UTERO-TUBAL INSUFFLATION TECHNIQUE FOR DIAGNOSIS OF TUBAL IMPATENCY IN COWS

BY

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THESIS

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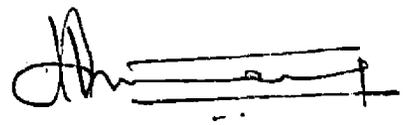
DECLARATION

I hereby declare that this thesis entitled "UTERO-TUBAL INSUFFLATION TECHNIQUE FOR DIAGNOSIS OF TUBAL IMPATENCY IN COWS" is a bonafide record of research work done by me during the course of research work and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.



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CERTIFICATE

Certified that this thesis, entitled "UTERO-TUBAL INSUFFLATION TECHNIQUE FOR DIAGNOSIS OF TUBAL IMPATENCY IN COWS" is a record of research work done independently by Sri. K.V. Athman under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship, or associateship to him.

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K. V. ATHMAN

DEDICATED

TO

MY LOVING FAMILY

C O N T E N T S

INTRODUCTION

INTRODUCTION

The cattle population of Kerala is about three million, of which about 13.7 lakhs are breedable cows above five years and 50 per cent of these are crossbreds belonging to Jersey and Brown Swiss. Using the present crossbreds as the target populations, the committee of experts constituted by the Government of Kerala, anticipate within near future that the state will have surplus crossbreds with good potentialities for sale outside the state. This depends mainly upon good management, sound breeding programme and maximum reproductive efficiency. One of the major infertility problem acting as a stumbling block for achieving maximum reproductive efficiency is the 'repeat breeder cow" which makes up about 19 per cent of total infertility in Kerala. Nair (1973) found pathological evidences of 3.52 per cent lesion of salpinx, bursa and broad ligaments in genitalia from slaughter house. Namboothiripad and Raja (1976) and Mathew and Namboothiripad (1979) reported an incidence of 4.58 per cent and 1.42 per cent ovarobursal adhesions respectively.

Diseases of bursa and salpinx constitute about 10 to 15 per cent of reproductive failure in cows

(Roberts, 1971). Rectal palpation is of limited value only in detecting extensive lesions on bursa and salpinx. Several tests like palpation, Rubin's test, visualisation and laparotomy are used for determining the tubal patency in human beings. Rubin's insufflation test is the most popular method used for the diagnosis of tubal patency. Several workers have reported modification of Rubin's insufflation technique in bovines (Hanley, 1953; Kawata and Koike, 1959; Koike and Kawata, 1959 and Nair and Raja, 1977). However, the success of these tests have been limited. The major lacunae faced by them were difficulty in total obturation of bovine cervix, poor dilatation of cervix, greater susceptibility of genitalia to "blow up" and lack of specialised skill and knowledge in its interpretation of the result in cows.

The present investigation was, therefore, taken up to evaluate the usefulness of utero-tubal insufflation technique for diagnosis of tubal impatency in 'repeat breeder' cows.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The major problem of cattle breeding even in well managed herds is the cyclic non breeding cows (Roberts, 1971). One of the important causes of this inevitable infertility is salpingeal and bursal affections (Rowson, 1942 and Lombard et al. 1951). Pathology of the salpinx and bursa ranged from 10 to 15 per cent of which half were bilateral which interfered with breeding (Roberts, 1971 and Arthur, 1975).

Earlier reports on the affections of salpinx and bursa were based mainly on abattoir studies. Lombard et al. (1951) examined the genitalia of 103 repeat breeder cows and reported 16 cases of salpingeal affections of which nine were unilateral and seven bilateral. Among the salpingeal affections eight were hydrosalpinx, three pyosalpinx and five with chronic interstitial salpingitis.

Moberg (1954) found pathological changes of the bursa and salpinx in two groups of sterile cows. He observed 192 bursal adhesions and 251 salpingeal affections in the first group of 1622 cows and 20 cases of bursal adhesions and 25 salpingeal affections in the second group consisting of 516 cows. He also observed that out of the total 276 salpingeal cases 69 were bilateral 118 right sided and 89 left sided. Majority of the bursal adhesions

were due to haemorrhages during rectal manipulation of the ovaries.

Cembrowicz (1956) conducted clinical and post-mortem examination of 1030 animals and reported 180 abnormalities of genitalia of which 73 were bursal and salpingeal involvements. The incidence was low in heifers than in cows. Dawson (1956) found either bursal adhesions or salpingitis in 105 out of 200 sterile cows on clinical and post-mortem examinations. Dawson (1958) also observed 51.5 per cent of either bursitis or salpingitis of 252 cows which had been discarded for sterility.

Maekava and Kawata (1959) diagnosed four cases of subacute or chronic mesosalpingitis and three cases of ovarotubal adhesions in seven infertile cows both macroscopically and histologically. Using normal saline injection test on 47 sets of genital organs, Koike and Kawata (1959) diagnosed seven cases of salpingitis and one case of bursitis. Kawata and Koike (1959) by employing human Rubin's apparatus detected nine bilateral and six unilateral oviductal block in 60 infertile cows. Kiesel and Dacres (1959) reported one each of salpingitis and ovarian adhesion in 24 beef cows examined at slaughter.

