparison with those having transient form of reproductive disorders. It is commonly observed that the individual females may be infertile due to a cause which does not involve other animals in a herd. One of the most important but poorly understood and commonly encountered sub-fertility condition in cows and buffaloes are hard to settle for various reasons.

Congenital or acquired genital abnormalities are important cause of infertility. The incidence of lesions of uterine tubes and adenexa in the abattoir specimen ranged from 0.95% in Australia (Summer *et.al*., 1974) to 100% in Egypt (Afiley *et.al*., 1973). The most frequently observed lesions were ovarian bursal adhesions. The main limitation is usually the absence of any detailed clinical history and identification of the animal concerned. Cows or buffaloes having tubular abnormalities may show repeat breeding of known or obscure etiology which requires to be confirmed by patency testing. The incidence of pathological conditions of different segments of bovine and buffalo genitalia has been reported to widely vary and tubal affections are opined to be more common in buffaloes than in cows (Alam, 1984). In a study on gross abnormalities of excised, non-pregnant cows and buffalo genitalia obtained from slaughter house and to assess tubal factor as a cause of culling them uterine tubes were tested for patency (Khasatiya *et.al.,* 1998) by infusing methylene blue solution in the 500 uterine tubes. Of them,24 were occluded (unilateral in 20 tracts and bilateral in 2 tracts), and 26 had gross lesions

(unilateral in 16 tracts and bilateral in 5 tracts). Approximately one-half of the occluded tubes were not associated with gross lesions and approximately one half of the tubes with gross lesions were patent.

The common inflammatory condition of the ovary in buffaloes is perioophoritis; while oophoritis was rare (Bhattacharya *et al.,* 1954).the occurrence of hematoma in the buffalo ovary, ranged from 0.26% -1.43%. In cystic ovarian degeneration, grossly there was neither a developing follicle nor a corpus luteum were apparent on the ovarian surface. However, persistent and embedded corpus lutea were noticed frequently in buffaloes. These were, small, capsulated, dark brown corpora lutea embedded in the thick fibrous stroma of the cortex, but did not protrude from the surface and the cut surface revealed a firm, particularly, fibrosed stroma. Further, the histological feature was, thickening of granulosa cell membrane and theca layer.

The incidence of female genital organ disorders in buffaloes ranged from 8.01 to 78.67 %.(Sharma *et al.,* 1993).There are various abnormalities of reproductive organs which effect the reproduction. various affections included Ovarian hypoplasia, Sclerosis, ovarian and par ovarian cyst, oophoritis, Hydrosalpinx, Pyosalpinx, Salpingitis, adenomyosis, hydrometra, mucometra, pyometra, endometritis, cervicitis, vaginitis and other anomalies like, pigmentation and tumours etc. Kumaresan and Ansari, 2002 also found that .the ovarian abnormalities in buffaloes are higher than the others.

Emadi *et. al*.,2003 in their study on 150 pair of buffalo ovaries reported, incidence of various abnormalities as ,follicular cyst 8%,Luteal cyst 2%,Cystic corpus luteum 2.7%,par ovarian cyst 4.7%,Ovarobursal adhesions 2.7%,Ovarian Hypoplasia or atrophy 4.2% and intra-follicular Bleeding 2% with high proportion of epithelial inclusion cyst2.7% In severe hypo-plasia the affected gonads varied in size from a cord like thickening with granular and uneven surface of a flat, smooth, firm, bean shaped structure.

The highest and lowest incidence of uterine lesions among buffaloes is 2.87 -68.40% (Rao and Rajya, 1976). Among them congenital abnormalities like infantile uteri, malformed uteri, rare uterus unicornis were also included which affect the reproduction. Inflammatory lesions were most common (30.06%) in buffaloes (Bajaj, 2000)

The affection of cervix included congenital abnormalities, double cervix, double external os with a band of tissue situated dorso-ventrally at the external os uteri, and complete absence of cervix in one buffalo (Deeb *et al.*, 1980).Cervical stenosis and incomplete closure and bending of cervix were also found but was rare. Cervical cysts of varying size and shape are reported in buffaloes. Generally the cysts were found at the external orifice of the cervix having inspissated cervical mucus, these were the retention cysts associated with the chronic cervicitis (Kumaran and Singh, 1985).

