Original article

Risk factors for laparoscopically confirmed pelvic inflammatory disease: findings from Mumbai (Bombay), India

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Objectives: Sexually transmitted diseases (STDs) are an important cause of pelvic inflammatory disease (PID) but have often not been detected in microbiological studies of Indian women admitted to hospital gynaecology wards or private clinics. In this cross sectional study, women living in the inner city of Mumbai (Bombay) were investigated for socioeconomic, clinical, and microbiological risk factors for PID.
Methods: Microbiological tests and laparoscopic examination were carried out on 2736 women aged ⩽35 years who came to a health facility with suspected acute salpingitis or infertility or for laparoscopic sterilisation. 86 women with a clinical diagnosis of PID were not referred for laparoscopy although their characteristics are described. Associations between various risk factors and PID status were investigated and logistic regression performed on all factors that remained significant.
Results: Of women with a laparoscopically confirmed evaluation, 26 women had acute and 48 chronic pelvic infection. Independent risk factors for PID were later age at menarche (⩾14 years), a history of stillbirth and no previous pregnancy, history of tuberculosis, STD, dilatation and curettage or previous laparoscopy, and presence of *Gardnerella vaginalis*.
Conclusions: It is concluded that STD related risk factors applied to only a small proportion of PID cases and that other determinants of PID are important, including obstetric complications, invasive surgical procedures such as laparoscopy, and tuberculosis.
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Introduction

It is difficult to assess how many women suffer from pelvic inflammatory disease (PID) in India or what the main causes of this disease are. Most information comes from gynaecological admissions to hospital but the number of cases so detected largely reflects the degree of awareness of personnel and the diagnostic criteria used.[1] In sub-Saharan Africa sexually transmitted diseases (STDs) are the main cause of PID,[2] but as far back as 1980, the view was expressed by Muir and Belsey that tuberculosis, puerperal sepsis, and postabortal infections were relatively more important causes of PID in India.[3] Earlier studies in Indian populations failed to detect gonococcal PID,[4] and there have been relatively few published studies of *Chlamydia trachomatis* in relation to PID.[5] In contrast, one study from a private clinic in Mumbai isolated genital mycoplasmas from 27.5% of PID cases, 15.7% of infertile women, and 3.7% of women undergoing tubal sterilisation.[6]

From 1993 to 1995 a study was undertaken in two inner city municipal hospitals in Mumbai to examine the socioeconomic, clinical, and microbiological characteristics of women admitted with suspected acute salpingitis or complaining of infertility. For comparative purposes, healthy, fertile women attending for laparoscopic sterilisation in a nearby postpartum centre were also routinely screened. The study sought to investigate risk factors for PID including prevalence of gonorrhoea, chlamydia, mycoplasmas, and bacterial vaginosis in women with and without PID as confirmed by laparoscopy. This paper describes the main determinants for PID that were found. HIV seroprevalence in the study population is reported elsewhere.[7]

Methods

STUDY POPULATION

A cross sectional study was conducted in Mumbai between October 1993 and December 1995, in association with the Brihan Mumbai Municipal Corporation. Study women were recruited at three centres—Lokmanya Tilak Municipal General Hospital, Mahim Maternity Home, and F-South Post Partum Centre. The women were recruited if they presented for gynaecological investigation, either with symptoms suggestive of acute pelvic infection or a history of infertility which might indicate previous salpingitis. Infertility was defined as inability to conceive during at least 12–18 months of cohabitation without any use of natural or modern contraception. Infertility cases related to a male factor were identified and excluded. In addition, fertile women seeking laparoscopic tubal ligation who had no symptoms of gynaecological disease were recruited as this provided an opportunity to screen a large group of asymptomatic women by laparoscopy. As acute salpingitis patients

were likely to be younger than those seeking tubal ligation, women older than 35 years of age were excluded. Informed consent was obtained from all women, and procedures were carefully explained by auxiliary nurse midwives who had been specially trained using participatory methods.

