

## Original Article

## Caesarean section at full cervical dilatation

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**Background:** Caesarean section at full cervical dilatation has many implications for maternal and neonatal morbidity as well as subsequent pregnancy outcomes. However, increasing trends are reported internationally for second-stage caesarean delivery.

**Objectives:** To review the rate and indication for a caesarean section at full dilatation over a 5-year period at a tertiary referral obstetric centre in Sydney.

**Materials and Methods:** Retrospective cohort review of all women with a singleton, cephalic presenting fetus at  $\geq 37^0$  weeks' gestation delivered by caesarean section in the second stage of labour between 1 January 2009 and 31 December 2013 at Royal Prince Alfred Hospital. Medical records were reviewed, and demographic, maternal and fetal outcome data were obtained. Consultant supervision and documentation standards were recorded. The main outcome measures were the rate of caesarean section at full cervical dilatation, maternal and fetal morbidity.

**Results:** During the study period, 8449/26063 (32.4%) babies were born by caesarean section. Of these surgical births, 476 (5.6%) were performed at full cervical dilatation at  $>37$  weeks' gestation. There was no observed trend over the 5 years. The majority of women delivered by caesarean section at full dilatation were nulliparous and in spontaneous labour. More than half of these women were delivered without a trial of instrumental delivery. Consultant obstetricians were present for 7% of public second-stage caesarean deliveries.

**Conclusion:** We report a 5-year experience with caesarean delivery at full dilatation at a tertiary unit. The rate was variable over the 5 years. Secondary outcome measures suggest that consultant supervision is uncommon and documentation standards require improvement.

**Key words:** caesarean section, full dilatation, instrumental delivery, second stage of labour.

## Introduction

The increasing rates of caesarean section (CS) are of major clinical interest in obstetrics today. CS now represents 30% of all deliveries in New South Wales.<sup>1</sup> The increasing CS rate is of significant international concern, with reported rates of 25.5 and 32.8% in the UK and USA, respectively.<sup>2,3</sup> Second-stage CS has been reported as a concerning increasing trend within the increasing CS rate.<sup>4,5</sup> Evidence suggests that this trend is multifactorial; a combination of lack of training and supervision for junior

staff in second-stage decision-making, a loss of technique associated with difficult-assisted delivery<sup>4</sup> and concerns relating to maternal and neonatal morbidity with associated litigious issues. Primary CS has many important implications for future pregnancies and subsequent labour and delivery.

The Royal College of Obstetricians and Gynaecologists (RCOG) reports that approximately 6% of caesarean sections for singleton pregnancies occur at full dilatation.<sup>6</sup> In half of these deliveries, there was no attempt at an instrumental delivery.<sup>6</sup> This may be due to the need to expedite delivery abdominally for fetal concerns or reluctance or concern over safety and or suitability from junior medical staff to attempt perceived difficult rotational or mid-cavity instrumental deliveries resulting in an immediate recourse to CS at full cervical dilatation.<sup>7</sup> Consultant presence and supervision of junior medical staff may improve vaginal delivery rates.<sup>8</sup>

Caesarean section at full dilatation, with or without attempt at operative vaginal delivery, is a more challenging

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surgical procedure than a first stage or nonlabouring CS<sup>9</sup> and carries a higher rate of maternal morbidity.<sup>1,10</sup> The morbidity related to a prolonged second stage is directly correlated with the incidence of extension of the uterine angles and prolonged surgical time<sup>11,12</sup> bladder injury<sup>13</sup> and increased incidence of postpartum haemorrhage, pyrexia<sup>14</sup> and length of hospital stay.<sup>1</sup>

Neonatal complications following operative delivery in second stage include fetal acidaemia, trauma (cephalohaematoma and intracranial haemorrhage; lacerations and facial nerve palsies)<sup>15</sup> and subsequent neonatal intensive care unit (NICU) admissions. The incidence of fetal acidaemia is increased in neonates who are delivered by CS after unsuccessful instrumental attempt.<sup>9,16</sup>