Cervicitis is classified as acute, chronic, necrotic, either alone or associated with metritis, vaginitis, appeared in animals. Tuberculosis of the cervix occurred occasionally alone or with the lesion of other part of genitalia. Cervical tumour is rarely found in dairy animals (Dinc, 1990).

Various pathological conditions involving vagina of animals, like congenital abnormalities other than those encountered in freemartins, is occasionally reported in animals. Imperforate vagina is particularly associated with white heifer diseases (Roberts, 1971). Spalash (1960) reported that, these developmental abnormalities are due to the arrest in the mullerian duct system, double vagina is rarely found in cattle. A variety of abnormalities like occlusion of vagina and uro-vagina, and melanosis (Rao and Rajya, 1976) and cervical fibro-leiomyoma a tumour of vagina in crossbred cow (Pandit, *et.al.*1990) has been recorded.

The Fallopian tubes are amazing because they not only collect the eggs from the surface of the ovary but they provide a hook-up spot for eggs and sperm that is simply perfect for fertilization. They provide the early nursery for the new embryo for the first five days of its life, while gently transporting it to the waiting uterus for implantation. The fallopian tube is not just a passive pipe or a conduit, but an active organ with its separate locations performing separate functions. Starting from the ovarian end (fimbria) and proceeding toward the uterus. The parts of the fallopian tube are;

- Fimbrial segment - faces the ovary
- Infundibulum segment - funnel shaped segment behind the fimbria
- Ampullary segment - wide middle segment
- Isthmic segment - narrow muscular segment near the uterus
- Interstitial segment - passes through the uterine muscle into the uterine cavity

Healthy fallopian tubes are an essential pre-requisite for conception to occur. If the tubes are completely blocked, the sperm are unable to reach the egg to fertilize. If the tubes are damaged and not completely blocked, the sperm may reach the egg, but the early embryo is more likely to be trapped in the distorted tube - a dangerous condition known as ectopic pregnancy. Thus it is not enough that the sperm have access to the egg. It is also necessary that the egg must not be prevented from reaching the open end of the tube. If the ovaries are surrounded by adhesions, there is a major barrier between egg and sperm.

Abnormities of the fallopian tubes have been attributed as one of the most important causes of female infertility in all species. Clinical diagnosis by rectal palpation of uterine tube abnormalities is only possible if there is gross enlargement and thickening of the tube or severe adhesion involving the tube. Less severe abnormalities and their patency are not detectable by rectal palpation and can only be

identified by special techniques. Such lesion of fallopian tubes generally result in tubal occlusion and the tubes lose its patency either uni-laterally or bilaterally (Johari and Sharma, 1964). Diagnosis of this condition as early as possible is essential for suitable course of action for the economic reason (Duchateau and Whitemore, 1978). Uterotubal insufflations were used for diagnosis and treatment of tubal disorders in women (Ansari, 1979), and is well adoptable in bovines (Kavani, 1984). The higher incidence of tubal affections was observed in pluriparous animals might be one of the major factors for culling them (Kumar and Singh, 1985). The incidence of right and left tube involvement was 57.8 and 42.2% (Khan et al., 1992).

The prevalence of gross abnormalities and lesions of the uterine tube in relation to parity like endo-salpingitis, Pyosalpinx, hydro-salpinx, occlusion, aplasia and other micro-lesion which are not palpable per rectum and could be responsible for reproduction failure in farm animals has been reported by Bhattacharya *et. al.*1970 in buffaloes. In their study in 63 genitalia having tubal lesions, the involvement of buffaloes and heifers was 80.95% and 19.05%.In another study it was observed that tubal pathology have more occurrence on the left side than the right side with unilateral and bilateral impatency in 29 and 50% of 48 animal examined (Nayar and Raja, 1977) almost identical incident of blocks in left and right side tubes.

The gross oviductal abnormalities like Salpingitis (3.2%) hydrosalpinx(1.6%),Pyosalpinx (0.8%), and adhesions(4.4%) or in apparent blocks (15.2%) were found in 63(25.2%) of 250 organs. The occurrence of unilateral disorders was found to be higher (71.42%) than the bilateral ones (28.58%). the right side involvement was found to be 41% and left side involvement 30%(Khasatiya et al.,1999).

In a study it was found that grossly, the oviduct abnormalities were present in 63 (25.2%) of 250 genitalia investigated. Salpingitis was found bilaterally in 3 (1.2%) and unilaterally in 5 (2.0%) animal genitalia. Hydrosalpinx and Pyosalpinx both were detected, bilaterally in 4 (1.6%) and unilaterally in 7 (2.8%) genitalia. (Khasatiya *et. al,* 1999).