RISK FACTORS

At recruitment, clinical and social questionnaires were administered. From questionnaires information was collected on variables hypothesised to be associated with PID. The clinical questionnaire covered reasons for referral—gynaecological history including menstruation, symptoms of genital and urinary tract infections, obstetric, medical, and surgical histories. Subjects covered by the social questionnaire included sociodemographic information (family, marital status, religion, education, income); contraceptive use; and sexual history of the woman and her partner.

GYNAECOLOGICAL EXAMINATION

Consultants were brought together to agree on study procedures and overall supervision was provided by the consultant at Mahim (SG). The vulva was examined for lesions and vaginal discharge was noted. The cervix was inspected for ulcers, warts, ectopy, and cervicitis defined as erythema or inflammation with or without a mucopurulent discharge. Three high vaginal swabs were taken: one was placed in TV medium for *Trichomonas vaginalis* and candida; a second was placed in Amies transport medium for aerobes, anaerobes, and *Gardnerella vaginalis*, and a third was placed in sterile saline solution for wet mount and Gram staining. After the ectocervix had been cleaned of secretions, two Dacron coated swabs were placed in the cervical os and rotated to collect endocervical secretions and cells. These were placed separately in Amies transport medium for Gram stain and culture of *Neisseria gonorrhoeae* and culture of *Mycoplasma hominis* and *Ureaplasma urealyticum*. A third wire swab for antigen detection of *Chlamydia trachomatis* by ELISA was collected in Mastazyme transport medium. After removal of the speculum, a bimanual examination was carried out to test for rebound tenderness and masses, which were recorded diagrammatically, as well as tenderness of the fornices and excitation of the cervix. A clinical diagnosis of PID was made when lower abdominal pain was present, together with tenderness of the fornices, adnexal tenderness, or fever. After physical examination and before any operative procedure, a 5 ml blood sample was taken for serological tests. At F/S postpartum clinic, where only control cases were enrolled, transvaginal sonography was performed before all laparoscopic tubal ligations were done to rule out any pelvic pathology and to confirm pregnancy in cases of medical termination of pregnancy with tubal ligation.

LAPAROSCOPY

Before laparoscopy, routine haematological tests (erythrocyte sedimentation rate, white blood count, haemoglobin) were carried out. Laparoscopic diagnosis was carried out under general anaesthesia in the usual manner. Acute salpingitis was classified as follows: mild, if the tubes were inflamed but mobile, with no pus observed; moderate, if tubes were immobile and pus was present; severe, if pyosalpinx or an abscess was present. The presence of adhesions around the uterus and adnexae, with or without formation of tubal ovarian masses, or hydrosalpinx without any evidence of inflammation or exudate, was considered to be chronic pelvic infection. Before any further endoscopic procedure, 20 ml sterile saline was inoculated into the cul de sac, sprayed over the uterus and adnexal areas and was aspirated back from the cul de sac. If any fluid was already in the cul de sac it was aspirated directly and returned to the laboratory for microbiological tests. Although obstetricians were requested to perform laparoscopy for all cases where acute salpingitis was suspected, most were extremely reluctant to perform laparoscopy for the more severe cases, as it was standard practice to treat such cases immediately on clinical grounds without performing laparoscopy. For these, culdocentesis was performed although it was recognised that cul de sac specimens obtained by this procedure would be open to interpretation.[8] Women with acute salpingitis were started immediately on antibiotic therapy.

MICROBIOLOGICAL ASSESSMENTS

Samples were transported to the laboratory at Sion Hospital within 4 hours of collection.

Microscopy

Wet mount microscopy of high vaginal swabs was done immediately on arrival at the laboratory for *T vaginalis*. Gram stained vaginal smears were examined microscopically for clue cells and white blood cells. Where >5 clue cells per high power field (×40) were counted and white vaginal discharge had been clinically observed, a diagnosis of bacterial vaginosis was made. Gram stained cervical smears were also used for observation of diplococci, candida, and any other micro-organisms.

