

**A STUDY OF BACTERIOLOGY OF THE FALLOPIAN TUBES WITH
A VIEW TO ESTABLISH THE OPTIMAL TIME FOR
PUERPERAL TUBAL LIGATION**

by

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Tubal ligation is one of the best methods available to-day for termination of reproduction as it has a high degree of safety in terms of health of the patient and has an extremely low failure rate. This study was undertaken to assess the optimal time for tubal ligation in the puerperium in relation to bacteriological and histopathological status of the fallopian tubes and clinical morbidity. A review of the literature revealed a controversy regarding the interval after which tubal ligation could be safely performed after delivery and the bacteriological positivity of the genital tract in the puerperium. It has been stated authoritatively that postpartum tubal ligation is best performed within the first 48 hours after parturition (Te Linde, 1962; Greenhill, 1965; Willson, Beecham and Carrington, 1966). Earlier studies reported an increased incidence of thrombosis, embolism and infection as the delivery-sterilization interval increased (Skaaja, 1932; Adaire and Brown, 1939; Pheutz, 1941). Recent studies (Mustafa *et al*, 1970; Spore *et al*, 1970) have not shown this progressive increase in morbidity with

tubal ligations performed at increasing intervals after delivery.

Pinkerton *et al* (1962) stated that bacterial invasion of endocervix occurs in the first 24 hours after delivery in 33% and by the end of the first week in 73%. They also stated that by the end of the first week the organisms reached the uterine cavity. It has been unanimously suggested by many workers that the risk of sepsis increased if puerperal ligations were done three or more days after delivery (Te Linde, 1962; Greenhill, 1965).

Mustafa *et al* (1970) could not correlate the presence of microorganisms in the fallopian tubes with pregnancy disease, delivery-sterilization interval or postoperative morbidity. Spore *et al* (1970) systematically studied bacteriologically endometrial aspirates and postpartum oviducts and found that most of them were free from micro-organisms and puerperal tubal ligation could safely be performed at any time after delivery.

With these conflicting reports, this study was undertaken to confirm the bacteriological status of the upper vagina, uterine cavity and fallopian tubes in controls and puerpera. The correlation with delivery-sterilization interval, age, parity, presenting symptoms, past history, family history, socio-economic status, menstrual history, general physical exa-

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mination, time of rupture of membranes before delivery, number of vaginal examinations, mode of delivery and signs of infection in the baby were studied. The relation with postoperative course of the patient and histopathological evidence of inflammation in the fallopian tubes was also evaluated.

Material and Methods

A total of 150 women were selected from amongst the admissions to the Clean maternity, Septic maternity and Gynaecology wards of the Irwin Hospital, New Delhi. Sixty-two women formed the control group. Of these 25 were not pregnant and their tubes were removed with or without the uterus as a part of other gynaecological procedures or for multiparity only. There were 37 women who were treated as pregnant controls in whom pregnancy was terminated by suction evacuation or abdominal hysterotomy. Eighty-eight cases formed the experimental group in whom tubal ligations were performed at varying intervals following delivery.

Collection of Specimens

High vaginal swabs were collected in the operation theatre before any antiseptics were applied. Intrauterine swabs were taken whenever uterine cavity was opened avoiding contact with the peritoneal cavity. Segments of fallopian tubes, from both the sides, were collected separately in sterile trays immediately after

their removal. They were only handled with sterile instruments. Each segment was divided into 2 parts. One part was put into 1:10 formaline to fix it before processing it for histopathological study. The other part was incised lengthwise to expose the whole length of its mucosa. The entire surface of the mucous membrane was swabbed carefully and repeatedly with two sterile swab sticks which were used for culture of bacteria. The opened tubal segment was put in a sterile test tube containing glucose broth. The same procedure was repeated on the other side. The bacterial cultures were made aerobically and anaerobically.

Observations

The age of all the women studied varied between 20 and 46 years. The mean age was 24.58 years. The maximum number of cases were between 30 and 36 years of age. The average parity of the controls was 5.6 and that of the puerperal cases 5.1. 82% had income below Rs. 200 per month, 16.6% between Rs. 200 and 300 per month and only 1.4% above Rs. 300 per month.

All the puerperal cases delivered between 36 and 40 weeks of gestation; one woman had conceived during lactational amenorrhoea.