CONGENITAL ABNORMALITIES

Kessy and Noakes, (1985) described various affections of fallopian tubes which are detailed as:

APLASIA OF THE UTERINE TUBE

Aplasia of the uterine tube is bilateral, no parts of the tube is present. The remainder of the genital tract is normal indicating a segmental defect of the mullerian duct system.

SEGMENTAL APLASIA OF THE UTERINE TUBE

In this type of abnormality the tube had a blind end near the uterotubal junction caused by the segmental aplasia. The whole length of the tube is distended.

ACCESSORY UTERINE TUBE

There is duplication of the uterine tube observed the normal and the accessory one, patent with two distinct uterotubal junctions. The accessory tube is macroscopically normal.

ACQUIRED TUBAL ABNORMALITIES

Salpingitis

Salpingitis is inflammation of the fallopian tubes which may be for some infectious cause. In a abattoir study on buffaloes, Salpingitis was encountered in 4 cases (0.79%) , which is 7.14 % of all the affected animals (Mittal, 2003).Grossly the salpinx were enlarged and thickened but did not reveal any changes in consistency.

In human being the term Pelvic inflammatory disease (PID) or diseases of the female upper genital tract include disease like Salpingitis endometritis, oophoritis, myometritis, parametritis and infection in the pelvic peritoneum. In contrast, Salpingitis only refers to infection and inflammation of the fallopian tubes in animals (Singh, 2009).

Hydrosalpinx

The hydrosalpinx is an affection in which the fallopian tube is filled with inflammatory fluid and is the end result of pelvic infection. Hydrosalpinx is most common condition with an incidence up to unilateral 0.97% and Bilateral 0.66 % in buffaloes (Khasatiya *et al*., 1998). The inflammatory fluid flow into the uterus and provide a hostile environment that will prevent implantation of an embryo. Hydrosalpinx is caused by tubal infection such as pelvic inflammatory disease (PID). In this infection the tubes become inflamed, which even after treatment may be blocked due to presence of residual fluid inside. Continued fluid buildup over time dilates the tube more, resulting in hydro-salpinx of various sizes.

Grossly, the fallopian tubes were found distended, elongated and tortuous forming many coils in the mesosalpinx. Histologically, the wall was thin, translucent, and distended with large amount of clear fluid .the Ampullary region was more affected (Khasatiya *et al.*, 1999). A hydrosalpinx does not have healthy cilia, hence, embryos that find their way into the fallopian tube become trapped and may implant there resulting in a dangerous ectopic pregnancy that needs to be removed surgically.

Pyosalpinx

A Pyosalpinx refers to presence of pus in one fallopian tube. When both tubes are affected with the accumulation of pus inside, the term used is pyosalpinges. Pyosalpinx is a consequence of pelvic inflammatory diseases (PID) which may be caused by streptococcus and staphylococcus infection.

Infections may start from vagina, and progress up to the cervix, uterus, and to one or both fallopian tubes if not treated early. Majority of Pyosalpx cases revealed moderate to marked infiltration of Neutrophils, mononuclear cells and hoisting mucosal and muscularis layers. Some cases revealed marked thickening of mucosal layer due to infiltration of Neutrophils, macrophages, histocytes and fibrous tissue formation (Tsianos ***et al*., 2011)**.

Cystic uterine tube

This condition is characterized by the enlargement of uterine tube and serosal surface was covered with multiple nodules. The normal tubal lumen is replaced by the multiple nodules. A single mucosal cyst which caused partial occlusion of the tube and multiple intraepithelial cysts were reported in the infundibulum (Kessy and Noakes, 1985).

Occluded uterine tube

Kessy and Noakes, 1985 found that occluded uterine tubes were macroscopically normal but the lumen was completely obstructed and the tunica mucosa was replaced by a mass of proliferative connective tissue with extensive cellular in filtration had been reported by .

Pachysalpinx

In the same report Kessy and Noakes, 1985 mentioned that Pachysalpinx is an affection characterized by the enlargement of the whole length of uterine tube which are kinked and distorted with normal shape and outline. The central lumen is completely filled with a connective tissue mass and the distinct tubal mucosal folds were absent.