Cultures

Aerobes were inoculated into glucose phosphate broth and anaerobes into sodium thioglycollate broth. Gonococcal culture specimens were incubated at 35–37°C in carbon dioxide (10%) for up to 48 hours on Thayer–Martin medium. Sugar utilisation test was done on all oxidase positive Gram negative diplococci. *G vaginalis* was grown on GV medium in 95% hydrogen and 5% carbon dioxide. *T vaginalis* specimens were cultured in AC medium. Sabouraud's agar was used for culture of candida. PPLO broth was used for ureaplasma and mycoplasma, followed by PPLO agar for colonies of *M hominis*. All the media were prepared, inoculated, and incubated as routine microbiology procedures.

Table 1 Proportion of women with genital infections and associated history, signs, and symptoms according to PID classification

Infection	Laparoscopically confirmed			Clinically diagnosed (n=86)
	Acute (n=26)	Chronic (n=48)	Without PID (n=2662)	
T vaginalis	3.9 (1)	2.1 (1)	0.8 (22)	0.0 (0)
G vaginalis	19.2 (5)	12.5 (6)	7.4 (196/2659)*	15.1 (13)
Bacterial vaginosis	0.0 (0)	2.1 (1)	0.5 (13)	8.1 (7)
Symptomatic candidosis	0.0 (0)	0.0 (0)	0.0 (0)	5.8 (5)
N gonorrhoeae	0.0 (0)	2.1 (1)	0.1 (3/2659)	0.0 (0)
C trachomatis	0.0 (0/24)	0.0 (0/46)	0.2 (4/2599)	1.2 (1/85)
M hominis	7.7 (2)	6.3 (3)	5.8 (155/2655)	5.8 (5)
U urealyticum	11.5 (3)	20.8 (10)	21.2 (565/2649)	12.8 (11)
Reported vaginal discharge	30.8 (8)	12.5 (6)	8.7 (233)†	61.6 (53)‡
History of STD	3.8 (1)	2.1 (1/47)	0.1 (3/2645)†	8.3 (7/84)
Partner infection	7.7 (2)	6.2 (3)	4.8 (125/2615)	16.1 (13/81)
Cervicitis	7.7 (2)	6.2 (3)	1.9 (51)†	16.3 (14)

Numbers in parentheses used to calculate the percentage in each group unless otherwise stated.
*Significant difference (p<0.05) between laparoscopically confirmed PID cases and women with no PID.
†Significant difference (p<0.01) between laparoscopically confirmed PID cases and women with no PID.
‡Significant difference (p<0.01) between clinically diagnosed and laparoscopically confirmed PID cases.

Antigen detection and serology

Cervical swabs of all cases as well as controls for chlamydia antigen were frozen at −40°C until processed by an ELISA method (Mastazyme; Mast Laboratories, Bootle). Antigen detection of *C trachomatis* by ELISA was performed on all the cases (suspected PID and infertility) and on every fifth specimen of the aspirates collected. All ELISA positive samples and a subsample of negatives were frozen and returned to Liverpool for PCR testing. PCR amplification was done by using both primers for *C trachomatis* major outer membrane protein (MOMP in-house assay) and for the *C trachomatis* cryptic plasmid (Roche). Occasionally problems of false negative arise from PCR detection owing to the presence of inhibitory factors (either destroying target DNA or inhibiting *taq* polymerase). In order to assess this possibility, 10% of PCR negative samples were retested having added some *C trachomatis*. In each case *C trachomatis* was detected (that is, no inhibitory factors were detected). Those samples that were positive by ELISA and confirmed by PCR were classified as positive for *C trachomatis*. Samples that were positive by ELISA and negative by PCR were classified as negative for *C trachomatis*, and similarly all ELISA negatives. The prevalence as cited in the results section was derived using this classification.

STATISTICAL METHODS

Significance was assessed using the χ^2 or Fisher's exact test. In order to allow simultaneously for the effects of several confounding variables, logistic regression was used. Included in the regression equations were terms for all risk factors that were significant in the univariate analysis ($p < 0.2$). The significance of each factor in the model was assessed using the likelihood ratio test. All analysis was performed using the STATA software.[9]

Permission to conduct the study was granted by the municipal corporation's appropriate authorities and ethical approval was obtained from the ethics committee of Lokmanya Tilak Hospital and Medical School.

