

CAESAREAN SECTION RATE IN SPONTANEOUS VERSUS INDUCED LABOUR: A PROSPECTIVE COHORT STUDY

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ABSTRACT

Background: The rate of induced labour is rapidly increasing all over the world. Induced labour is reported to be associated with high rates of caesarean section (C-section). However, data is limited in high volume tertiary care centres from developing countries.

Objectives: The aim of this study was to compare C-section rate in spontaneous versus induced delivery in a prospective manner.

Methods: This is a prospective cohort study where we selected patients who either had a spontaneous or an induced labour between July 2016 and June 2017. We recorded patient age, parity, gestational age at the time of labour, body mass index (BMI), overall Bishop Score and comorbidities or obstetric complications. We analysed the data for C-section rate and association between various clinical factors and the mode of delivery.

Results: 488 patients with 240 (49.2%) spontaneous onset labour and 248 (50.8%) with induced labour. The mean age was 27.7 ± 5.6 years with 299 (61.3%) nulliparous and 189 (38.7%) multiparous women. The mean gestational age was 39.8 ± 0.6 weeks (range: 38.5 – 41.5) and mean BMI was 23.3 ± 2.9 . A total of 50 C-sections were performed, out of which 19 (3.9%) in patients with spontaneous onset labour while 31 (6.4%) in patients with induced labour (Fisher's exact $p = 0.095$). Significant mean difference (MD) of age between multiparous and nulliparous women (MD = 8.8, 95% CI: 8.2 to 9.5), $t = 25.7$, $p < 0.0001$) as well as the BMI (MD = 0.92, (95% CI: 0.401 to 1.434), $t = 0.968$, $p = 0.001$) was found. Additionally, patients who underwent C-section had significantly higher BMI (mean: 27.6 ± 1.9) as compared to those who did not (mean: 22.9 ± 2.5) and this difference was significant (MD: 4.8, (95% CI: 4.1 to 5.5), $t = 12.9$, $p < 0.0001$).

Conclusion: Higher rates of C-section are associated in patients with induced labour; however, there is no statistically significant difference as compared to spontaneous onset labour. Higher body mass index and lower Bishop Scores are associated with increased rates of induction and eventual C-section.

Keywords: spontaneous Labour, induction of labour, C-section.

INTRODUCTION

Induction of labour is a common obstetrical entity which is indicated in about 20% of childbirth cases. The rates of induced labour are increasing steadily and studies have suggested a range of 9.5% to 23% in developed countries.¹ In Asia, this rate is reported in up to 35% deliveries in Sri Lanka. Another study has reported about 38% induction rate from Pakistan.^{2,3} A major concern of induction is that elective labour induction may increase the risk of C-section. The World Health Organisation (WHO) recommendation about induction of labour states that labour should be

induced if there are clear medical or obstetrical reasons and in such situations where the benefits outweigh the risks.^{4,5} Such situations include post-term gestation, abnormalities of amniotic fluid, premature rupture of membranes (PROM), intrauterine growth retardation (IUGR), maternal hypertension, diabetes and several other foetal problems.⁶

Some studies have shown that induction of labour may improve outcome for both the mother and foetus as compared to expectant management.⁷ This argument holds true for selected cases of those women who are in need of induction, such as those with severe eclampsia, diabetes, foetal distress or premature rupture of membranes.⁸ However, other studies have shown that induction of labour is associated with increased rates of caesarean section (C-section) which reaches to a twofold increase in patients without proper indication of induction. Studies which have favoured induction of labour (IOL) argues that patients with resource poor countries may benefit from timely intervention and reduce the hazards associated with prolonged pregnancy, maternal risk factors or foetal exposure to prolonged distress.^{9,10}

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The WHO has recommended a C-section rate of not more than 15%.¹ Various studies have reported a wide range of C-section with a range of 9-52%. Caesarean delivery has several hazards including anaesthesia related, intraoperative haemorrhage, postpartum haemorrhage, neonatal asphyxia and postpartum depression. Keeping these hazards in view, a high C-section rate will increase the rate of these complications.¹¹

We undertook this study to determine the rates of caesarean delivery in induced versus spontaneous labour in a resource poor country. If safety of IOL is established, it will improve maternal and foetal outcome substantially since our country has high maternal and foetal mortality rates.