Zemjanis et al. (1961) found a low incidence (274) of salpingeal lesions out of 20,913 dairy cows on clinical examination. They detected 37 cases of hydrosalpinx and 237 cases of salpingitis or perisalpingitis and suggested that the low incidence might be due to careful and

infrequent rectal examination. Mylera (1962) reported 24 cases affected with salpingeal and bursal affections and most of these cases were in non-pregnant animals. Half of the bursal cases were bilateral and the others were unilateral. Rao et al. (1965) reported few cases of salpingitis and bursitis in their study with 200 cows on slaughter. Donaldson et al. (1968) found three cases of cystic oviduct in 74 beef cattle. Young (1968) recorded two cases of salpingitis in 7,355 beef cows. Namboothiripad (1971) reported pathological involvement of bursa and salpinx in 41 repeater cows out of 99 Sindhi and 24 Jersey-Sindhi cross bred adult females. Rogers et al. (1972) detected 14 cases of salpingitis and 61 cases of fibrosed salpinx macroscopically from 163 beef cows. Afiefy et al. (1973) noted a close association between the salpinx and ovarian lesion in Egyptian cows. The common lesions found were chronic inflammation of salpinx, hydrosalpinx, pyosalpinx and ovarobursal adhesion. Most of the bursal lesions were on the right side.

Summers (1974) found a low incidence of ovarobursal adhesion on a slaughter study with 6,471 animals. Summers et al. (1974) diagnosed four cases of hydrosalpinx and eleven cases of interstitial salpingitis in a group of 35 infertile beef cows and five cases of salpingitis from a group of 42 apparently normal females.

Nair and Raja (1974) in a study of 1,250 genitalia collected from slaughter house observed four cysts in the salpinx, two acute salpingitis, one chronic catarrhal salpingitis, one papillary hyperplasia, two hydrosalpinx, twenty five chronic bursitis, two hydrops bursa, four parovarian cysts, and two parovarian abscess cases. Miller (1977) observed 80 cases of hydrosalpinx and 66 cases of ovarotubal adhesions in a group of 254 non-pregnant range cows. Mild to severe interstitial salpingitis were also found in both pregnant and non-pregnant animals.

Extensive use and adaptation of utero-tubal insufflation technique have been done in human medicine both for diagnosis and treatment of tubal blockage. The first attempt to carry out utero-tubal insufflation in human medicine was made by Rubin in 1920, the gas used being oxygen which was changed to less irritating carbon dioxide later. Rubin's insufflation apparatus consisted of a steel cannula with a rubber 'acorn' or 'bung' at the tip for sealing the cervix from backflow of gas through cervix and a kymograph to read the pressure. If a steady pressure was maintained even after the inflow was turned off, it was considered as an indication of the tubal impatency.

The first attempt to carry out utero-tubal insufflation in bovines was made by William,(1925) and followed shortly afterwards by Moench,(1925). Both of them used a steel catheter with a cone shaped rubber 'acorn' fixed three to four inches below the tip. The catheter was held against the external os of the cervix. They could not get a complete obturation because of the unevenness of the bovine cervical folds and practical difficulty in dilating the cervix.

The detailed technique of utero-tubal insufflation both on post-mortem specimens and on live animals have been described by Hanley,(1953). He used a Kymograph and a mercury manometer to read the pressure changes of bovine genitalia during insufflation. The inflation of the genitalia was done with carbon dioxide by adjustable valves. The cannula was made from a teat syphon and a long copper tubing of 53 cm. length and 5 mm. diameter and the obturation of cervix was by using a tyre shaped balloon at its tip.

McDonald (1954) described a technique of examining starch granules in vaginal mucous for diagnosis of tubal patency under low power microscope after treating the vaginal mucous with dilute iodine solution. Sterile

starch solution was injected intraperitonfally at the sublumbar fossa 24-48 hours prior to the test. Johari and Sharma (1964) applied the above tests in six cows and six buffaloes. All of them gave negative results which they attributed to the metabolisation and destruction of starch granules in the peritonium and genital tract. Kessy and Noakes (1979a) conducted starch grain test in eight previously fertile Friesian cows and one heifer and observed that the test should be performed on or about day 14 of the oestrous cycle to get maximum results. Dawson (1958) performed fluid injection test on 56 cows affected with severe endometritis which failed to provide convincing evidence of tubal blockage.

Koike and Kawata (1959) subjected the genitalia to normal saline injection test with a catheter and a manometer in the circuit. The pressure was noted when saline first passed the uterine ostium and was increased to 200 mm. Hg. and rate of fall of pressure was correlated as patency. Kawata and Koike (1959) used uterine catheters of different diameters suitable to varying cervix and a dial manometer for pressure reading. An adjustable air blower was used for inflating the uterus. The introduction of the metal catheter through cervical canal was by using cervical dilators, cervical forceps and vaginal speculum. The obturation of the cervical canal was made by employing

an assistant to hold the bulb of catheter in cervix through vagina. Feeling through the rectum, the bubbling of air through either one or both the salpinx was taken as patency. Berchtold and Brummer (1968) tested the patency of bovine salpinx by Phenolsuphonphalein (PSP) on the principle of its absorption rate by peritonium and endometrium. They infused (PSP) cranially as far as possible to the horn to be tested. The quickness of appearance of PSP in alkalanised urine was taken as an indication of tubal patency. On the contrary, Kothari et al. (1978) suggested that adequate volume of the dye may be necessary to cause uterine distension to eliminate false results and concluded that this test was not valuable in unilateral occlusion. Kessy and Noakes (1979a) observed that the above test should be done in the midluteal phase of the oestrous cycle to get maximum results.

Kessy and Noakes (1979b) applied a combined starch grain and PSP test to investigate five 'repeat breeder cows'. Using starch grain test they found three animals were bilaterally impatent and two unilaterally impatent and using the PSP test, four bilaterally impatent cases. They could confirm occlusion only in two of the four PSP positive results, visually and by palpation at laparotomy and also by flushing with saline.