Delivery-sterilization interval

Puerperal ligations were performed between 0 and 150 days after delivery. One sterilization was done 8 days after a

TABLE I
Delivery-sterilization Interval

No. of days	0	1	2	3	4	5	6	7	8	9	10	11	22	26	150
No. of cases	4	29	11	11	8	6	2	0	2	0	1	2	1	1	1

TABLE II
Bacteriological Studies

No. of cases	High vaginal swab		Uterus		Right tube		Left tube	
	Sterile	Growth+	Sterile	Growth+	Sterile	Growth+	Sterile	Growth+
Non-pregnant	1 (4%)	24 (96%)	4 (75%)	1 (25%)	18 (75.0%)	7 (25%)	16 (68%)	9 (32%)
Early pregnancy	9 (24.3%)	28 (75.7%)	10 (83.3+)	2 (16.7%)	24 (64.9%)	13 (35.1%)	26 (70.3%)	11 (29.7%)
Puerperal	5 (5.6%)	83 (94.4%)	3 (75%)	1 (25.0%)	43 (48.8%)	45 (51.2%)	51 (57.8%)	37 (42.2%)

spontaneous abortion. Few cases only could be included after day 5 as the patients could not be persuaded to stay longer.

Table II shows the presence of bacteria at various sites in the genital tract in the three groups. In the non-pregnant controls, only one (4%) of the high vaginal swabs was sterile. Cultures were performed from 5 uteri, of which 4 (80%) were free of bacteria. Eighteen (75%) of the fallopian tubes from the right side and 16 (68%) of those on the left side were sterile. Of 37 pregnant controls, 9 (24.3%) high vaginal swabs did not show any bacterial growth. Of the 12 uterine cultures, 10 (83.3%) were sterile. 24 (64.9%) of the fallopian tubes on the right and 26 (72.3%) of the left side did not show any organisms. In 88 puerperal cases 5 (5.6%) of the high vaginal swabs free from micro-organisms. Forty-three and 3 out of 4 uterine cultures were tubal cultures on the right and 51 (57.8%) on the left side were sterile.

Histological Observations

Signs of tubal inflammation were observed in 11 (12.5%) out of 88 puerperal cases and in 2 (3.2%) of the 62 controls. Two cases amongst the controls showed evidence of chronic inflammation on both sides. Salpingitis in the experimental group occurred in cases operated between one and six days after delivery. One of the 11 cases had signs of chronic inflammation. The mucosa and muscular layer showed marked thickening with slight thickening of the serosa. There was round cell infiltration of the mucous and muscular layers (Figs. 1 and 1a). The remaining 10 cases showed signs of inflammation on both sides in 8 and on one side in 2 cases. There was oedema of all the coats of the tube, especially the

mucosa and the muscular layers. There was polymorphonuclear infiltration of the mucosa and submucous layer. In one case the mucosa had sloughed and polymorphonuclear leucocytes were seen in the lumen of the tube in one of the cases (Fig. 2).

Discussion

Incidence of pathogenic and probably pathogenic bacteria in all the high vaginal swabs cultured is indicated in Table III.

(1905) found 96% of the uterine cultures to be sterile on the third postpartum day and 70% on the 7th postpartum day and Hasseltine and Hite (1949) found 74% of the uteri free from micro-organisms. Various other workers have reported the incidence of different organisms in puerperal uteri. Pinkerton *et al* (1962) reported bacterial invasion of the endocervix during the first week in 73%.

Bacterial Flora in the Fallopian Tubes

Beta-haemolytic streptococci and sta-

TABLE III

Organisms	Non-pregnant controls (25)	Pregnant controls (37)	Puerperal cases (88)
Beta-haemolytic strep.	1 (4%)	2 (5.4%)	5 (5.6%)
Staph. pyogenes		3 (8.1%)	6 (6.8%)
Candida albicans	1 (4%)	2 (5.4%)	
Gram negative rods	10 (40%)	2 (5.4%)	34 (38.6%)
Coagulase neg. staph.	9 (36%)	3 (8.1%)	33 (37.5%)
Diphtheroids	3 (12%)	5 (13.5%)	11 (12.5%)

The incidence of pathogenic bacteria in the high vaginal swabs was higher in the puerperal group. Anaerobic streptococci were not isolated from any of the high vaginal swabs in the present study.