Kavani *et al*. 1986 in a study on repeat breeding associated with fallopian tube affections in cows and buffaloes found that Salpingitis and pyosalpingitis causes atrophy /denudation of mucosal folds and moderate to massive fibrosis of tubular wall with multiple sub mucosal cyst formation in Ampullary region. Further they found multi-locular intramuscular cyst formation by the fusion of adjacent folds and denuded epithelial linings due to Salpingitis causes tubal blockage.

Further, they found that if there are no indications in history that the tubes may be blocked, are given the benefit of the doubt initially while other causes of infertility are investigated. However, about 50-70% animals that have tubal problems while being attended for infertility have a definite past history indicating possible tubal obstruction. Different tests of tubal patency should be carried out at early stage, such as uterotubal insufflations by air, PSP dye and other tests.

These tests are:

1. Tubo-insufflation test- a. Gas Insufflations (Rubin's test)

b. Hydrotubation

2. PSP dye test (Phenol sulphonapthaline Dye Test)

3. Hysterosalpingography (H.S.G.)

4. Sono-salpingoGraphy

Other modalities

1. Laparoscopic Chromopertubation

2. Transvaginal falloscopy

3. Ampullary& fimbrial Salpingography

4. Hysterosalpingo Contrast Sonography

1. TUBO-INSUFFLATION TEST

a. Gas Insufflations (Rubin's Test)

This is the oldest method of assessing tubal patency and is referred to as "blowing the tubes". It is a simple test to carry out and does not require any general anesthetics,

In this method only carbon di oxide are choice of gas, other gases are not used, if the oxygen are used in Rubin's apparatus, the disadvantage that it take more than24-48 hrs. , for absorption from peritoneal cavity and create theoretical danger of introducing infectious material. But the Carbon di oxide is readily absorbed and no occasion was bacterial growth. (Kawata and Koike, 1959)

PRINCIPLE

When the fallopian tubes are normal, the air insufflated into the uterus comes out from the tubal abdominal ends, passing through the tubal cavity. Therefore, if one holds his hand, per rectum near the abdominal os, at the end portion of either side of the tubes, the air coming out through the tube can easily be felt as a peculiar fremitus-like sensation to the touch. The manometer showing at the same time a gradual fall of the air-pressure once elevated by pressing the bulb. When the fallopian tube ends are allowing air passage normally, the air insufflated into the uterus comes out from the tubal abdominal ends, passing through the tubal cavity.

APPARATUS

Kawata and Koike, 1959 designed an apparatus which composed of these parts:

1. Three metal catheters of different diameter which serve the air insufflations into the uterine cavity.
2. A manometer.
3. A rubber bulb for sending air.
4. A filter for removing air dust.

5. A stopcock.
6. An adaptor.
7. A three way valve.
8. Three pieces of hard rubber tube for connecting the respective parts.

METHOD

If the animal is not cooperative and struggle, caudal epidural anesthesia may be induced. Rectal examination is carried out to know the reproductive status of the animal. The cervix is grasped and the uterine catheter is passed into the cervical canal up to the uterine body. The catheter is fixed on the external os to prevent the leakage or back flow of the air. Air is infused into the uterus using the continuous pipetting by syringe @30mmHg pressure/minute. The gradual building up of the pressure in the manometer is taken as an indication, that there is no backflow of air from the cervical canal. When sufficient pressure is built up, uterus is inflated ,enlarged, air starts escaping through ostium tube abnormalities .If there is rapid fall in the uterine pressure this indicates tubal patency. If the rate of fall is slower from the uterine pressure it indicates unilateral tubal patency. When the intrauterine pressure remains 200 mmHg for more than 3-5 minute, this is considered as bilateral impatency.

Similarly an instrument called Carbatome is inserted into the canal of the cervix and carbon dioxide gas is "blown" into the uterine cavity. The machine controls the flow of carbon dioxide and also record the pressure of the gas as it builds up in the uterus. There will be an increase in pressure of the gas within the uterus if the tubes are blocked. If the tubes are open, the initial rise in pressure is followed by a sudden reduction as the gas escapes along the tubes and into the abdominal cavity.

RESULTS

(a) Passable type, When the patency is good passage of air being continuous, the pressure falls gradually after insufflations about 60-80mmHg.

(b) Relatively passable, when the passage of air is intermittent the pressure is standing still at the 120mmHg.while in unilateral patency the decrease of pressure is very slow.