Supervision and teaching of junior obstetric trainees is an important factor when considering the performance of future obstetricians. Traditionally, junior trainees make clinical decisions about second-stage deliveries with variable amounts of consultant supervision. Currently, the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) has a guideline for the supervision of trainees in birth suite.<sup>17</sup> It suggests that on-call consultant obstetricians are immediately available for advice by telephone and able to attend the hospital in a timely manner to assist the trainee in delivering safe patient care. Consultant presence for supervision or assistance is expected for CS at full dilatation for trainees who are not yet accredited as competent according to assessments of surgical competency and in keeping with local hospital policies. RCOG's good practice guideline outlines the 'responsibility of the consultant on call'.<sup>18</sup> Consultant presence at trial of instrumental delivery or a fully dilated CS is mandated. Unterscheider<sup>4</sup> reported that an obstetrician attended only 40% of these deliveries over a 3-year period and, in 30% of cases, the consultant's vaginal assessment findings agree with the trainee. Furthermore, the chance of achieving vaginal delivery with a consultant present in second stage is reported as 70% compared to 30% in their absence.<sup>7</sup> This illustrates an important learning opportunity for trainees in theory and practical skill in operative obstetrics.

The aims of this study were to determine the rates of CS at full dilatation at Royal Prince Alfred Hospital, their indications, associated maternal and neonatal morbidity and address supervision and documentation deficits.

## Materials and Methods

This retrospective cohort study assessed all caesarean sections performed at full cervical dilatation between 1 January 2009 and 31 December 2013 at Royal Prince Alfred Hospital, a tertiary obstetric unit. Caesarean section cases were identified through the operating theatre data log of obstetric cases. The electronic medical record, specifically the record of labour and operation reports, was reviewed for all CS cases over the study period. For those cases where the cervical dilatation or accordance with the inclusion criteria was not clear, the clinical file was

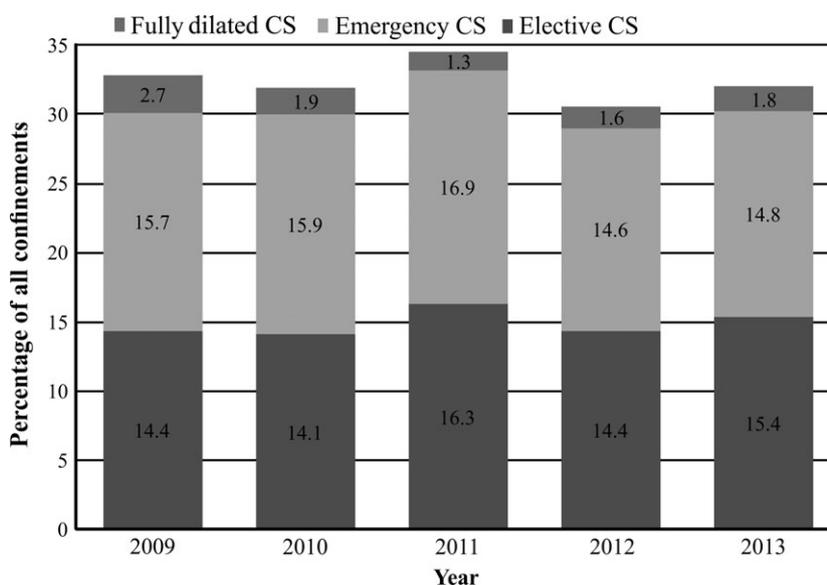
reviewed. Women with a singleton fetus in cephalic presentation at term ( $\geq 37^0$  weeks) who underwent CS at full dilatation were included. Maternal demographics, labour and delivery details as well as neonatal outcomes were collected. Data analysis was performed with the SPSS Statistical Package. Proportions were compared using the chi-squared test. Statistical significance was conferred at  $P < 0.05$ . The Local Health District Ethics Review Committee granted approval for access to clinical records.