METHODS

This is a prospective cohort study of 12 months duration (July 2016 to June 2017). The study was commenced after the approval of institutional review and ethical board. All patients included in the study provided consent for the study as well as any medical or surgical procedure, according to the declaration of Helsinki. Patients who presented to our labor services with either spontaneous or medically induced labour were included. We excluded patients with severe medical comorbidities, intrauterine death of the fetus, PROM, abruption placentae, pre-planned C-section and multiple pregnancies. We calculated the gestational age from the first day of the last menstrual period or as denoted by the antenatal ultrasound.

Two study groups were created; A) spontaneous labour, B) induced labour. We recorded data regarding patient age, parity (nulliparous, multiparous), gestational age (weeks), reason for induction of labour (post-date, hypertension, diabetes, large or small for gestational age, oligohydramnios and patient preference), BMI, Bishop Score and labor duration. Labour duration was recorded stage wise and as a whole. First stage was defined as the start of cervical dilation at 3 cm to full cervical dilatation. Second stage of labour is defined from full cervical dilatation to the delivery of the baby.

Post-date gestation was defined as a gestational age between 40 + 0 weeks and 41 + 6 weeks. We included all forms of hypertension as high risk to the mother including pregnancy induced hypertension, pre-eclampsia and chronic hypertension while diabetes of gestational origin as well as overt diabetes mellitus were regarded as high risk. Small for gestational age was defined as fetal weight of less than 10th percentile by antenatal ultrasound while large for gestational age was defined as greater than 90th percentile of weight.

We used prostaglandin E2 pessary (dinoprostone 10 mg) as the sole therapy or in combination with oxytocin. We assessed Bishop Score at the time of admission. If Bishop Score was ≤ 4 , a vaginal prostaglandin E2

pessary was inserted for cervical ripening and maintained for up to 10 hours, or until dictated by rupture of membrane, fetal distress and regular contractions.

Spontaneous onset labour was defined as the onset of regular painful uterine contractions with cervical dilatation. In case of unsatisfactory uterine contractions, it was augmented with the help of oxytocin. During this, fetal monitoring was performed. Induction of labour was termed as failed when a woman did not enter active labour pains but the decision for C-section was on the discretion of the consultant caring for the patient, taking into consideration multiple factors such as the risk to mother or fetus and induction failure etc.

The data was entered and analysed using IBM SPSS version 22.0. Independent t test was used to determine mean differences for the two study groups while chi-square test was used to look for significant associations between categorical variables. Statistical significance was kept at ≤ 0.05 .

RESULTS

We included 488 patients where 240 (49.2%) patients were in the spontaneous onset labour group and 248 (50.8%) were in the induction group. We excluded 430 patients according to the exclusion criteria. In this study mean age was 27.7 ± 5.6 years (range: 16 – 40). 299 (61.3%) of patients were nulliparous while 189 (38.7%) were multiparous females. Table 1 The overall mean gestational age was 39.8 ± 0.6 weeks (range: 38.5 – 41.5) and mean BMI was 23.3 ± 2.9 .

Table 1: Parity of women across the study groups

Study group		Parity	
		nulliparous	Multiparous
spontaneous	n	145	95
	%	29.7%	19.5%
Induced	n	154	94
	%	31.6%	19.3%
Total	n	299	189
	%	61.3%	38.7%

Table 2: Comorbid and the indications for induction of labour

Indications for IOL	nulliparous	Multiparous
hypertension	41 (13.7%)	36 (19%)
post-date	30 (10%)	17 (9%)
diabetes	21 (7%)	14 (7.4%)
small for age	10 (3.3%)	8 (4.2%)
large for age	21 (7%)	9 (4.8%)
oligohydramnios	15 (5%)	10 (5.3%)
patient preference	16 (5.4%)	-

Table 3: Mode of delivery across the nulliparous and multiparous women

	nulliparous (299)	multiparous (189)
C-section	34 (11.4%)	16 (8.5%)
Vaginal	265 (88.5%)	173 (91.5%)
Spontaneous	232 (77.6%)	146 (77.2%)
Vac assisted	33 (11.0%)	27 (14.3%)