(c) Impassible type, in which passage of air is not as palpate, in bilateral impassible cases the pressure remains still after insufflations of air showing no decrease.

(d) Perplexing type, in which the pressure once elevated falls suddenly to zero, and there is no increase in spite of continuous insufflations, this indicated there is penetration of air in uterine sub mucosa.

Kawata and Koike, 1959, found that the result of bilateral passable cases were only 9 (13.9%) whereas in unilateral passable cases were 16 (24.0%) and bilateral impassible were 30 (40.88%).

When the patency of oviduct is normal the insufflations test was quite reliable ,in general the air begins to escape from abdominal oss from 100-120 mmHg pressure and it is continuous till 60mmHg.In healthy fallopian tubes insufflated pressure is of 60-100mmHg and the air continue to escape at 60-40mmHg pressure.

The results of this test can be difficult to interpret. If the tubes are blocked, the test gives no information about the location or nature of the obstruction. The inaccuracy of the test has led it to be largely superseded by the following two procedures.

b. HYDROTUBATION

In this test Injection of a liquid medication or saline solution through the cervix is introduced into the uterine cavity and Fallopian tubes for dilation and/or treatment of the tubes. Khasatiya *et al*., 1999 performing this test reported that the most frequent site of tubal blockage found by Hydrotubation was uterotubal junction (72.72%) and the results when compared with that of airo-tubation were reduced or dislodged with the occurrence of bilateral block by 2.0% and unilateral block by 4.4%, the location of blockage were block at the isthmus (22.75%) and at ampulla (4.5%).

2. PHENOL-SULPHONPHTHALEIN (PSP) DYE TEST

The PSP dye test is another method to diagnose patency of the fallopian tube. Animals are examined rectally to access the overall size of the uterus and the ovarian structures. The PSP dye is prepared by dissolving 0.3g phenol red, pH range5.8 to 8.4(BDH Chemical) and 4.2 g of anhydrous sodium bicarbonate in 100 ml of distilled Water and is filtered through a 0.54 Millipore filter paper(Kothari *et al.,* 1978).

METHOD

The animal to be tested is restrained in a cattle crush with the tail tied on one side to avoid soiling of the perineum. The vulva and perineum area is thoroughly cleaned. An initial urine sample is collected by passing a plastic pipette through Urethra into the bladder and the bladder is emptied. The cervix is grasped per-rectum and a sterile uterine catheter was introduced through it up to the body of uterus. While firmly grasping the cervix, PSP dye solution (20-50ml) is introduced by way of a syringe attached to catheter up to the clear demarcation of uterine distension. Complete instillation of the dye is ensured by injecting 10 ml of air through catheter and is withdrawn with the syringe still attached to avoid contamination of the vagina.

The subsequent urine samples are collected at 5,10,15,30,45,60,75, and 90 minutes and were alkalinized by adding a drops of 1M sodium hydroxide. The appearance of red colour in the alkalinized urine indicated positive response i.e. patency of tube.

RESULT

A positive response is considered if dye appears within 45 minutes, while in unilateral impatency it requires 45-90 minutes .If dye appearance require more than 90 minutes, it is considered as bilateral tubal blockage. Respectively, the dye is detected in urine between15-45 minute of intrauterine infusion of animals. The dye takes 60-90 minutes to appear in urine probably due to restricted rate of flow of dye through such oviducts, considered as bilateral tubal blockage; the dye did not appear in urine even after 90 minutes of dye infusion. Further, they reported that the frequency of bilaterally impatent tube was higher and blocked tube was lower with PSP dye test, when compared with air insufflations method suggesting higher efficiency of the former test.

Further, they mentioned the results of PSP dye test as; frequency of bilateral patency, unilateral impotency and bilateral blockage of fallopian tube was 62.50, 25.00 and 12.50% in cows and in buffalos, as 64.71, 26.47 and 8.82%respectively.

Results of the PSP dye test 20ml was instilled into the uterus

Cows	Time(minutes)first appearance of dye in urine	Air insufflation of tubes
1	>15	Both tube patent
2	15-45	Both tube patent
3	30	Both tube patent
4	60	Left/ Right oviduct blocked
5	90	Bilateral oviduct blocked

False negative results were also obtained, in which dye did not appear in urine within 2 hrs. These are the case of bilateral tubal Blockage where this dye test reflects variability in the size of uterus. The optimum volume of dye which initiates uterine contraction should be infused, although the movement of dye through the fallopian tube may merely the result of increased uterine pressure. Uterine

contractions play an important role since the dye overcoming the barrier at utero-tubal junction varies with the size of uterus.