Gowda and Khan (1975) conducted utero-tubal insufflation test in 250 normal excised non-gravid genitalia of cows and heifers. They observed a comparatively low percentage of "blown up" condition in heifers than in cows and uterine damage was observed more in oestrus phase. Nair and Reja (1977) carried out several experiment on freshly excised uteri using an apparatus on the same line suggested by Kawata and Koike, (1959). They concluded that since the safety margin was too low and not uniformly noticed in all cases, the test was unsafe in cattle.

MATERIALS AND METHODS

MATERIALS AND METHODS

One hundred and sixty one genitalia of cows and heifers roughly over three years collected from the Municipal Slaughter House, Trichur were used for utero-tubal insufflation tests. Eight cross bred cows and four heifers belonging to the University Livestock Farm, Mannuthy and 25 repeat breeder cows brought to the Artificial Insemination Centre, Trichur under the Department of Animal Reproduction were also used for the application of the above test.

A new apparatus in modification of the one used by Nair and Raja, 1977 was used for the present study (Fig.1). The metal catheter with bulb was replaced by stainless steel catheters of 3 mm. and 5 mm. diameter over which 22 FR. Neo Foley's latex catheter was sleeved. In addition, the tail end of metal catheter was provided with two bulbs, one rectangular and another round for tightly holding Foley's catheter and plastic tube respectively. A 'Y' shaped steel cannula instead of a glass cannula was used for interconnecting the dial manometer, the rubber blower and the uterine metal catheter.

The apparatus essentially consisted of the following units (Fig.2).

(A) Two 50 cm. long uterine metal catheters of 3 mm. 5 mm. diameters to varying cervix.

(B) Two 22 FR. Neo Foley's latex balloon catheters with universal aperture for inflating and deflating the balloon.

(C) A dial manometer (Japan) caliberated to read between 0-300 mm. Hg. pressure.

(D) A rubber blower with one way air valve at the tip and a stopcock to release the air.

(E) A 'Y' shaped steel cannula for attaching the metal catheter with Foley's latex balloon at its straight end and the dial manometer and rubber blower with stopcock at its angular wings with plastic tubes.

(F) A 5 ml. syringe for inflating and deflating the Neo Foley's balloon with distilled water.

(G) Plastic tubes for interconnecting uterine metal catheter, dial manometer and rubber blower.

The metal catheter with Foley's balloon was inserted into the uterine body of the excised genitalia through the cervical canal. About 2 ml. of distilled water was introduced initially into the balloon through the universal aperture and after ascertaining the location of balloon in the midcervix by palpation, sufficient quantity of water (1 - 3 ml.) was introduced to get complete obturation. To avoid kinking of salpinx, bursa and broad ligaments were stretched by introducing the left fingers into the bursal pouches. The whole genitalia with locked catheter was immersed in a bucket of physiological saline solution. Air was blown into the uterus at a rate of 10 mm. Hg. pressure at a time and

the rate was reduced to 5 mm. Hg. after reaching 50 mm. Hg. pressure. The pressure at which bubbling of air occurred through ostium tubae abdominalis of either one or both the salpinx was noted. Thereafter, the pressure was gradually raised until the uterus was "blown up" as indicated by a sudden drop in air pressure and this pressure was also noted.

For conducting the experiment in live animals, the well lubricated Foley's balloon with metal catheter was inserted into the vagina under aseptic precautions and was guided by the left hand in the rectum. The catheter was then introduced into the cervical canal to fix the balloon at the midcervix between two cervical annular rings. The rubber balloon was inflated by injecting 2 - 5 ml. of distilled water with the help of an assistant, who was also made to hold the manometer in view of the operator (Fig. 3). Complete obturation of the genitalia was thus effected as in the case of excised genitalia. Air was blown into the uterus by the operator observing the manometer initially at a rate of 10 mm. Hg. pressure at a time and the rate was reduced to 5 mm. Hg. after reaching 50 mm. Hg. pressure. Gradual building of pressure in the manometer was taken as complete obturation of cervix. The sensation of air coming out

through the ostium tubae abdominalis of either one or both the salpinx with gradual decrease of pressure was considered as the test for patency. Pressure reading in the manometer beyond 150 mm. Hg. without bubbling sensation at one or both ends of the salpinx was considered tubal impatency. In few cases, the air pressure was increased until "blown up" condition was produced as indicated by sudden drop in air pressure and all these animals were clinically examined every day for four to five days. Two of them were slaughtered at 48 hours to study the changes in the uterus. All the animals subjected to the test were administered one g. Streptomycin and four lakh units of Penicillin in 30 ml. distilled water intrauterine to prevent possible uterine infection. All the cows with bilateral patency which returned to heat after the test were inseminated in the first heat to study the conception rate.

The data were collected and subjected to statistical analysis (Snedecor and Cochran, 1967).

RESULTS

Results of the utero-tubal insufflation test on 161 excised genitalia and 37 infertile cross bred cows and heifers are presented in Tables 1 to 9.

The test was conducted using the utero-tubal insufflation equipment designed in partial modification to the one by Nair and Raja, (1977). Bilateral patency, unilateral impatency and bilateral impatency were recorded in 72.05, 8.70 and 19.25 per cent genitalia respectively. The incidence of bilateral patency, unilateral impatency and bilateral impatency in genitalia of cows was 73.19, 7.97 and 18.84 per cent respectively as against 65.22, 13.04 and 21.74 per cent in the genitalia of heifers (Table 1). Analysis of the data revealed that there was significant difference in tubal impatency between cows and heifers ($P < 0.01$).