Uterine swabs could be cultured from only 4 out of 88 puerperal cases studied, as only 4 uteri were opened for caesarean section. No pathogenic organisms were isolated from them. Swabs were taken from 5 uteri from the non-pregnant cases. Four of these yielded no growth, while the fifth only micrococci. Out of 12 uterine cultures from pregnant controls, only 2 grew coagulase negative staphylococci. Spore *et al* (1970) cultured endometrial aspirates taken transfundally at operation from 26 cases and found that achromobacter obtained from one uterus was the only significant isolated. Little

phylococcus pyogenes were isolated from the fallopian tubes of puerperal cases in one case each. These pathogenic bacteria could not be isolated from the tubal cultures of either non-pregnant or pregnant controls. The incidence of Gram negative rods was highest in the puerperal group. Gram negative bacteria isolated included pseudomonas pyocyanea, alkaligenes faecalis and klebsiella. Sp. A strain of salmonella typhi was isolated from the left fallopian tube in a puerperal case. 57.8% of the fallopian tubes on the left and 48.8% on the right side were free from bacteria. Lukasik (1963) cultured the fallopian tubes in 10 normal cases and found them all to be sterile. Ghosh (1964) found sterile fallopian tubes in 45% of 40 puerperal cases. Mustafa *et al* (1970) in their study in 100 cases of

TABLE IV
Bacterial Flora in the Fallopian Tubes

Organisms	Non-pregnant controls (25)		Pregnant controls (37)		Puerperal cases (88)	
	RT	LT	RT	LT	RT	LT
Beta-haemolytic strept.						1 (1.13%)
Strep. pyogenes					1 (1.13%)	
Anaerobic strep.			1 (2.7%)	1 (2.7%)		
Escherichia coli		1 (4.0%)	3 (3.39%)		5 (5.65%)	2 (2.26%)
Klebsiella		1 (4%)	1 (2.7%)	1 (2.7%)		1 (1.13%)
Pseudomonas pyocyanea					1 (1.13%)	
Salmonella typhi						1 (1.13%)
Strep. faecalis					2 (2.26%)	1 (1.13%)
Coagulase neg. staph.	4 (16%)	4 (16%)	7 (18.9%)	7 (18.9%)	20 (22.7%)	19 (21.6%)
Alkaligenes faecalis					1 (1.13%)	
Candida albicans					1 (1.13%)	

RT = Right tube. LT = Left tube.

tubal ligation, 0 to 4 days postpartum, found 25% to be free from bacteria. The commonest organism grown was coagulase negative staphylococcus in 32 (66.6%) cases, coagulase positive staphylococci in 9, coliform in 3, bacillus subtilis in 2 and a mixture of bacillus pyocyanea and enterococci in one case. Spore *et al* (1970) considered staphylococcus epidermidis to be a non-pathogenic contaminant. They found *Achromobacter* in only one of the 52 tubal segments studied. 98.1% of their cultures showed no growth.

Positive cultures were more frequently found from the various sites in the puerperal cases as compared to pregnant cases in the early weeks of gestation.

The puerperal group showed a definite invasion of the uterine cavity and tubes by bacteria from the vagina. *Staphylococcus pyogenes*, Beta-haemolytic *Streptococci* and *Candida albicans* were isolated from tubal cultures only during the later weeks of pregnancy. Anaerobic streptococci were isolated from the fallopian tubes on both sides in only one pregnant control. The incidence of coagulase negative *Staphylococci* and *Coliform* organisms was nearly the same in both control and study groups. Organisms of low or doubtful pathogenicity like the *Streptococcus faecalis*, *Diphtheroids*, *Streptococcus viridans* were also isolated from the fallopian tubes only during the later weeks of pregnancy. The fallopian

tubes seemed to be more prone to invasion by pathogenic bacteria during and immediately after delivery. No significant relationship could be established between the bacteria in the genital tract and history of congestive dysmenorrhoea, local or systemic infection or time of rupture of membranes before delivery. Positive cultures increased as more vaginal examinations were performed. The postoperative morbidity in cases in whom vaginal examinations were performed was double, i.e. 22.6% compared to 11.1%. Higher incidence of sepsis with vaginal examination was also demonstrated by Reis (1924), Manning (1961), Eastman (1961) and Popli (1963), though other workers have reported their comparative safety (Prytowsky, 1964; Fara *et al*, 1956; Schafer *et al*, 1956; Bishop, 1960).

interval between delivery and operation lengthened.