3. Hysterosalpingography (H.S.G.)

A hysterosalpingogram is an X-ray of the uterus and fallopian tubes. An instrument is gently passed into the canal of the cervix and a special radio-opaque dye is carefully injected into the uterine cavity. The test does not require any form of general anesthesia. (Coulam *et al*.,1991).

The dye is shows on an X-ray screen and is visualized as the fluid filling in the uterus and then it's passing along both tubes to enter the abdominal cavity. If the dye fails to enter in the tubes, it may be indicating an obstruction at the utero-tubal junction which causes temporary spasm. Sometimes the dye can be seen to enter the tubes, and they become distended.

By the H.S.G. diagnosed at the site of tubal obstruction and can also show the presence of any irregularity in the shape of the uterine cavity. This test cannot identify the existence of pelvic adhesions, which may be enveloping the ovaries and preventing eggs from having access to the tubes.

Dye –two types of dye are used for this test; these are

a. Water soluble (preferable) e.g. - 60% urograffin.

b. Oil Soluble e.g. Lipiodol.

Water soluble dye:

50% Iodine with 6% polyvinyl Alcohol in water having advantages of

- Rapid absorption
- Less tissue reaction & less adhesion
- Harmless if Intravasated in venous system

Oil soluble dye:

Lipiodol & Ethiodol having advantages and disadvantage of

- It gives more clear & Sharper image
- Slow – so, delayed
- More pain
- May cause oil granuloma & embolism (Steiner *et al.,*2003)

The choice of contrast medium is between an oil-based medium and a water-based medium mostly it depends upon the choice of doctor. Initially, oil-based media is the choice because of the intense contrast provided and ability to obtain good delayed films. Subsequently, this medium is less

commonly used because; the intra-peritoneal oil is associated with intra-peritoneal granuloma. Retention in the body was investigated by x-ray imaging, plasma kinetics, and urinary and fecal excretion. The water-based material is entirely excreted into the urine within 2 days but the oil contrast media is excreted with a half-life of 50 days and retained for 21 days in the abdomen. The water-soluble material did not induce inflammatory reaction, whereas the oil-based media produced an abdominal inflammatory reaction, including granuloma formation. The oil-based product remains in use in animals because of the better contrast. Water-based contrast specifically designed for HSG is available (Sinografin); and this material provides excellent imaging but is quite expensive. Other dyes that is generally available as water-based contrast media (*e.g.* Hypaque) may be used, although contrast is less than optimal (Steiner *et al.*, 2003).

PROCEDURE

The hysterosalpingogram takes about 5 -15 minutes to perform. The procedure to perform test is as below.

- The patient (small animal) should lie on the table on dorsal recumbence.
- The doctor places a speculum in the vagina and visualizes the cervix.
- A soft, thin catheter is placed through the cervical opening into the uterine cavity or an instrument called a vaginal speculum is placed on the cervix and then a narrow metal catheter is inserted through the cervical opening.
- Contrast (radio opaque dye) is slowly injected through the cannula or catheter into the uterine cavity. An x-ray picture is taken as the uterine cavity is filling and then additional contrast is injected, so that the tubes should fill and begin to spill into the abdominal cavity. More x-ray pictures are taken as this "fill and spill" occurs.
- When both tubes spill dye, the patient roll on one side or the other slightly to give a slightly oblique x-ray image which can further delineate the anatomy.
- The procedure is now complete. The instruments are removed from the cervix and vagina.
- The patient remains on the table for a few minutes to recover from the cramping caused by injection of the contrast.
- The results of the test can be immediately available.

Visualization by screening with image intensifier in X-ray room:

Foley's catheter or Double channel catheter is used for insufflations with aseptic precaution. DYE injected by cannula in uterine cavity is under vision with Fluoroscopic

screen.15- 50 ml dye infusion is adequate.DYE flow observed. It will come out from fallopian tube to peritoneal cavity and the dye spill is detected.