Bilateral patency, unilateral impatency and bilateral impatency were recorded in 83.78, 2.70 and 13.52 per cent in cows and heifers together. It was observed that out of the 35 cows subjected to the test, 82.86 per cent had bilateral patency, 2.86 per cent unilateral impatency and 14.28 per cent bilateral impatency. On the contrary, both the heifers were found to have bilaterally patent salpinx (Table 2).

The pressure range at which air escaped from both the tubes in excised genitalia was 60 - 185 mm. Hg. with a mean of 128.12 mm. Hg. in cows and 80 - 190 mm. Hg. with a mean of 148.93 mm. Hg. in heifers (Table 3). Analysis of the data revealed that significantly higher pressure was required in heifers to open both the tubes than in cows ($P < 0.01$).

The pressure range at which air escaped from both the tubes, in bilateral patency cases was 65 - 155 mm. Hg. with a mean of 116.38 mm. Hg. in cows and 110 - 145 mm. Hg. with a mean of 127.50 mm. Hg. in heifers (Table 4). Analysis of the data revealed that significantly higher pressure was required to open both the tubes in heifers than in cows ($P < 0.01$).

It may be observed from Table 5 that in 69.31 per cent of bilateral patency in the excised genitalia of cows, the right salpinx was first to open with a mean pressure of 113.57 mm. Hg. The mean additional pressure required to open the left side in these cases was 15.79 mm. Hg. The left salpinx opened first in 26.73 per cent genitalia with a mean pressure of 108.15 mm. Hg. An additional mean pressure of 19.63 mm. Hg. was required to open the opposite salpinx. In the remaining 3.96 per cent genitalia both the salpinx opened simultaneously at a mean pressure of 105.00 mm. Hg. Analysis of the data revealed that significantly higher pressure was required to open the left

salphinx ($P < 0.05$). The test carried out in 15 genitalia of heifers with bilateral patency revealed that in 80.00 per cent cases, the right salpinx was first to open with a mean pressure of 120.42 mm. Hg. The mean additional pressure required to open the left side was 29.17 mm. Hg. in these cases. The left salpinx opened first in 13.33 per cent cases with a mean pressure of 97.50 mm. Hg. An additional mean pressure of 47.50 mm. Hg. was required to open the opposite salpinx. In the remaining 6.67 per cent genitalia both the salpinx opened simultaneously at a mean pressure of 160.00 mm. Hg. Analysis of the data revealed that significantly higher pressure was required to open the left salpinx ($P < 0.01$).

The test revealed that in 20 out of the 29 cows with bilateral patency, the right tube was first to open with a mean pressure of 97.50 mm. Hg. The mean additional pressure required to open the left tube in these cases was observed to be 17.25 mm. Hg. The left tube opened first in seven cows with a mean pressure of 98.57 mm. Hg. and an additional pressure of 17.86 mm. Hg. was required to open the opposite salpinx. Both the tubes opened simultaneously in two cows with a mean pressure of 80.00 mm. Hg. The right and left tubes were first to open in one case each in heifers (Table 6). There was no significant difference between the right and left salpinx on the pressure required to open them.

The pressure at which "blown up" condition of the uterus took place in excised genitalia of cows was between 100 - 280 mm. Hg. with a mean of 164.46 mm. Hg. Similarly in genitalia of heifers, "blown up" condition occurred at a pressure range of 100 - 260 mm. Hg. with a mean of 210.00 mm. Hg. An additional pressure of 36.53 mm. Hg. over the pressure required to open both the tubes was needed to "blow up" the uterus of cows. In contrast, in the genitalia of heifers, an additional pressure of 60.33 mm. Hg. was required to produce "blown up" condition. Statistical analysis showed that significantly higher pressure was needed for producing "blown up" condition in uterus of heifers ($P < 0.01$). The safety margin viz. the difference between the highest pressure at which air escaped through the normal patent salpinx and the maximum safe pressure (5 mm. Hg. less than pressure at which "blown up" condition occurred) was 31.53 mm. Hg. in excised genitalia of cows and 55.33 mm. Hg. in excised genitalia of heifers (Table 3).

Blown up condition of uterus was produced in seven bilateral patency, one unilateral impatency and four bilateral impatency cases in live animals (Table 7). In five cows with bilaterally patent tubes the pressure at which "blown up" condition occurred was between 120 - 220 mm. Hg. The mean additional pressure required to produce "blown up" condition was 65.00 mm. Hg. and therefore the

safety margin was estimated to be 60.00 mm. Hg. On the contrary, in two heifers with bilateral patency the pressure at which "blown up" condition occurred was between 195 - 200 mm. Hg. The mean additional pressure required to produce "blown up" condition and the safety margin were found to be 60.00 mm. Hg. and 55.00 mm. Hg. respectively. Analysis of the data revealed that there is significant difference between cows and heifers in the additional pressure required to produce the "blown up" condition of uterus. ($P < 0.05$). Clinical examination of cows and heifers subjected to "blown up" condition revealed total absorption of the escaped air in all cases. The uterine tear was not traceable and there was only very small quantity of blood in the uterine cavity on post mortem examination.