Results

In all, 2879 women were eligible for the study, of whom 2736 underwent a laparoscopic examination. Seventy four women were found to have pelvic infection—26 with acute salpin-

Table 2 Demographic characteristics (% (n)) of women according to PID classification

	Laparoscopically confirmed			Clinically diagnosed (n=86)
	Acute (n=26)	Chronic (n=48)	Without PID (n=2662)	
Age group:				
<25 years	27.0 (7)	31.2 (15)	19.9 (530)	31.4 (27)
25–29 years	50.0 (13)	39.6 (19)	45.8 (1220)	33.7 (29)
30–35 years	23.0 (6)	29.2 (14)	34.3 (912)	34.9 (30)
Currently married:	100.0 (26)	95.9 (46)	99.7 (2653)*	96.5 (83)
Education:				
≤3 years	50.0 (13)	41.7 (20)	40.8 (1086)	39.5 (34)
4–9 years	34.6 (9)	35.4 (17)	42.6 (1133)	40.7 (35)
≥10 years	15.4 (4)	22.9 (11)	16.6 (44)	19.8 (17)
Not known			(2)	
Household income (per month):				
≤1000 rupees	15.4 (4)	20.8 (10)	13.2 (351)	25.6 (22)
1001–3000 rupees	46.1 (12)	62.5 (30)	66.4 (1767)	58.1 (50)
>3000 rupees	38.5 (10)	16.7 (8)	20.4 (544)	16.3 (14)
Religion:				
Hindu	73.1 (19)	75.0 (36)	73.6 (1959)	75.6 (65)
Muslim	19.2 (5)	12.5 (6)	12.3 (328)	10.5 (9)
Other	7.7 (2)	12.5 (6)	14.1 (375)	13.9 (12)
Place of birth:				
Mumbai	34.6 (9)	31.2 (15)	41.4 (1099)	29.1 (25)
Elsewhere	65.4 (17)	68.8 (33)	58.6 (1588)	70.9 (61)
Not known			(8)	

*Significant difference (p<0.01) between laparoscopically confirmed PID cases and cases with no PID.

Table 3 Reproductive indices (% (n)) according to PID classification

	Laparoscopically confirmed			
	Acute (n=26)	*Chronic (n=48)*	*Without PID (n=2662)*	*Clinically diagnosed (n=86)*
Age of menarche				
⩾14 years	58.3 (14/24)	66.0 (31/47)	49.8*(1312/2632)	50.0 (42/84)
Age at first sex				
<18 years	42.3 (11)	37.5 (18)	41.1 (1092/2659)	55.8 (48)
Age at first pregnancy				
<18 years	28.6 (4/14)	24.0 (6/25)	21.4 (528/2467)	32.5 (25/77)
Never pregnant	46.1 (12)	45.6 (21/46)	6.7†(178/2645)	9.4 (8/85)‡
History of stillbirths				
Yes	11.5 (3)	4.2 (2)	2.2† (59)	4.6 (4)
Termination of pregnancy				
Yes	3.8 (1)	8.3 (4)	12.2 (325)	11.6 (10)
Spontaneous abortion				
Yes	7.7 (2)	8.3 (4)	6.9 (184)	8.1 (7)
Ever used oral contraceptives				
Yes	7.7 (2)	8.3 (4)	10.7 (285)	2.3 (2)
Ever used IUCD	7.7 (2)	8.3 (4)	22.0†(586)	16.3 (14)
Yes				
Ever used condom				
Yes	3.8 (1)	12.5 (6)	16.4 (437)	14.0 (12)

*Significant difference (p<0.05) between laparoscopically confirmed PID cases and women with no PID.
†Significant difference (p<0.01) between laparoscopically confirmed PID cases and women with no PID.
‡Significant difference (p<0.01) between laparoscopically confirmed and clinically diagnosed cases.

gitis and 48 with indications of chronic infection. No evidence of PID was found in the remaining 2662. Eighty six women were not referred for laparoscopy, but were considered on clinical grounds to have acute salpingitis; 6.8% of confirmed cases reported recent use of antibiotics.