Efficacy

Steiner *et al.*, 2003 reported that the sensitivity and specificity of Hysterosalpingography detecting any fallopian tube pathology to be 53% and 87%, respectively for unilateral impatency and 46% and 95%, respectively, for bilateral tubal pathology. For bilateral tubal pathology, these sensitivities were estimated to be 13% without risk factors, versus 47% with risk factors. For bilateral tubal blockage, the sensitivity decreased with the age with a factor estimated to be of 0.93 per year.

Complications

Complications of the procedure include infection, allergic reactions to the materials used, intravasation of the material, and, if oil-based material is used, embolisation. Air can also be accidentally instilled in to the uterine cavity by the operator, thus limiting the exam due to iatrogenically induced filling defects. This can be overcome by administering the Tenzer Tilt which will demonstrate movement of the air bubbles to the non-dependant portion of the uterine cavity.

Other modern tests

These are commonly used in human being and are use of current technologies in medical field which can be very well adapted in Veterinary practice.

4. Sono-salpingoGraphy

Salpingo-scopy is an advanced surgical procedure which requires specialized training & skill. It involves the handling of fallopian tubes which is a unique & delicate structure, especially the fimbriae. Salpingography is defined as ultrasound visualization of mucosa of the Ampullary portion of the tube using ultrasound echo enhancing (contrast) agent. It is a recent diagnostic procedure in human infertility cases. This is basic screening test for evaluating tubal patency. Further this test can also confirm the tubal patency by visualization of the fluid spill from fimbrial end of fallopian tube. Normally the fallopian tube is iso-echoic and do not visualize as a separate organ entity. But for this purpose a 1.8 mm telescope is introduced from the fimbrial end of the tube to evaluate the lumen (Lall *et al*., 2007).

Principle: Normal saline is pushed into uterine cavity with Foley's catheter & bulb inflated above interior os which prevents leakage.

- Nearly 200 ml saline is needed.
- Inj. of small amount of air helps in visualization of air bubble movement

Procedure – A balloon catheter is preferred as it is less likely to dislodge and create a better seal at the internal cervical os following the insertion of catheter the speculum is removed and the trans-vaginal ultrasound probe is inserted. Following changes is seen, which is classified.

Grade the tubes according to brojen's classification.

These changes have been classified as follows

- Grade 1 Normal fold pattern.
- Grade 2 Separation and flattening of major folds.
- Grade 3 Peripheral filmy and focal adhesions.
- Grade 4 Fibrous adhesions across more than 50% of the lumen.
- Grade 5 Fibrosis of the tubal walls with loss of the fold system.

Advantages –

Non- invasive.

No radiation exposure.

Tubal pathology can be detected.

Uterine malformation can be detected**.**

5. Laparoscopic Chromo-pertubation

This is the simple test involve injecting the little amount of light blue colour fluid (methylene blue) into the fallopian tubes via plastic tubes or catheter, which passes through the vagina and cervix. It is a surgical procedure performed through very small incisions in the abdomen, using specialized instruments. A pencil-thin instrument called a laparoscope is used having a thickness similar to ordinary pen. Before insertion of the laparoscope the abdomen is distended by a volume of gas using a special fine needle. This is to ensure that there is an adequate space inside the abdomen for inserting the instrument. A dye can be introduced into the uterine cavity through the cervical canal and then it is observed that how and when it comes out of the ends of the tubes into the peritoneal (abdominal) cavity. (Habibaj *et al*.,2012)

Procedure-

For this test 5 -6 ml Lidocane (xylocane) is injected superficially in each utero-sacral ligament (using 16 gauge needle) immediately adjacent to the posterior tip of the cervix. The uterine cervix is allowed to return its original position by releasing the pressure from the widely opening of speculum. This provides better visualization .After sometime Foley's catheter is inserted into the uterine lumen and its position is secured by inflating with water, approximately 50cc dilute methylene blue is slowly infused into the uterine cavity.

Double puncture method is used and pelvic organs are visualized specially for fimbrial end & its relation.

Indication: - Abnormal HSG finding.
Failure to conceive after 6 month of treatment
Unexplained infertility & age above 35 yr

Time - Prior to tubal microsurgery
In secretary phase
Recent corpus luteum may be visualized
Endometrial biopsy can take.

The limitations and advantages of the procedure are:

- Invasive procedure.
- Laparoscopic visualization of pelvis, organs & injection of Methylene Blue dye through Cervix & its spill is visualized.

6. Trans-vaginal Falloposcopy

Falloposcopy is endoscopic visualization of the uterine tubes by a non-incision Trans- vaginal and trans-uterine approaches.