The incidence of unilateral impatency in excised genitalia was recorded to be 8.70 per cent. The impatency of the right salpinx was 28.57 per cent as against 71.43 per cent in left side (Table 8). Analysis of the data revealed that there is significantly higher incidence of impatency in left side than right side ($P < 0.01$). The pressure range at which air escaped through the left patent salpinx in impatency of the right side was between 80 - 120 mm. Hg. with a mean of 106.25 mm. Hg. On the contrary, in the left sided impatency, air escaped through the right salpinx at a range of 60 - 160 mm. Hg. with a mean of 117.14 mm. Hg. pressure. Analysis of the data revealed that there was no significant

difference in the pressure at which air escaped from the left and right salpinx in unilateral impatency. Mean pressure at which "blown up" condition of uterus occurred was 175.00 mm. Hg. in left sided impatency as against 178.75 mm. Hg. in right impatency cases. The additional pressure required to produce "blown up" condition of the uterus in right and left sided impatency were 72.50 mm. Hg. and 57.86 mm. Hg. respectively. Safety margins in unilateral impatency cases were noted to be 67.50 mm. Hg. and 52.86 mm. Hg. respectively in right and left sided impatency in cows. Unilateral impatency in genitalia of heifers was found to be restricted to the left salpinx. In these cases the right tube opened with a mean pressure of 146.67 mm. Hg. and an additional pressure of 53.33 mm. Hg. was required to produce "blown up" condition. Safety margin of 48.33 mm. Hg. was noted in the genitalia of heifers (Table 8).

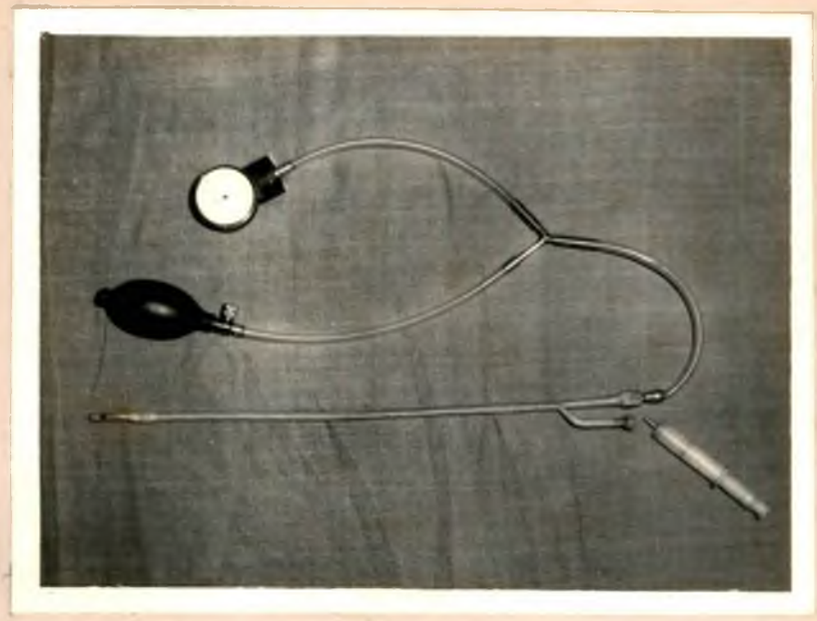
The man additional pressure used to produce "blown up" condition of the uterus in one cow with unilateral impatency was 90.00 mm. Hg. Thus a safety margin of 85.00 mm. Hg. was obtained in cows with unilateral impatency of salpinx (Table 7).

Incidence of bilateral impatency in excised genitalia of cows and heifers was recorded as 18.84 and 21.74 per cent respectively (Table 1). The pressure at which the "blown up" condition occurred in bilateral impatency, ranged from 80 - 210 mm. Hg. with a mean of 157.12 mm. Hg. in cows and

120 - 225 mm. Hg. with a mean of 171.00 mm. Hg. in heifers (Table 3).

The pressure at which uterus was "blown up" in cows and heifers with bilateral impatency were 195 mm. Hg. and 210 mm. Hg. respectively (Table 7).

Conception rate of cows with bilaterally patent tubes, after utero-tubal insufflation test is given in Table 9. Sixteen out of 23 cows inseminated (69.56 per cent) conceived with an average of 1.13 insemination per conception.



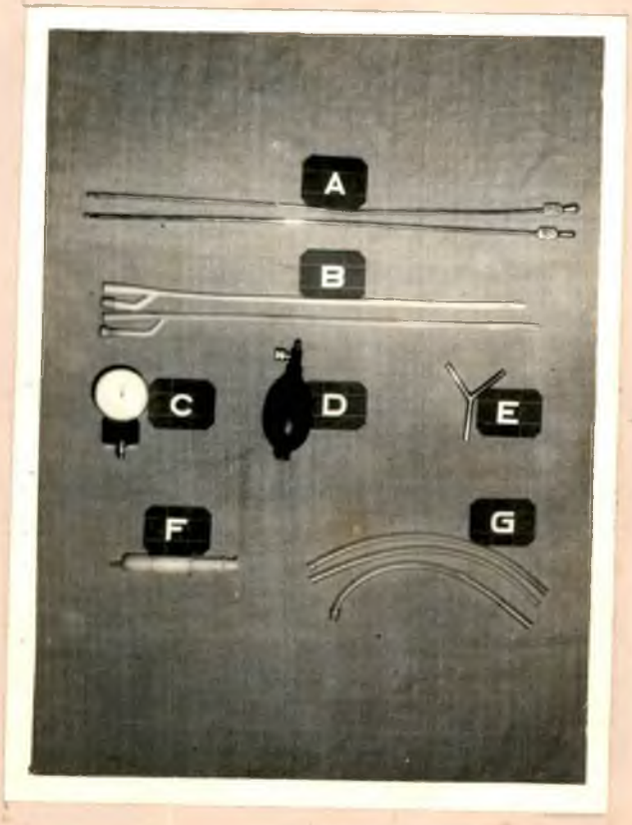

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Table 1. Incidence of tubal impatency in the excised genitalia

