

Research Article

Incidence of Post-Cesarean Uterine Infection in relation to Methods of Placental Management

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Abstract

Objectives: To study the rate of uterine infection following cesarean delivery with respect to mode of placental delivery and the practice of removal of residual membranes.

Material and Methods: In 318 women undergoing elective cesarean delivery grouped based on placental management (four groups, viz., those with manual removal with uterine wiping, 102 cases; manual removal without uterine wiping, 65 cases; spontaneous extraction with uterine wiping, 79 cases; and spontaneous extraction without uterine wiping, 72 cases - taken as control group) were prospectively studied. The cases were monitored for 7 post-cesarean days for evidence of uterine infection. Uterine infection was considered to be present if at least two of the parameters with one of them being laboratory evidence, were positive.

Results: Incidence of uterine infection was (65/ 318 cases, 20.4%). Occurrence of uterine infection did not differ when placenta was managed either manually or not ($p=1$). Uterine infection was apparently higher when residual membranes were not removed after placental delivery ($p=0.4$). Proportion of cases with uterine infection appeared to be lower in the group who had manual placental delivery and removal of residual membranes (17.7%) than in manual placental removal with no uterine wiping groups (24.6%). And there was no influence of post-placental removal of residual membranes in the cohort with unaided placental delivery ($p=0.854$).

Conclusion: The practices of either manual removal of placenta or uterine wiping to clear the residual placental membranes do not increase the rate of post cesarean uterine infection rate after elective surgeries.

Keywords: Elective cesarean delivery; manual removal of placenta; uterine wiping; residual membranes; endometritis

1. Introduction

Cesarean delivery is a common and major surgical intervention in obstetrics. Women delivered by cesarean face 5 to 20-fold increased risk of morbidity than those delivered vaginally¹. Depending on the service facility, cesarean delivery rates vary from 20 to 47 percent being highest in private sectors². It is projected that if the cesarean delivery rates continue to rise as they have in recent years, it may reach beyond 55 percent by the year 2020.³

Cesarean techniques continue to be taught and practiced. There have been many efforts to improve selected aspects of the surgical procedure and operative technique for cesarean delivery like confinement of the uterine incision to the lower uterine segment, use of prophylactic antimicrobials, placental delivery at surgery, suture materials used, uterine closure and so on to decrease both blood loss and infectious morbidity at abdominal delivery. The method of placental delivery and the practice of removing the residual tissue from the uterine cavity after cesarean are two such issues that are without a uniform practice.

The purpose of this study was to compare two methods placental removal - manual and spontaneous, and removal of residual fetal membranes at the time of elective cesarean delivery, to evaluate the incidence of subsequent postpartum endometritis.

2. Material and Methods

Consecutive consenting women scheduled for elective cesarean delivery during the period August 2011 through July 2012 at a Government District Hospital attached to a Medical College were recruited for the study. Women with anemia (Hb<9%), gestational diabetes mellitus, placenta praevia, obvious vaginal infection were excluded. Details of the cases recruited were recorded on the designed proforma.

In addition to identification data, the format sought the information about obstetric profile, antenatal problems and medical history to note the risk factors. These inputs were obtained from the antenatal records. The physical examination findings at admission to hospital and operative details were recorded. The information that was noted with respect to cesarean operation included indication, duration of surgery, type of anesthesia, method of placental removal, treatment with residual membranes, uterine closure, suture material used and operative blood loss.

At cesarean operation decision regarding the method of placental delivery, removal of residual membranes and method of closure of uterus was left to the discretion of concerned surgeon.

- For manual removal of placenta, the surgeon used their gloved hands to cleave the placenta from the deciduasbasalis.
- Placental delivery by cord traction involved external uterine massage and gentle traction on the exposed umbilical cord.
- When uterine cavity was wiped it was so done with a wet surgical sponge. The mop covered hand was moved from posterior wall through fundus and then along anterior uterine wall.