Table 4: Distribution of Bishop Scores across the study groups

Study group		Bishop score		
		< 4	5 - 6	> 6
Spontaneous	n	80	44	116
	%	16.4%	9.0%	23.8%
Induced	n	157	38	53
	%	32.2%	7.8%	10.9%
Total	n	237	82	169
	%	48.6%	16.8%	34.6%

Table 5: Mode of delivery and the distribution of various clinical factors

	C-section (50)	Vaginal (438)
Spontaneous	19 (38%)	221 (50.5%)
Induced	31 (62%)	217 (49.5%)
Nulliparous	34 (68%)	265 (60.5%)
Multiparous	16 (32%)	173 (39.5%)
Bishop		
< 4	33 (66%)	204 (46.6%)
5 - 6	8 (16%)	74 (16.9%)
> 6	9 (18%)	160 (36.5%)
Failed induction	13 (26%)	-
Fetal Distress	24 (48%)	-
Failure to progress	14 (28%)	-

Labour induction was most commonly indicated in patients with hypertension (n = 77, 31.0%) followed by postdate. Table 2 We did not find any significant difference between the mode of delivery with regard to parity (Fisher exact p = 0.703) Table 3. On the other hand, significant difference was found for Bishop Score between the study groups, where patients had lower Bishop Scores in the induction group as compared to the spontaneous delivery group (Fisher exact p < 0.0001). Table 4

A total of 50 C-sections were performed, out of which 19 (3.9%) in patients with spontaneous onset

labour while 31 (6.4%) in patients with induced labour (Fisher's exact p = 0.095). Additionally, in the spontaneous onset group, out of 19 C-sections there were 12 (5.0%) out of 34 nulliparous patients who underwent C-section and 7 (2.9%) out of 16 multiparous women who underwent C-section (Fisher's exact p = 0.799). On the other hand, in the induction group, out of 31 C-section there were 22 (8.9%) nulliparous women who underwent C-section and 9 (3.6%) multiparous women with C-section (Fisher's exact p = 0.276). Table 5

Out of 24 cases of fetal distress that underwent C-section 12(5.0%) cases were in the spontaneous labour group and out of 14 cases of progress failure that underwent C-section 7 (2.9%) cases were in the spontaneous labour group. On the other hand, in the induced group there were 12 (4.8%) cases of fetal distress and 7 (2.8%) cases of labour progress failure with C-section. The difference for fetal distress was statistically insignificant (p = 0.093) and similarly for progression failure, there was no significant difference between the two study groups (p 0.950). Table 5

Majority of our patients presented during 39th week of gestation. The majority of C-sections occurred during the 39th week in both the spontaneous onset labour (5.4%) as well as in the induction group (7.7%). However, for the spontaneous group, the difference of C-section rate was not statistically significant (p = 0.816) while it was significant for the induction group (p = 0.049) as most of C-sections occurred during the 39th week. The C-section rate did not increase with increasing gestational age for both study groups (p = 0.270). Similarly, though we observed higher rates of C-section in nulliparous women as compared to multiparous (7.0% vs 3.3%), the difference was not significant (Fisher's exact p = 0.303).

On independent samples t-test we did not find mean difference of age, BMI and labour duration for the two study groups. However, there was significant difference of gestational age between the study groups (p < 0.0001). We, however, did find significant mean difference (MD) of age between multiparous and nulliparous women (MD = 8.8, 95% CI: 8.2 to 9.5), t = 25.7, p < 0.0001) as well as the BMI (MD = 0.92, (95% CI: 0.401 to 1.434), t = 0.968, p = 0.001). Additionally, patients who underwent C-section had significantly higher BMI (mean: 27.6 ± 1.9) as compared to those who did not (mean: 22.9 ± 2.5) and this difference was also significant (MD: 4.8, (95% CI: 4.1 to 5.5), t = 12.9, p < 0.0001).

In this study, the C-section rate was two times higher in the induction group (n = 31, 6.4%) as compared to the spontaneous group (n = 19, 3.9%), however, the difference was not statistically significant (p = 0.095). C-section rate, on the other hand was two times higher in nulliparous women (n = 34, 7.0%) than multiparous women (n = 16, 3.3%) and this difference was also not statistically significant (p = 0.303).