Particulars	No. observed			Percentage		
	Cows	Heifers	Total	Cows	Heifers	Total
Bilateral patency	101	15	116	73.19	65.22	72.05
Unilateral impatency	11	3	14	7.97	13.04	8.70
Bilateral impatency	26	5	31	18.84	21.74	19.25
Total	138	23	161	100.00	100.00	100.00

Normal deviation for significance difference of impatency is 1.96 (P / 0.05) and 2.54 (P / 0.01)

Table 2. Incidence of tubal impatency in infertile cows and heifers

Particulars	No. observed			Percentage		
	Cows	Heifers	Total	Cows	Heifers	Total
Bilateral patency	29	2	31	82.86	100.00	83.78
Unilateral impatency	1	..	1	2.86	..	2.70
Bilateral impatency	5	..	5	14.28	..	13.52
Total	35	2	37	100.00	100.00	100.00

Table 3. Tubal-insufflation test in the excised genitalia

Condition	No. of genitalia examined			Pressure at which left tube opened (mm. Hg.)				Pressure at which right tube opend (mm.Hg.)				Pressure at which both tubes opend (mm. Hg.)				Pressure at which uterus "blown up" (mm.Hg.)				Additional pressure required to blow up uterus (mm.Hg.)				Safety margin pressure (mm. Hg.)			
	Cows	Heifers	Total	Cows		Heifers		Cows		Heifers		Cows		Heifers		Cows		Heifers		Cows		Heifers		Cows		Heifers	
				Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Bilateral patency	101	15	116	60 - 185	123.02± 2.68	80 - 180	143.33± 8.15	60 - 180	117.23 ± 2.45	65 - 190	126.33 ± 8.10	60 - 185	128.12 ± 6.81	80 - 190	148.93± 8.47	100 - 280	164.46± 2.86	100 - 260	210.00± 11.15	5 - 145	36.53 ± 2.37	20 - 120	60.33 ± 7.49	0 - 140	31.53 ± 2.37	15 - 115	55.33 ± 7.49
Unilateral impatency	11	3	14	80 - 120	106.25 ± 8.98			60- 155	117.14 ± 12.04	140 -160	146.57 ± 6.67	60- 155	113.18 ± 8.18	140 - 160	146.67 ± 6.67	150 - 225	176.36 ± 6.75	160 - 240	200.00 ± 23.09	15 - 140	61.37 ± 11.28	20 - 80	53.33 ± 17.64	10 - 135	56.37 ± 11.28	15- 75	53.33 ± 17.64
Bilateral impatency	26	5	31													80 - 210	157.12± 6.58	120 - 225	171.00± 13.68								

Both tubes opened in heifers than in cows $t = 3.1245^{**}$ with df 114
(P < 0.01)
Pressure needed for producing blown up in heifers $t = 14.294^{**}$ with df 114
(P < 0.01)

Table 4. Tubal-insufflation test in infertile cows and heifers

Conditions	No. of cattle subjected to the test			Pressure at which left tube opened (mm. Hg)				Pressure at which right tube opened (mm. Hg.)				Pressure at which both tubes opened (mm. Hg.)			
	Cows	Heifers	Total	Cows		Heifers		Cows		Heifers		Cows		Heifers	
				Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Bilateral patency	29	2	31	80-155	110.52±4.28	120-130	125.00±5.00	65-145	104.48±4.12	110-145	127.50±17.5	65-150	116.38± 3.88	110-145	127.50± 17.5
Unilateral impatency	1		1						120.00						

Both tubes opened in heifers than in cows $t = 5.91^{**}$ with df. 29 ($P < 0.01$)

Table 5. Bilateral patency of salpinx in the excised genitalia

Particulars	No. observed			Percentage			Mean pressure at which Ist tube opened (mm. Hg.)		Mean Pressure at which 2nd tube opend (mm. Hg.)		Mean Additional pressure required to opend 2nd tube (mm. Hg.)	
	Cows	Heifers	Total	Cows	Heifers	Total	Cows	Heifers	Cows	Heifers	Cows	Heifers
Left tube first opendd	27	2	29	26.73	13.33	25.00	108.15 ± 4.96	97.50 ± 2.50	127.78 ± 3.96	145.00 ±45.00	19.63 ± 2.34	47.50 ±42.50
Right tube first opendd	70	12	82	69.31	80.00	70.69	113.57 ± 2.94	120.42 ± 7.52	129.57 ± 2.96	149.58 ± 8.24	15.79 ± 1.32	29.17 ± 5.50
Both tube opened simultaneously	4	1	5	3.96	6.67	4.31	105.00 ± 15.00	160.00	105.00 ± 15.00	160.00	..	55.00 ± 9.57

Pressure to open left salpinx in cows .t = 2.1457* with df 95
(P ⟨ 0.05)
Pressure to open left salpinx in heifers t= 3.2088** with df 12
(P ⟨ 0.01)

Table 6. Bilateral patency of salpinx in infertile cows and heifers

Particulars	No. observed			Percentage			Pressure at which Ist tube opened (mm.Hg.)		Pressure at which 2nd tube opened (mm. Hg)		Additional pressure required to open 2nd tube (mm.Hg.)	
	Cows	Heif-ers	Total	Cows	Heif-ers	Total	Cows.	Heifers	Cows	Heifers	Cows	Heifers
Left tube first opened	7	1	8	24.14	50.00	25.81	98.57 ±5.95	120.00	114.43 ± 5.53	145.00	17.86 ±3.91	25.00
Right tube first opend	20	1	21	68.97	50.00	67.74	97.50 ±6.90	110.00	117.00 ±16.64	130	17.25 ±2.65	20.00
Both tubes opend simul-taneously	2		2	6.89		6.45	80.00		80.00			
Total	29	2	31	100.00	100.00	100.00						