7. Ampullary & fimbrial Salpingo-scopy

To Study mucosa of fallopian tube in deciding between tubal microsurgery & IVF, by using Colour Doppler Ultrasound.

8. Hysterosalpingo Contrast Sonography (HYCOSY)

HyCoSy is a nick-name for Hysterosalpingo contrast sonography. It is a technique to check that the Fallopian tubes are open, and not blocked. Hysterosalpingo-contrast-sonography (HyCoSy) is a trans-vaginal ultrasound technique in which a solution of galactose and 1% palmitic acid (Levovist) - or a mixture of air and saline - is infused into the uterine cavity and observed to flow along the Fallopian tubes to assess tubal patency. The bright echoes generated by the Levovist make tubal visualization easier, which is further improved by the addition of colour Doppler imaging.

In this method a speculum is introduced into the vagina. It feels like a Pap smear. Then will slip a thin tube into the cervical canal and inflate a tiny balloon on the end to hold it in place. The speculum is removed and replaced by the trans-vaginal ultrasound transducer.

Levovist is a sterile solution which has to be made up especially for each individual patient, immediately before use. It is the most expensive part of the procedure. A solution of saline is used to outline the endometrial cavity and then the special Levovist contrast agent is injected. The Levovist

shows up as bright white sparkly fluid on ultrasound examination. Its path is followed up into the uterus and then (hopefully) out through the Fallopian tubes on each side. Use of colour Doppler imaging to demonstrate the presence of the contrast agent in the Fallopian tubes and spilling out over the ovaries on each side. If one or both tubes are not open then this becomes obvious during the examination.

TREATMENT OF TUBAL PATENCY

There are many reasons for the patient that may not be able to conceive. However, one of the common reasons of all is because there is a tubal blockage The blocked fallopian tubes are either preventing sperm from reaching the egg or is preventing the egg from reaching the uterus., This condition occurs because the fallopian tubes are damaged by disease, tubal ligation or simply a mechanical problem. Surgical methods are used for helping to deal with this particular condition.

1. Tubal Anastomosis

   This particular form of surgery referred to as tubal re-anastomosis and is performed where the tubal blockage occurs between the uterus and fimbrial end of the fallopian tubes. This surgical treatment will require the patient to be asleep and involves the actual blocked segment of the fallopian tube being removed. Once the tubal blockage has been removed then the surgeon will join the two open segments of the fallopian tubes together.

2. Tubal Implantation

   This form of surgery will be used where there is either a proximal tubal blockage, or a blockage to be found between the fallopian tubes and uterus. Rather than the blocked fallopian tubes segments being removed, instead they are bypassed and a new opening will then be created into the uterus. Into this opening a healthy portion of the woman's fallopian tube will then be inserted into the cavity of the uterine. The other names which surgeons may use when talking about this form of tubal blockage surgery are tubo-uterine implantation or uterotubal implantation.

3. Salpingostomy

   Sometimes referred to as Neo-Salpingostomy, this operation creates a new opening into the blocked fallopian tubes and is the one most often used for dealing with distal tubal blockages which are found close to the fimbrial end of the fallopian tubes. That is the end of the tubes that is nearest the ovary which captures the egg after it is released from the ovary.

4. Salpingectomy

Salpingec-tomy is the removal of part of a fallopian tube. This procedure is most often performed prior to in vitro fertilization (IVF) if the patient has a build-up of fluid within the tube. This

build-up of fluid is called a hydrosalpinx. IVF success rates are much higher after salpingectomies if there was a hydrosalpinx large enough to be seen by ultrasound.

Conclusion

1. Infertility especially due to fallopian tube blockage is a very serious problem in the dairy industry which causes huge economic losses to the dairy owner.
2. There is no single test which can diagnose the actual site and extent of fallopian tube blockage.
3. There is no specific medicinal treatment for the tubal patency, however, pressurized inflation with antibiotics and mucolytics, intra uterine infusion may sometimes be beneficial. And conception rate 31.48 ±2.57 in cow and 30.58 (Kavani, 1984).
4. Some time some mucolytics (Guaifenesion) may be also beneficial. (Leppert, 2003).
5. The surgical treatment is possible to correct these problems, which are also very expensive to the owner.
6. Even after the surgery there may be the chances of reoccurrence of the tubal blockage.

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