EVIDENCE OF STDS

Lower tract infection

The prevalence of lower tract infection in the different categories of women with pelvic infection is shown in Table 1. The most common organisms detected in all women were *G vaginalis* and *U urealyticum*. *G vaginalis* was the only organism detected significantly more frequently in laparoscopically confirmed PID cases compared with women with no PID (p <0.05). *N gonorrhoeae* was cultured for only four women, three of whom did not have PID. There were five women with *C trachomatis* infections, of whom four did not have PID. Women with clinically diagnosed PID reported a much higher prevalence of vaginal discharge (61.6%) than other women (p <0.01). Confirmed PID cases were more likely to report a vaginal discharge, give a history of STD, and have clinical evidence of cervicitis than women without PID (p <0.01).

Upper tract infection

Among women with no visual signs of PID at laparoscopy, *M hominis* was recovered from 0.08% (2), *U urealyticum* from 1.2% (31), and anaerobes from 0.04% (1) of cul de sac aspirates. Among women with laparoscopically confirmed PID, none of these micro-organisms was detected; 2.3% (12) of samples collected by culdocentesis were positive for *U urealyticum*.

UNIVARIATE ANALYSIS OF RISK FACTORS FOR PID

The other main results of the univariate analysis are given in Tables 2–4. The demographic characteristics of women with and without PID were similar (Table 2). Table 3 shows various reproductive indices according to PID classification. Mean age of menarche for the whole sample was 13.5 years (SD 1.1); 63.4% (45) of laparoscopically confirmed PID cases began menarche ⩾14 years of age compared with 49.8% (1312) of women without PID (p = 0.02). Age at first sex and first pregnancy was not associated with PID. In terms of obstetric history, women with laparoscopically confirmed PID had experienced fewer pregnancies and more stillbirths (p <0.01). Whereas 45.7% of confirmed cases had never been pregnant, this was true of only 9.4% of clinically diagnosed cases (p <0.001). No differences between PID groups were found with respect to previous spontaneous abortion or medical termination of pregnancy. No association was found between use ever of oral contraceptives or condoms. Ever use of an intrauterine contraceptive device (IUCD) was negatively associated with PID. A history of tuberculosis was given by 16.4% (12/93) of confirmed PID cases compared with 1.6% (42/2653) of

Table 4 History of surgical/invasive procedures (% (n)) according to PID classification

	Laparoscopically confirmed			
	Acute (n=26)	*Chronic (n=48)*	*Without PID (n=2662)*	*Clinically diagnosed (n=86)*
Appendicectomy	3.8 (1)	0.0 (0)	0.7 (20)	2.3 (2)
Peritonitis	0.0 (0)	0.0 (0)	0.0 (0)	1.2 (1)
Cervical cauterisation	0.0 (0)	0.0 (0)	0.1 (4)	0.0 (0/84)
Hysterosalpinogram	0.0 (0)	14.6 (7)	0.4*(12/2660)	0.0 (0)
Dilatation and curettage	15.4 (4)	31.2 (15)	5.4*(143/2659)	9.3 (8)
Laparotomy	3.8 (1)	8.3 (4)	1.8*(47/2659)	4.6 (4)
Laparoscopy	15.4 (4)	25.0 (12)	1.8*(48)	36.0 (31)

*Significant difference (p <0.01) between laparoscopically confirmed PID cases and women with no PID.

Table 5 Multivariate analysis of risk factors for PID

Variables	*Adjusted odds ratios*	*95% Confidence interval*	*p Value from LRS**
Currently unmarried	42.8	(4.1, 446.9)	0.03
Age at menarche (≥14 years)	1.8	(1.0, 3.3)	0.05
Never pregnant	11.2	(5.8, 21.8)	<0.01
Stillbirths: 1 or more	9.7	(3.3, 28.4)	<0.01
Ever use IUCD	0.5	(0.2, 1.4)	0.20
History of STD	19.4	(1.7, 217.3)	0.02
Vaginal discharge	2.1	(0.9, 4.9)	0.11
G vaginalis	2.3	(1.0, 5.3)	0.07
Cervicitis	0.8	(0.1, 4.1)	0.74
T vaginalis	3.9	(0.4, 35.3)	0.30
Ever had hysterosalpinogram	1.2	(0.3, 4.9)	0.81
Ever had dilatation and curettage	2.6	(1.1, 6.1)	0.03
Ever had laparotomy	1.6	(0.3, 8.4)	0.58
Ever had laparoscopy	6.0	(2.3, 15.3)	<0.01
History of tuberculosis	8.9	(3.5, 22.9)	<0.01

*LRS = likelihood ratio test.

women without PID (p <0.01), and 5.9% of clinically diagnosed cases.