## Results

During the index period, 8449 women were delivered by caesarean section. Of these, 476 were at full cervical dilatation  $>37^0$  gestation with a singleton fetus in cephalic presentation. Figure 1 illustrates the CS rate including the proportions of elective and emergency deliveries over the time period examined. The CS rate overall was 32.4%, and this varied from 30.6% in 2012 to a maximum of 34.6% ( $P = 0.0004$ ). Table 1 summarises the number of CS at full dilatation as proportions of all confinements, all CS deliveries and all fully dilated women. These proportions varied significantly over the study period ( $P < 0.0001$ ). Table 2 outlines the maternal demographics and characteristics. 87.2% of women were nulliparous and 62.4% were in spontaneous labour. 5.5% of women had a previous CS, and there was an overall epidural rate of nearly 80%.

The most common indication (44.9%) for CS in the second stage was failure to progress without an attempt at instrumental delivery (Table 3). The ventouse was used in 59% of the attempted instrumental deliveries and unsuccessful ventouse deliveries accounted for 19.1% of CS at full dilatation. 92% (58/63) of forceps attempts were with Neville Barnes traction forceps and 5 cases of unsuccessful Kiellands rotational forceps. However there was a 4.4% double instrumentation rate (21/476), and this decreased from 9% in 2009 to 2.2% in 2013.

Table 4 outlines maternal and neonatal morbidity. Forty-eight (10.1%) women had a postpartum haemorrhage of more than 1000 ml. Four of these women required blood transfusions (8.3%), and the overall transfusion rate was  $<1\%$ . One woman returned to the operating room for management of postpartum haemorrhage. One infant was delivered through a laparoelytotomy, an uncommon complication of CS at advanced dilatation where the incision is made in the upper vagina, rather than the lower uterine segment. There were three maternal intensive care unit (ICU) admissions over the 5 years. Sixty-eight (14.3%) babies were admitted to the NICU for management of respiratory distress, sepsis, jaundice, subgaleal haemorrhage and observation. Thirty-five (7.4%) had Apgar scores of  $<5$  and 9 at one and 5 min, respectively. Four babies were delivered by breech extraction at CS due to difficulty delivering a fetal head deeply impacted in the maternal pelvis. There were six confirmed subgaleal haematoma, and there were no stillbirths or neonatal deaths.



**Figure 1** Summary of CS Deliveries 2009–2012. The overall caesarean section rate as a percentage of all confinements is presented for 2009–2013. The proportions of elective, emergency and fully dilated caesarean sections for each year within the total proportion. CS = caesarean section.

**Table 1** Summary of CS at full cervical dilatation

	2009	2010	2011	2012	2013	Total	<i>P</i> value
Fully dilated CS (% of all confinements)	133/5023 (2.7)	97/5213 (1.9)	70/5375 (1.3)	83/5352 (1.5)	93/5100 (1.8)	476/26063 (1.8)	<0.0001*
Fully dilated CS (% of all CS)	133/1649 (8.1)	97/1681 (5.8)	70/1852 (3.7)	83/1636 (5.1)	93/1631 (5.7)	476/8449 (5.6)	<0.0001*
Fully dilated CS (% of all Emergency CS)	133/923 (14.4)	97/928 (10.5)	70/976 (7.1)	83/865 (9.6)	93/846 (10.9)	476/4538 (10.4)	<0.0001*
Fully dilated CS (% of all fully dilated women)	133/3507 (3.8)	97/3629 (2.7)	70/3593 (1.9)	83/3803 (2.2)	93/3562 (2.6)	476/18094 (2.6)	<0.0001*

\*Proportions of fully dilated CS varied significantly over the 5-year period.

**Table 2** Maternal characteristics

	2009	2010	2011	2012	2013	Total
CS at full dilatation (n)	133	97	70	83	93	476
Median age (years) (Interquartile range)	32 (29–35)	32 (29–35)	32 (29.23–35.75)	33 (29–36)	32 (28–36)	32 (29–36)
Nulliparous (%)	118 (88.7)	86 (88.6)	62 (88)	75 (90.4)	74 (79.6)	415 (87.2)
Previous CS (%)	6 (4.5)	4 (4.1)	2 (2.8)	4 (4.8)	10 (10.6)	26 (5.5)
Median gestation (interquartile range)	40.2 (39.4–41.1)	40.2 (39.1–41)	40.2 (39.4–40.6)	40.4 (39.4–41)	40.2 (39.4–41)	40.2 (39.4–41)
Spontaneous labour (%)	82 (61.6)	65 (67)	46 (65.7)	50 (60.2)	54 (58.0)	297 (62.4)
Epidural in labour (%)	114 (86)	74 (76)	56 (80)	64 (77.1)	72 (77.4)	380 (79.8)
Public patient (%)	91 (68.4)	68 (70.1)	48 (68.5)	69 (83.1)	73 (78.5)	349 (73.3)