Total duration of surgery was recorded in minutes from skin incision to skin closure. Operative blood loss was calculated by using the formula:

$$\text{Blood loss} = \text{Blood volume}^{\#} \times \frac{\text{Difference in hematocrit}^{\dagger}}{\text{Average hematocrit}^{\vee}}$$

[#] Blood volume = body weight * 70 ml

[†] Difference between pre- and post-operative hematocrit

[∨] Average of the pre- and post-operative hematocrit

All the cases received cefotaxime 1 g intravenously twice a day on the day of surgery followed by cefadroxil 500 mg orally for five days, as per the hospital policy.

For the purpose of study, post cesarean uterine infection was considered to be present if at least two defined parameters were positive of which one is laboratory evidence. Clinical parameters considered were temperature greater than 38°C, uterine tenderness, abnormal lochia, uterine sub-involution (<1cm/day); and the laboratory parameters considered were C-Reactive Protein (> 90 mg/ dL), leukocytosis (>14000/ mm³), endocervical culture.

Symphysio-fundal height was measured in centimeters using measuring tape. Measurements were made to record rate of involution, with women in dorsal position. She was asked to void urine before recording. First measurement was taken on first post-operative day and there after every day until discharge from hospital. Rate of involution of <1cm per day was considered as sub involution.

Temperature in Celsius was recorded every day. Rise in temperature beyond 38°C from first postoperative day was considered as elevated temperature.

For uterine tenderness, palpation was done over the fundus of uterus from 1st post-operative day. Wincing of face by patient during palpation and or verbal expression of pain on enquiry was taken as indicative of tenderness.

On 3rd post-operative day, blood was drawn for determination of hemoglobin, estimate of hematocrit, total white blood count, and C- reactive protein. Endo cervical swab was collected on 3rd post-operative day for culture.

The observed cases were grouped as those who had,

- No manual removal of placenta and no uterine wiping for removal of residual placental membranes.

2. No manual removal of placenta but with uterine wiping for removal of residual placental membranes.
3. Manual removal of placenta and no uterine wiping for removal of residual placental membranes.
4. Manual removal of placenta and uterine wiping for removal of residual placental membranes.

2.1 Statistical Methods

For describing frequency distribution of characteristics of categorical and continuous variables of the observations made and compiled under these subject groups, and to determine the significance between the groups chi-square test, Fisher's exact test, Kruskal-Wallis test were used. To measure the association between uterine infection and influencing/confounding variables the data was subjected to bivariate analysis. For all statistical calculations the SPSS (version 16) and InStat 3 statistics softwares were used.

The study was approved by the institutional ethics committee and informed consent for the study was obtained from all the recruited patients.

3. Results

During the period of study 318 women undergoing elective cesarean delivery consented to participate. An average woman studied had a mean age of 28.3 ± 4.3 (range 18-42) years, parity 1.97 ± 0.9 (range 1-6) and had body mass index (BMI) of 24.8 ± 3 (range 18.1-35.2) kg/M^2 . Average gestational age at the time of cesarean was 38.25 ± 0.8 weeks.

Nearly half of the women were aged between 25 and 30 years (143 of 318 cases, 45%), were second gravidae (168 of 318 cases, 53%) and had an average built (BMI between 20-25 kg/M^2 163 of 318 cases, 51%).

Previous cesarean was the most common indication (65%) and breech presentation was the reason in 17% of cases. For cesarean, the most often administered anesthesia was spinal (96%).

Mean duration of surgery was 35.9 ± 8.5 (range 20-55) min. The surgery was completed in less than 30 min in 110 patients and between 31 to 40 minutes in 136 patients. The calculated operative blood loss was 54 ± 7234 ml (222-1227) ml.