Whereas history of appendicectomy, peritonitis, and cervical cauterisation were not risk factors for confirmed PID (Table 4), other surgical procedures—hysterosalpinography, dilatation and curettage (D&C), laparotomy and laparoscopic procedures—were significantly associated (p <0.01). The same procedures were also reported more frequently by clinically diagnosed cases, 36% of whom had experienced a previous laparoscopy.

MULTIVARIATE ANALYSIS OF RISK FACTORS FOR PID

Multivariate analysis was performed on all variables that were associated with laparoscopically confirmed PID on the univariate analysis (that is, p <0.2). Table 5 lists all the variables used. The factors that remained as significant independent risk factors were: later age at menarche, a history of stillbirths and no prior pregnancy, history of TB, D&C or laparoscopy, and presence of *G vaginalis*. Being unmarried and having a history of STD remained significant but the size of the associated confidence intervals was too wide for meaningful interpretation. Factors such as vaginal discharge, history of laparotomy, hysterosalpinogram and IUCD use, that were initially significant in the univariate analysis, were no longer found to be independent risk factors.

Discussion

One of the main findings of this study is that risk factors normally associated with PID, such as young age, early onset of menarche, marital status, STDs, and sexual behaviour[2] applied to only a small proportion of the laparoscopically confirmed PID cases in this study. Although vaginal discharge was reported more frequently by cases (Table 1) vaginal discharge correlates poorly with microbiological assessment of infection,[10] and this variable did not remain significant in the multivariate analysis. A low prevalence of STD infections among healthy women attending for tubal ligation may not be surprising, but failure to detect a higher prevalence of chlamydial or gonococcal infections, even in acute PID cases, was unexpected. These infections were also rare among women with clinical symptoms of PID who were not referred for laparoscopy, so it is unlikely that their exclusion from the risk factor analysis biased the results. It was considered more rigorous to include only laparoscopically confirmed cases in the risk analysis, even though this meant combining acute and chronic cases.

While STDs are associated with a much increased risk of PID,[11] in a population with a low prevalence of STDs other determinants must be considered. *Gardnerella vaginalis*—but not bacterial vaginosis with which *G vaginalis* is usually associated—was detected in 14.9% of PID cases and remained independently associated with PID. Medical termination of pregnancy was not a determinant of PID risk, perhaps because routine antibiotics are given to prevent complications from underlying genital tract infections such as bacterial vaginosis.[12 13] The same applies to IUCDs which were the most popular modern contraceptive used by women. IUCD use is no longer considered to be a major determinant of PID risk beyond the first 20 days after insertion[14] and Daling *et al* [15] found that the lowest risk of tubal infertility was associated with use of a copper IUCD. Antibiotic coverage at the time of IUCD insertion and a low prevalence of STDs are likely to have eliminated much of the potential risk entailed in their use by study women. *G vaginalis* was also not found in association with gonorrhoea or chlamydia in spite of the fact that bacterial vaginosis is usually described as having a role as a facilitator or as an opportunistic infection interacting with these virulent cervical pathogens.[16 17] Thus, other interactions of *G vaginalis* with PID may be surmised.