**Table 3** Indication for CS at full dilatation

	2009 <i>n</i> = 133 (%)	2010 <i>n</i> = 97 (%)	2011 <i>n</i> = 70 (%)	2012 <i>n</i> = 83 (%)	2013 <i>n</i> = 93 (%)	Total <i>n</i> = 476
Nonreassuring fetal status	14 (10.5)	13 (13.4)	7 (10.0)	12 (14.5)	19 (20.4)	65 (13.7)
Failure to progress in second stage	70 (52.6)	41 (42.2)	30 (42.9)	28 (33.7)	45 (48.4)	214 (44.9)
Vaginal delivery declined †	0 (0)	0 (0)	1 (1.4)	2 (2.4)	0 (0)	3 (0.6)
Unsuccessful ventouse	29 (21.8)	30 (30.9)	20 (28.6)	18 (21.7)	12 (12.9)	91 (19.1)
Unsuccessful forceps	8 (6)	11 (11.3)	10 (14.3)	19 (22.9)	15 (16.1)	63 (13.2)
Unsuccessful double instrumentation	12 (9)	2 (2)	2 (2.9)	3 (3.6)	2 (2.2)	21 (4.4)

†One woman with a previous CS presented in the second stage requested repeat CS, two women declined trial of operative vaginal delivery and opted for second-stage CS.

Figure 2 illustrates the most senior person documented as present or scrubbed during the CS at full dilatation for public patients according to their stage of training towards their fellowship. For public patients, consultant obstetricians were present for 6.9% of fully dilated CS over the 5 years. There were significant deficits in documentation noted with cervical dilatation being documented in only 77% of cases by medical staff in either the clinical notes or the operation report (Table 5). In the absence of medical documentation, full cervical dilatation was confirmed either by the midwifery notes or the partogram. Abdominal palpation and other important aspects of the vaginal examination such as the presence and degree of caput and moulding were recorded poorly.

There was no significant difference in the time of day the second-stage CS was performed with 50.4% performed on the day shift (0800–2000) and 49.6% performed during the night shift (20:00–08:00).

## Discussion

The international literature<sup>1,5,10</sup> suggests that within a rising CS rate, there is an increasing trend to CS at full cervical dilatation. This trend appears to be multifactorial with an increasing perceived safety of CS coupled with a decrease in the experience of junior trainees with reluctance to attempt anticipated difficult instrumental deliveries. The strong medicolegal mindset in current obstetrics and concerns over neonatal and maternal morbidity associated with difficult or failed instrumental delivery may contribute to this trend. Over the 5-year study period, the overall CS rate was equivalent to local and international rates.<sup>1,3</sup> There was considerable variation in the number of women delivered by CS in the second stage of labour, with no significant trend calculated. However, our rates of CS at full cervical dilatation are lower than other published cohorts.<sup>4,7</sup> The majority of these women were in spontaneous labour, so these women delivered by CS in the second stage may represent true cephalopelvic disproportion or arrest of labour due to malposition. The lower rate may be explained by more women not reaching full dilatation due to an arrest in the first stage of labour or unsuccessful induction of labour.

This study did not address the outcomes of all women who reached full dilatation or record the outcomes of successful instrumental deliveries.