Table 9. Conception rate of cows with bilateral patency of tubes after utero tubal insufflation test

No. of cows subjected to the test	No. of cows which came to heat	No. conceived	Percentage of conception	Average number of insemination per conception
24	23	16	69.56	1.13

DISCUSSION

DISCUSSION

A new utero-tubal insufflation equipment was designed and used for the diagnosis of tubal impatency in both excised genitalia and live animals. The equipments designed by Koike and Kawata, (1959) and Nair and Raja, (1977), have the inherent defect of possible backflow of air as the mechanism of obturation of cervix is not perfect. Though total obturation could be obtained using the instrument designed by Hanley, (1953), there was possibility of the inflated balloon in the body of the uterus blocking the entrance of one of the horns of the uterus, thus giving false positive results. The equipment presently designed overcomes both these defects. The latex balloon in the Foley's catheter sleeved over the metal catheter can be positioned anywhere in the cervical canal and inflated to the required size, thus providing total cervical obturation.

It was observed that a higher pressure range (60 - 180 mm. Hg.) was needed for air to escape from both the salpinx in excised genitalia than pressure range in infertile cows (65 - 155 mm. Hg.). This might be on account of high tensile strength and mobility of the genitalia <u>in situ</u>.

The test was applied for diagnosis of tubal impatency in infertile cows at a pressure range of 65 - 155 mm. Hg. with a mean of 116.38 mm. Hg. Out of the 12 animals

in which the pressure was raised to produce "blown up" condition, in one case only the uterus was "blown up" at a pressure (120.00 mm. Hg.) lesser than the maximum pressure for the test (150.00 mm. Hg.). So also, the safety margin was found to be high ranging from 35 - 100 mm. Hg. with a mean of 65.00 mm. Hg. Hence it is felt that the test can be applied as a clinical test without the danger of producing "blown up" condition at a pressure range of 65 - 150 mm. Hg. Since in one case at least "blown up" condition was produced at 120 mm. Hg. pressure, raising the pressure beyond 120 mm. Hg. may be done gradually and with caution. The subserous ballooning of the uterus by the escape of air through a slight tear in the uterine wall in "blown up" condition disappeared within 48 hours. The "blown up" condition did not endanger the life of the animal, as there was very little bleeding at the site of tear. However, this might affect the future breeding performance of the animal.

The incidence of tubal impatency both unilateral and bilateral was 27.95 per cent in the excised genitalia and 16.22 per cent in the infertile experimental animals. This is much lower than that reported earlier (Koike and Kawata, 1959; Gowda and Khan, 1975; Nair and Raja, 1977). The incidence of tubal impatency was found to be significantly higher in heifers than in cows. In contrast Gowda and Khan, (1975) reported a higher patency rate in the genitalia of heifers than in the genitalia of cows.

Significantly higher pressure was required for both the tubes to open in heifers than in cows both in excised genitalia and live animals. This would probably be explained by the fact that the genitalia of heifers is endowed with better tensile strength than that of the cows. The fact that the heifer genitalia suffered "blown up" condition at a higher pressure than the genitalia of cow supports the above contention (Tables 5 and 6).

The right tube was first to open in majority of cases in both excised genitalia and in live animals. This observation is in confirmity with that of Hanley, (1953). The incidence of impatency of the left tube was significantly higher (71.43 per cent) than that of the right (28.57 per cent). This is also in agreement with the other reports (Hanley, 1953; Koike and Kawata, 1959; Nair and Raja, 1977).

The pressure at which "blown up" condition of the uterus took place in the genitalia of cows was between 100 - 280 mm. Hg. with a mean of 164.46 mm. Hg. as against a pressure range of 100 - 260 mm. Hg. with a mean of 210.00 mm. Hg. in heifers. Additional pressure of 36.53 mm. Hg. and 60.33 mm. Hg. were required to produce "blown up" condition of the uterus in excised genitalia of cows and heifers respectively. The mean additional pressure required to produce "blown up" condition in infertile cows and heifers were 65.00 mm. Hg. and 60.00 mm. Hg. respectively. These

data indicate that a significantly higher pressure was needed to produce "blown up" condition in heifers than in cows. So also the mean additional pressure required to produce "blown up" condition was more in live animals than to the excised genitalia. This indicates that the tensile strength genitalia is more in heifers than in cows.

SUMMARY

SUMMARY

The objective of the present investigation was to design an apparatus for utero-tubal insufflation test and to standardise its use in both excised genitalia and in live animals for the diagnosis of tubal impatency.

An apparatus was designed in modification to the one used by Nair and Raja, (1977). The metal catheter with bulb was replaced by a stainless steel catheter of 3 or 5 mm. diameter over which 22 FR. Neo Foley's latex catheter was sleeved over. The use of the instrument was first standardised on 161 excised genitalia with a view to apply the apparatus on live animals later. The instrument was used for diagnosis of tubal impatency of 12 problem cows and heifers of the University Livestock Farm, Mannuthy and 25 repeat breeder cows presented at Artificial Insemination Centre, Trichur.