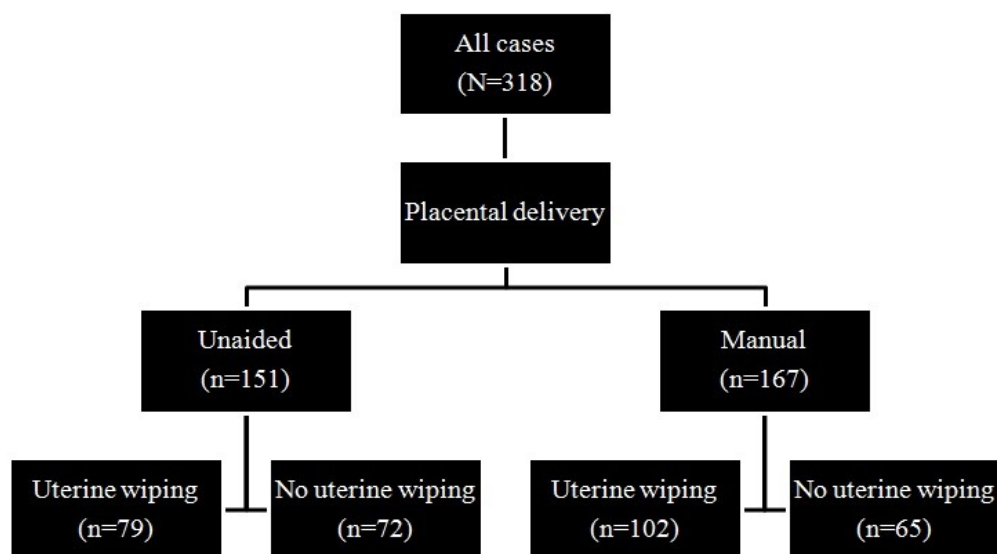
Most of the surgeries were performed by Senior Residents (226 of 318 cases, 71%) and the most common suture material used for closure of uterus and abdomen was polyglactin 910. The overall post-operative uterine infection was seen in 65 of 318 cases (20.4%).

Microbiological study of endo-cervical swabs revealed proportion of organism positivity was higher in the uterine infection group (55 of 65 cases, 84.6% and 102 of 253 cases, 40.3% in uterine infection and no infection groups, respectively; $p < 0.0001$). Finding to note was that they were isolated also from women without uterine infection and that there was no definite spectrum for uterine infection. The frequently isolated organisms were *S. aureus* followed by mixed flora, *E coli*, *Pseudomonas* and *K pneumoniae*. (Table I)

Table I. Microbiogram of endocervical swab culture

	Uterine Infection (n =65) Cases (%)	No Uterine Infection (n = 253) Cases (%)	Significance
Culture Positivity	55 (84.6)	102 (40.3)	<0.0001
Organisms Isolated			
<i>S aureus</i>	17 (30.9)	34(33.3)	0.177
Mixed flora	16 (29.1)	22 (21.6)	
E coli	09 (16.4)	09 (8.8)	
<i>Pseudomonas</i>	04 (7.3)	12 (11.8)	
<i>K pneumonia</i>	06 (10.9)	07 (6.9)	
Diphtheroids	03 (5.5)	11 (10.8)	
Others	00 (0)	07 (6.9)	

Based on method of placental delivery and removal of placental membranes, the 318 cases were regrouped to study the attributability of surgical practice to the uterine infection rate. (Figure 1)

Figure 1. Distribution of cases according to placental management

Among the four placental management groups the uterine infection rate, influence of surgical practices and frequency of possibility of suggestive variables of infection were studied.

Age of the woman and their BMI was similar among all the groups ($p=0.84$). The mean parity was apparently higher in the group that had placental delivery spontaneously and no uterine wiping (2.15 ± 1.2 ; $p=0.39$). (Table II)

Table II. Profile of cases in placental management groups.

Group / Characteristic	Manual removal + uterine wiping (n=102)	Manual removal + No uterine wiping (n=65)	Spontaneous + uterine wiping (n=79)	Spontaneous + No uterine wiping (n=72)	Significance
Age in years (Mean \pm SD)	28.3 \pm 4.8	28.5 \pm 4	28.5 \pm 4.3	27.8 \pm 3.8	0.84 NS
Parity (Mean \pm SD)	1.86 \pm 0.7	1.94 \pm 0.8	1.97 \pm 0.8	2.15 \pm 1.2	0.39 NS
BMI kg/M2 (Mean \pm SD)	24.9 \pm 3	25.1 \pm 3.5	24.5 \pm 2.8	24.8 \pm 2.8	0.73 NS
Gestational Age (Mean \pm SD)	38.2 \pm 0.6	38.7 \pm 0.8	38.6 \pm 0.7	38.4 \pm 0.6	0.46 NS
Uterine Infection (n; %)	18 (17.7)	16 (24.6)	16 (20.1)	15 (20.8)	0.85 NS

NS – Not significant.