DISCUSSION

The aim of our study, as evident from the above discussion was to determine if labour induction in term deliveries with normal fetal presentation increases the risk of C-section as compared to spontaneous onset labour. We found a two times higher C-section rate in induced labour as compared to spontaneous labour, however, the difference was statistically insignificant ($p = 0.095$). Moreover, there was a significant difference of BMI between the study groups and it was evident that women with higher BMI (≥ 26) undergo C-section frequently as compared to those with normal or average BMI (≤ 25). Similarly, women with lower Bishop Scores (≤ 4) were more likely to undergo induction as compared to those with higher Bishop Scores (≥ 6) ($p < 0.0001$). No other significant differences were found between the study groups in terms of maternal age, gestational age and parity.

On the progress of labour and the C-section rate, we found that there were no statistically significant differences between the spontaneous and induced labours in terms of fetal distress and progress failure. However, duration of labour in induced labours that underwent C-section was higher. Numerous studies have shown that induced labour is associated with a higher risk of C-section in both nulliparous and multiparous women.^{5,12,13,14} In our study, we found an increased rate of C-section in induced labour, however, it is interesting to note that the rate did not reach statistical significance, which means that labour induction in itself is not associated with higher C-section rate, rather, other factors may also play important role.

In a recent review of induction of labour (IOL) in resource limited middle or low income countries, Smid and colleagues¹ have presented detailed discourse of the current status of IOL in developing countries. They have asserted that the WHO standard of IOL should be maintained and IOL should only be performed if there are clear indications in terms of health of the mother and baby. However, it is important to note that IOL has increased and so has its associated complications. In a retrospective review, Ehrenthal and co-workers¹² have stated that IOL increases the risk of C-section about two times, which is similar to our study. However, their study was limited because they only included nulliparous women. Another study by Seyb and colleagues¹⁵ have answered these shortcomings, as they included multiparous women and women with PROM. This study also showed that the rates of C-section increase with increasing rates of IOL.

Recently, in a study from PAEC hospital Islamabad by Haq and colleagues¹⁶ about IOL in postdates women at different time interval, it was shown that IOL after 40 weeks is associated with higher rates of success in terms of vaginal delivery as compared to IOL at 40 weeks or less. Our study is in agreement with the above study, where we found significantly higher

rates of C-section during the 39th week as compared to later gestational period (40 weeks and above) in the induction group.

Davey and co-workers¹⁷ in a population based cross-sectional analysis of nearly 43000 births concluded that about 10% of nulliparous women undergo labour induction without any justifiable indication of IOL and this increases the risk of C-section about two to three folds. This study has also shown that the method of induction does not affect the C-section rates. On the contrary, Caughey and co-workers¹⁸ have shown that IOL is associated with lower C-section rates as compared to those who were managed expectantly. However, several other studies have criticised this study by pointing out the lack of data about Bishop Scores which may lead to a selection bias. Unfavourable cervical status leads to higher rates of labour induction. In support of this study, is the study by Michelson and co-workers¹⁹, who has asserted that higher maternal age, higher birth weight, diabetes, hypertension and parity, all influence the rate of C-section, and not the IOL. Osmundson and co-workers²⁰ also agree with this statement and they state that induction does not result in higher C-section rate. Our findings are slightly different than statement of all these studies. We found that, though the rates of C-section are high in patients with IOL, however, there is no significant difference when compared to the spontaneous onset labour patients. However, it is an agreed upon condition that the interplay of various factors may affect the final approach towards delivery. These factors include parity, Bishop Score, maternal age and birth weight of the baby.

In our study, we have found that comorbidities especially hypertension are the primary indication of labour induction. Bishop score and BMI are significantly different between patients who eventually undergo C-section, irrespective of their mode of labour onset.

The limitations of our study include a relatively smaller sample size, single centre experience and the lack of data about the new-born. We could not study the complications associated with C-section because of our study design. Future research may alleviate these limitations by larger population based analysis and those taking into consideration the effect of labour induction and C-section on the overall health of the mother and baby.

CONCLUSION

Labour induction is increasingly being practiced, especially in women with comorbidities or conditions where the foetus may be at risk. Higher rates of C-section are associated in patients with induced labour; however, there is no statistically significant difference as compared to spontaneous onset labour. Higher body mass index and lower Bishop Scores are associated with increased rates of induction and eventual C-section.

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