Caesarean section in the second stage of labour is a challenging operation with distortion of pelvic anatomy and a fetal head that is often deeply impacted in the maternal pelvis. Women delivered by CS at full dilatation have a higher risk of postpartum haemorrhage, operative morbidity with visceral injury, sepsis and prolonged hospital stay.<sup>13,14</sup> Major obstetric haemorrhage of >1000 ml was recorded in 48 cases. Three of these women required blood transfusions with an overall transfusion rate of <1%, which is lower than similar cohorts.<sup>4</sup> Six women (1.3%) experienced serious operative morbidity such as inverted ‘T’ uterine incisions, laparolytrotomy, bladder and bowel injury and return to theatre for management of postpartum haemorrhage. Laparolytrotomy is a surgical complication of mistaking the upper vagina for the lower uterine segment enabling the abdominal delivery through a vaginal incision. It has most commonly been reported in caesarean deliveries in the second stage of labour.<sup>19</sup> 49.2% of women had a length of stay longer than 5 days reflecting the complex perioperative postpartum care required for these women.

Over half of the women delivered by CS in the second stage did not have an attempt at operative vaginal delivery (59.4%). The indication for the majority of these deliveries was failure to progress in the second stage (75.6%). This is consistent with published literature.<sup>4,6</sup> In our review, three women at full dilatation declined vaginal delivery; one with a previous CS arrived fully dilated and requested a repeat CS and 2 women deemed suitable for operative vaginal delivery opted for CS delivery after the informed consent process. There was no significant trend towards the use of the ventouse over forceps. However, this trend has been observed in a 10-year retrospective review showing a ventouse to forceps ratio increasing from 0.2:1 to 1.9:1.<sup>10</sup> We observed a reduction from 2009 to 2013 in unsuccessful attempts of double instrumentation from 9 to 2.2%.

All but one of the six neonates treated for subgaleal haemorrhage were a result of delivery in the second stage by CS after unsuccessful attempts at instrumental vaginal delivery. Short-term fetal morbidity such as low Apgar

**Table 4** Maternal and neonatal morbidity

	2009 n = 133	2010 n = 97	2011 n = 70	2012 n = 83	2013 n = 93	Overall % n = 476
<b>Maternal</b>						
PPH >1000 mL (%)	16 (12)	9 (9.2)	10 (14.3)	9 (10.8)	10 (10.8)	48 (10.1)
Length of stay >5 days (%)	50 (37.6)	36 (36.7)	26 (37.1)	57 (68.7)	65 (69.9)	234 (49.2)
Transfusion (%)	2 (1.5)	1 (1.02)	0	0	1 (1.08)	4 (0.8)
Operative complications (%)	4 † (3)	0	1 (1.4) ‡	1 (1.1) §	0	6 (1.3)
<b>Neonatal</b>						
Median birthweight (g) (range)	3650 (2470–4930)	3530 (2530–5120)	3629 (2722–4756)	3570 (2290–4884)	3622 (2770–4795)	3579 (2470–5120)
Apgar score <5 <sup>1</sup> & <9 <sup>5</sup> ¶	8 (6)	8 (8.2)	3 (4.3)	8 (9.6)	8 (8.6)	35 (7.4)
Arterial cord pH <7.2	34 (25.6)	28 (28.8)	10 (27.1)	32 (38.6)	27 (29.0)	131 (27.5)
NICU admission	13 (9.8)	13 (13.4)	4 (5.7)	16 (19.3)	22 (23.7)	68 (14.3)
Subgaleal haemorrhage	1 (0.8)	1 (1)	0	3 (3.6)	1 (1.1)	6 (1.3)

†One inverted T uterine incision, one bladder injury, one laparotomy, return to theatre for management of PPH.

‡Inverted T uterine incision.

§Bowel injury.

¶Neonates with Apgar scores of both <5 at 1 min and <9 at 5 min of age.