The incidence of similar organisms present in the vagina, uterus and the fallopian tubes was much higher among the puerperal than in the controls (fig. 3). The organisms were found in high vaginal swabs and tubal lumina in 5 (8.6%) cases among the controls. Of these 4 grew Coagulase negative Staphylococci and one Micrococci. Postoperatively only one showed a rise of temperature. Both the organisms isolated are known to have only negligible pathogenicity. In 88 puerperal cases, 21 showed a similar bacterial flora in the high vaginal, uterine and fallopian tubal cultures. Sensitivity of the organisms was found to be similar. This strongly suggested that there was a fairly rapid ascent of micro-organisms during

TABLE V

Delivery-sterilization interval	No. of cases	Positive high vaginal swabs	Positive tubal culture		Post-operative morbidity	Histological salpingitis
			Rt	Lt		
0	4	4	1	1	2	-
1	29	25	10	8	3	1
2	19	19	1*	10	4	3
3	11	11	6	4	4	1
4	8	8	6	6	1	1
5	6	6	3	2	1	-
6	2	2	2	1	1	-
7	3	3	1	2	—	-
10	1	1	1	1	—	-
11	2	2	1	-	—	-
22	1	1	-	1	—	-
26	1	-	-	1	—	-
150	1	1	-	-	—	-

The number of positive cultures did not rise with the increase in the interval. Postoperative morbidity or histopathological signs of inflammation in the fallopian tubes also did not increase when

delivery. Fifteen (71.3%) out of 21 cases did not show any postoperative morbidity, while 6 (28.7%) had a rise of temperature. Ghosh *et al* (1964) found that there was ascending infection after delivery. Many

other workers (Whitcare *et al*, 1946; Calman *et al*, 1954; Pinkerton *et al*, 1962) are also in agreement with the above findings. Spore *et al* (1970) on the contrary could not demonstrate ascent of bacteria into the uterus after delivery.

Postoperative Morbidity

The overall morbidity was 22.6%. Morbidity in pregnant controls was the lowest, while in nonpregnant controls it was the highest. This could be due to the more extensive operation which they were subjected to.

Mustafa *et al* (1970) who studied 100 puerperal cases reported the presence of organisms in 48 cases (fig. 4). Febrile morbidity in this group was 10%. The remaining 52 cases who did not have any organisms in the fallopian tubes also had a morbidity of 6% showing that bacteriological findings could not be correlated with the clinical progress of the patients. From analysis of the bacterial flora in the fallopian tubes, histological evidence of inflammation in the fallopian tubes and postoperative morbidity in the non-pregnant, pregnant controls and the experimental group has led to the conclusion that absence or presence of nonpathogenic opportunistic or even definitely pathogenic organisms have little role in inducing inflammatory changes in the tubes or giving rise to postoperative morbidity. Ghosh *et al* (1964) observed salpingitis in 32.5% of their puerperal cases, 96.9% of the cases showing salpingitis had the same organism in the uterine cavity and the fallopian tubes. No such correlation was found in the present study.

Mild endosalpingitis was observed in 10 out of 11 cases showing inflammation and chronic salpingitis was observed in one case. Black Schaffer (1944), Hellman

(1945) and Ghosh *et al* (1964) all found a similar picture with mucosal involvement in the puerperal cases. Novak and Woodruff (1962) described puerperal salpingitis to be an exosalpingitis.

Conclusions

The incidence of pathogenic bacteria was higher in the puerperal group at the various sites in the genital tract. A definite evidence of ascent of bacteria during parturition was observed. The presence of pathogenic or potentially pathogenic bacteria, however, did not show any correlation with the post-operative febrile morbidity, or evidence of inflammation in the tubes. Increase in delivery-sterilization interval did not affect the bacteriological status of the fallopian tubes or uteri, postoperative morbidity or histological evidence of salpingitis. Sterilization could safely be performed any time after delivery without affecting the postoperative clinical course.

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See Figs. on Art Paper V-VI