We were not able to culture *G vaginalis* from the upper genital tract but this probably reflects the fact that cul de sac aspirations, which are most accessible in surveys such as ours in Mumbai, are not the optimal method for isolating micro-organisms from the pelvic cavity.[8] However, one of the more likely pathways for *G vaginalis* to ascend to the upper genital tract would be as a result of obstetric complications, such as amniotic fluid infection or infection of the chorioamnion.[18] An obstetric mechanism is also suggested by the fact that a history of stillbirths was an independent risk factor for PID. Prenatal infection with *G vaginalis* may contribute to risk of stillbirth or *G vaginalis* may ascend to the upper genital tract following a difficult labour—another cause of stillbirth. In Mumbai, most women deliver in a health facility although some women still return to their home villages for delivery. In this study, we were unable to perform endometrial biopsies, but it is likely that some women with PID, either concurrently or previously, had endometritis.[19] Postpartum endometritis is one of the most common obstetric infections and in a study in Seattle *G vaginalis* was the most common isolate from blood and from the endometrium of women with postpartum fever and endometritis.[20] The high prevalence and increased concentration of particularly virulent micro-organisms in bacterial vaginosis patients is considered to be operative in the pathogenesis of postpartum endometritis. Whether

G vaginalis is sufficiently virulent to cause tubal pathology is unclear.

Another indication that risk factors for PID in Indian women are different from Europe and from sub-Saharan Africa is indicated by the fact that 25.7% of women with confirmed PID had previously undergone surgical procedures such as dilatation and curettage (Table 4)—a procedure on which women themselves often insist, believing it to be helpful in curing many gynaecological problems—and it is commonly carried out in private clinics: 21.6% had undergone a previous laparoscopy (including tubal ligation) and this compared with 1.8% for women who did not have PID. Tubal ligation is vigorously promoted in India[21] and although laparoscopy is normally regarded as a very safe procedure, in India thousands of sterilisations are performed in mass clinics in rural areas,[22] and access to health facilities is so poor that complications would be difficult to evaluate. Mehta sent out questionnaires following his sterilisations camps, although a large proportion of women would have been illiterate.[22] In the present study, almost 60% of women had migrated to Mumbai—most from rural areas where their tubal ligations may have been performed. Laparoscopic tubal ligations are also frequently performed following medical termination of pregnancy (37.9% of ligations in this study) and following hospital delivery (37.1%). It is generally accepted that mini-laparotomy is the recommended approach for postpartum sterilisation after vaginal delivery, for less developed as well as for developing countries.[23] Only when the surgeon is very experienced and the procedure carried out in a well equipped hospital is it regarded as acceptable. Even then women with no complications during labour, such as premature rupture of the membranes,[24] or delivery complications, should be accepted. In rural India laparoscopy is preferred because it is a much quicker procedure for mass sterilisation camps than mini-laparotomy. In such camps, exclusion criteria are less rigorously applied. Mehta[22] reported including some women with previous abdominal surgery as well as women having had a recent abortion or birth. If PID does occur more frequently in this setting, particularly following MTP or recent pregnancy (with or without tubal ligation), it may account for the different range of micro-organisms found in this study compared with previous studies.

The other determinant of PID which emerged from this analysis was a history of tuberculosis. Women with no evidence of sexually transmitted organisms, who were found to have tubal occlusion, may have been cases of previous genital tuberculosis. Tubercular salpingitis once accounted for a significant proportion of salpingitis throughout the world.[1] It is now a rarity in most developed countries, and its importance in developing countries is hardly known as it is a difficult condition to detect.[25] Pulmonary tuberculosis remains a major problem in India. This study recruited women who lived in a most crowded and polluted environment, in the shadow of the textile mills, where tuberculosis is common.[26] Tuberculosis is, none the less, a preventable and treatable infection, although treatment follow up rates for women are often disappointing.[27]

In conclusion, this paper presents risk factors for PID in Mumbai which differ from those which are classically based on Western studies, where STDs are more prevalent. Among Indian women at high risk of contracting STDs, like commercial sex workers, classic risk profiles will still be most discriminatory. For many women admitted to gynaecological wards in Mumbai, however, assessment and treatment based on those profiles may lead to suboptimal management. Moreover, risk of PID could probably be reduced by providing more information and appropriate reproductive health services for women with less emphasis on invasive operations. Most operational procedures carry a degree of risk and should not be used without good reason. If women were better informed about their disadvantages, they might choose to avoid using them unnecessarily (for example, by opting for birth spacing contraceptives rather than sterilisation). This, in turn, might reduce the incidence of pelvic infection in Mumbai.

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