Proportion of cases with uterine infection was higher in the group with manual removal and no uterine wiping and lower in the group that had manual removal and uterine wiping (24.6% and 17.7% respectively; $p=0.85$). The timing of cesarean delivery was not different among the four groups.

With respect to the placental management, analysis of significance of individual diagnostic attributes of uterine infection revealed uniformity. Amongst cases with uterine infection the common clinical contributor to the diagnosis was fever (8 of 65 cases, 12.3%) and in the laboratory variables, endo-cervical culture (55 of 65 cases, 84.6%).

There was no association between developing fever (day1 to day3), rate of uterine involution, rise in total leucocyte count, C - reactive protein, endo-cervical swab culture being positive with either of the practices - the method of placental delivery or practice of removing residual placental membranes. (Table III)

Table III. Relative risk of individual diagnostic attributes of uterine infection according to practice of placental management

Attributes for diagnosis of Uterine Infection	Spontaneous Placental Delivery		Manual removal of Placenta	No uterine wiping		Uterine wiping
	P	RR	CI	P	RR	CI
Fever (>380C)	1	1.02	0.70 - 1.40	0.77	0.76	
Uterine sub involution (<1 cm/d)	0.16	1.03	0.99 - 1.07	0.73	1	0.97 - 1.04
Leucocytosis (>14000/mm3)	0.88	1.05	0.64 - 1.70	0.09	0.65	0.40 - 1.10
CRP (>90 mg/ dL)	0.56	0.84	0.53 - 1.34	0.77	0.93	0.58 - 1.48
Endocervical swab culture	0.43	0.92	0.74 - 1.14	0.82	1.04	0.74 - 1.14

P=probability; RR- relative risk; CI- confidence interval

By day 3 of post-operative period, 65 patients had uterine infection. Group with manual removal and no uterine wiping had the highest incidence (16 of 65 cases, 24.6%) of uterine infection. Those who underwent manual removal of placenta with uterine wiping had lower incidence of uterine infection (18 of 102 cases, 17.7%). However, the difference was not statistically significant.

The operative attributes like surgical time, blood loss and the uterine closure variables did not appear to influence the uterine infection rate when analyzed according to the placental management subgroups

Bivariate analysis to study the effect of confounding variables such as age, gestation, BMI, operating time, blood loss, uterine closure, method of placental removal, and removal of placental membranes did not appear to influence occurrence of uterine infection. (Table IV)

Table IV. Bivariate analysis of confounding variables for uterine infection

		Age	Gestation	Duration	Uterine closure	BMI	Blood loss	Placental removal	Wiping
Infection	Pearson Correlation	0.017	0.033	-0.027	0.045	-0.054	-0.019	0.002	0.047
	Sig. (2-tailed)	0.761	0.555	0.628	0.427	0.340	0.742	0.970	0.402

3. Discussion

Puerperal endometritis is one of the common complications associated with cesarean delivery. Endometrial cavity is considered sterile in non-laboring women and endometritis is thought to be resulting from bacteria ascending from the lower genital tract. However, not all women with microbial colonization of the chorioamnion or endometrium have clinically apparent infection, suggesting that there are other factors, such as bacterial inoculums and local host defenses that play an important role in the development of post-cesarean infections.

Wide variation in the incidence of uterine infection has been reported by different authors across the globe. Post-cesarean uterine infection rate is reported to be as high as 34% when no prophylactic antimicrobials were used⁴ to a low of 7.7% with wide spread use of prophylactic antibiotics⁵. Although we used antimicrobials for longer period in therapeutic dosage the recorded higher incidence of endometritis in the present study population of 20.4% may be due to the use of liberal definition for endometritis.