scores, acidaemia and NICU admission concurred with similar groups.<sup>4</sup>

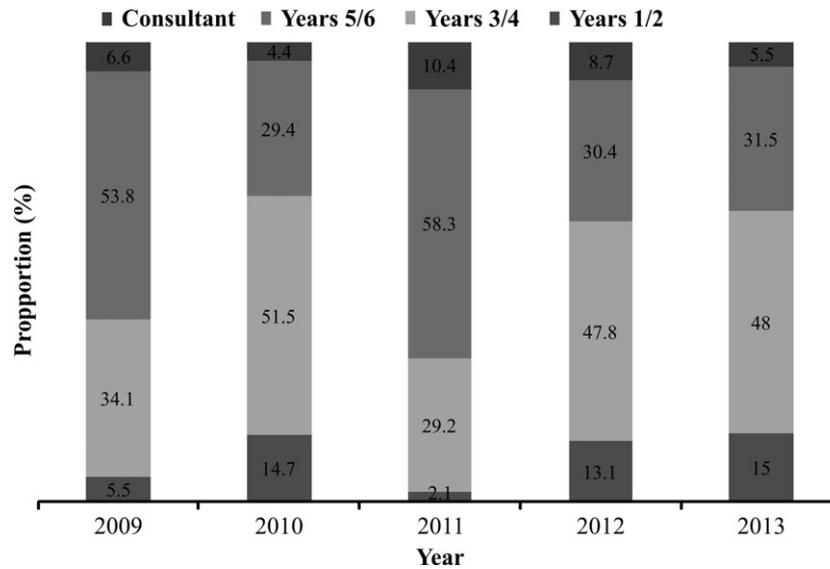
When faced with difficult decisions relating to the management of arrest in the second stage of labour, practice is shaped by the obstetrician's skill, experience and preference. There are no randomised controlled trials guiding obstetricians when faced with the dilemma of determining whether to attempt an anticipated difficult instrumental vaginal delivery or immediate caesarean section at full dilatation is the most appropriate mode of delivery.<sup>20</sup>

Consultant obstetricians for public patients were documented as present (either scrubbed or in a supervisory role) in the operating room in only 6.9% of cases overall. This is significantly lower than that reported from groups in the UK<sup>4,10</sup> where up to 41% of deliveries attended by a consultant. Olah<sup>8</sup> reported that decision for CS in the second stage of labour may be reversed after consultant review. In his study, vaginal examination findings matched the trainees in only 19% of cases. In 81% of cases, the station of the fetal head differed. Specialist registrars estimated the fetal head to be 3 cm higher in the maternal pelvis in 38% of cases. This illustrates important training opportunities in vaginal assessment and decision-making at full dilatation are being missed. Interestingly, we observed in 2011, where consultant presence in the operating room was the highest (10.4%), the rate of CS deliveries at full dilatation was the lowest (1.3%). Chances of achieving vaginal delivery are reported to be higher when senior obstetricians are present for a trial of instrumental delivery in theatre.<sup>7,15</sup>

Documentation standards need to be improved. The abdominal palpation, an important aspect of the assessment in the second stage of labour, was poorly documented. Cervical dilatation was documented in 77% of medical notes and the position and station of the fetal head in only in less than two-thirds of cases. Caput, moulding and asynclitism were documented infrequently. Adequate documentation of the examination findings at a fully dilated CS with or without attempt at instrumental vaginal delivery is important for counselling of women for future labour and deliveries. An instrumental vaginal delivery proforma has been introduced in our unit to improve documentation.

The limitations of this review include its retrospective nature and to the poor documentation standards contributing to bias. The clinical notes of any CS case were consulted when it was not clear from the operation report or the midwifery generated electronic record or labour if full cervical dilatation was achieved. Consultant supervision may indeed be higher than presented here. They could only be recorded as being present if this had been documented in the progress notes of operation report.

Avoiding CS delivery has important implications for a woman's future obstetric course. Achieving vaginal delivery lowers risks associated with repeat CS deliveries. There may be a role for mandated consultant review when



**Figure 2** Senior Accoucher: Public Patients. The proportion of the most senior accoucher present at second-stage caesarean deliveries per year over the course of the study. Trainee levels are grouped as years 1/2, 3/4 and 5/6. Consultant denotes the obstetrician in charge.

**Table 5** Documentation

Documentation	2009–2013 (%)
Abdominal Palpation	20.9
Cervical dilatation†	77.0
Station	72.9
Position	73.6
Caput	32.5
Moulding	14.3
Asynclitism	4.2
Fetal attitude	12.7

†Full cervical dilatation was confirmed by the midwifery notes if not documented by medical staff.

a junior trainee wishes to deliver a woman in the second stage of labour in the operating theatre. The current focus is to review the successful trial of instrumental deliveries in the same cohort of women to establish any predictors of success in our unit.

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