The lubricated catheter was aseptically guided into the cervix by the left hand in the rectum. The rubber balloon was fixed in the midcervix between two cervical annular rings and was inflated by injecting 2 to 5 ml. of distilled water through the universal aperture of the balloon. Thus total obturation of the cervix was effected. Air was blown into the uterus by the operator at a rate of 10 mm. Hg. pressure at a time upto 50 mm. Hg. and thereafter reduced to 5 mm. Hg. pressure until bubbling of air could be felt at ostium tubae abdominalis. The sensation of air coming out through one or both the

ostium tubae abdominalis with gradual decrease in manomatric pressure was considered as test for patency. Maintenance of manometric pressure beyond 150 mm. Hg. without bubbling sensation at one or both the ostium tubae confirmed tubal impatency. In order to estimate the safety margin (the difference between the highest pressure at which air escaped through the normally patent salpinx and the maximum safe pressure), the air pressure was increased until "blown up" condition of the uterus, as indicated by a sudden drop in air pressure was produced. Clinical examination of all the animals and post mortem examination of two cases were carried out to evaluate the degree of damage to the "blown up" uterus. Twenty three cows with bilateral patency were inseminated in the succeeding heats to study the efficacy of the test for treatment of temporary tubal blockage.

Bilateral patency, unilateral impatency and bilateral impatency were recorded in 72.05, 8.70 and 19.25 per cent cases in the excised genitalia. There was significant difference in tubal impatency between cows and heifers. Bilateral patency, unilateral impatency and bilateral impatency were recorded in 83.78, 2.70 and 13.52 per cent in the experimental animals. The pressure range at which air escaped from both the tubes in excised genitalia was 60 - 185 mm. Hg. with a mean of 128.12 mm. Hg. in cows and 80 - 190 mm. Hg. with a mean of 148.93 mm.Hg.

in heifers. Similarly, the pressure range at which air escaped in bilaterally patent case was 65 - 155 mm. Hg. with a mean of 116.38 mm. Hg. in cows and 110 - 145 mm.Hg. with a mean of 127.50 mm. Hg. in heifers. Significantly higher pressure was required to open both the tubes in heifers than in cows.

The right salpinx opened first in 70.69 and 67.74 per cent of bilateral patency cases in excised genitalia and in live animals respectively. Air escaped from the left salpinx first in 25.00 per cent cases in excised genitalia and 25.81 per cent cases in experimental animals. Simultaneous opening of the tubes was observed in the remaining cases in both excised genitalia and in experimental animals.

The pressure at which "blown up" condition of the uterus took place in excised genitalia of cows was between 100 - 280 mm. Hg. with a mean of 164.46 mm. Hg. Similarly in excised genitalia of heifers "blown up" condition occurred at a pressure range of 100 - 260 mm. Hg. with a mean of 210.00 mm. Hg. In five cows with bilaterally patent tubes, the pressure required to produce "blown up" condition ranged from 120 to 220 mm. Hg. with a mean of 171.00 mm. Hg. On the contrary in heifers, "blown up" condition of uterus occurred at a pressure range of 195 - 200 mm. Hg. with a mean of 197.50 mm. Hg. The safety margin was estimated to be 60.00 mm. Hg. in cows and

55.00 mm. Hg. in heifers respectively.

The involvement of the left salpinx was found to be more (71.43 per cent) than the right in unilateral impatency of excised genitalia. The left salpinx was impatent in all cases of unilateral impatency in the experimental animals.

Clinical examination of all cows and heifers subjected to "blown up" condition was carried out every day for four to five days to study the course of absorption of the escaped air. It was observed that there was total absorption of the escaped air in the subserous space in all cases. within five days. Two cows with "blown up" uterus were slaughtered 48 hours later to study the extend of damage to the uterus. Uterine cavity contained only traces of blood and the tear in the uterine wall was not traceable.

Twenty four cows with bilaterally patent tubes on test were utilised to study the beneficial effect of tubal insufflation test in relieving temporary tubal ostruction. Twenty three cows came into heat and were inseminated, out of which 16 (69.56 per cent) conceived with an average of 1.13 insemination per conception.

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UTERO-TUBAL INSUFFLATION TECHNIQUE FOR DIAGNOSIS OF TUBAL IMPATENCY IN COWS

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ABSTRACT OF A THESIS

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ABSTRACT

The objective of the present study was to design an apparatus for utero-tubal insufflation test and to standardise its use in both excised genitalia and in live animals for the diagnosis and treatment of tubal impatency. Perfect obturation of the cervix was obstained using a stainless steel catheter with 22 FR. Neo Foley's latex catheter sleeved over. Unilateral and bilateral impatency were recorded in 8.70 and 19.25 per cent of the excised genitalia. The incidence of unilateral and bilateral impatency in 37 infertile animals were found to be 2.70 and13.52 per cent respectively. The mean pressure at which air escaped from both the tubes in excised genitalia was 128.12 mm. Hg. in cows and 148.93 mm. Hg. in heifers. On the contrary in experimental animals the corresponding pressure in cows and heifers were 116.38 mm. Hg. and 127.50 mm. Hg. respectively. It was observed that a higher pressure was required to open both the tubes in heifers than in cows.

Blown up condition of the uterus took place in excised genitalia of cows and heifers between 100 - 220 mm. Hg. and 100 - 260 mm. Hg. respectively. The pressure range for producing "blown up" condition in experimental animal was found to be 120 - 220 mm. Hg. in cows and 195 - 200 mm. Hg. in heifers. Since the safety margin was estimated to be 60.00 mm. Hg. in experimental cows, the test is

considered to be a safe diagnostic test for tubal impatency. Although uterus might be "blown up" in a very few cases at a pressure lower than the higher pressure for escape of air from normally patent tubes, the test will not endanger the life of the animal. Since 69.56 percentage of cows with bilateral patency of salpinx on testing conceived after insemination, utero-tubal insufflation test could also be exploited for the treatment of temporary tubal blockage.

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