Endocervical cultures yielded growth in 85% of patients with endometritis. Most common organism isolated was *Staphylococcus aureus* followed by mixed flora, *Escherichia coli*, *Klebsiella pneumonia* and *Pseudomonas*. A study that noted growth of aerobic bacteria of 75% and anaerobic organisms of 85% isolated different bacterial spectrum⁶. The aerobes most frequently recovered were *Staphylococcus epidermidis*, *Escherichia coli*, *Enterococci* and *Streptococci*. The prevalent

anaerobes were the gram positive anaerobic cocci viz., *Peptostrepto coccus* and *Peptococcus*, and *Bacteroides* species. Anaerobic culture was not studied in the present study. Liberal use of cefotaxim (a broad spectrum antibiotic) could account for the different spectrum of aerobic bacteriae isolated. The spectrum of bacterial isolates was similar in those with and without endometritis in our study. Other investigators too have not found difference in the isolated flora between those with uterine infection and those without⁷.

Indication for cesarean did not appear to make much significant difference in occurrence of endometritis because of placental and post-placental management, be it between manual extraction group and in spontaneous group or that between uterine wiping and no wiping groups in the present study. Similar was the opinion by others^{6,7}.

As in the other reported studies^{8,9,10}, no significant difference in uterine infection rate was found related to different techniques of abdominal opening and layers of uterine closure.

Average estimated blood loss was 547 ml in our study. The group with manual removal of placenta and no wiping had highest blood loss and the group with spontaneous removal of placenta and wiping had the least blood loss, but the difference was not significant ($p=0.109$). The blood loss was higher ($p=0.6$) in the manual removal group than the spontaneous placental delivery group. Magann *et al*¹¹ also found that removal of residual membranes affected the blood loss. However, the study did not describe the method used to estimate blood loss.

Placental management methods, manual removal of placenta and spontaneous placental delivery in the present study did not appear to influence the development of uterine infection (20.3%, 20.5% respectively, $p>0.05$). Significant post-cesarean uterine infection rates were, however, reported in cases where manual placental removal was practised^{12,13}. The possible explanation for the secular incidence of uterine infection in the present study irrespective of method of placental management may be due to liberal use of antimicrobials.

Present study did not find any difference in rate of uterine infection whether uterine cavity was wiped or not to remove placental membranes (22.6% vs. 18.8%; $p=0.4$). Although the absolute figures for uterine infection were lesser, studies have not reported influence of the practice on rates of uterine infection¹¹.

Uterine contraction and spontaneous cervical dilatation after cesarean delivery appears to be effective in clearing the residual membranes. Also any small advantage gained by the removal of residual membranes may be negated by the introduction of a potentially contaminated surgeons hand into the uterine cavity. As already stated the antimicrobial policies may be responsible for the change in absolute figures for infection in both the studies.

Neither the influence of surgical practices and placental management on the uterine infection, nor that of other practices (operative factors, patient characteristics, placental management) was noted in the present study. For a common obstetric surgery that would be carried out by so many practitioners working in different conditions is bound to have different practices. Inability to find no influence of some of these practices on uterine infection does provide the confidence to the practitioner. But, inability to randomize and use of not so stringent criteria for diagnosis of uterine infection that too in the backdrop of liberal antimicrobial use ordained by the hospital policy were the avoidable limitations of the present study.

We feel that there is a need to follow one method uniformly. Awaiting the spontaneous separation of placenta, assisting delivery by controlled traction at umbilical cord and not wiping the uterine cavity to remove residual membranes can be suggested to be the default method at surgery. Under circumstances when uterus is atonic or bleeding is more any of the other practices can be supplemented.

Acknowledgement

Permission given by Medical Superintendent and Heads of Clinical Units of Lady Goschen Government District Maternity Hospital, Mangalore to conduct the study is thankfully acknowledged.

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