Original Article

Kjelland's forceps in the new millennium. Maternal and neonatal outcomes of attempted rotational forceps delivery

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Background: The use of Kjelland's forceps is now uncommon, and published maternal and neonatal outcome data are from deliveries conducted more than a decade ago. The role of Kjelland's rotational delivery in the 'modern era' of high caesarean section rates is unclear.

Aims: To compare the results of attempted Kjelland's forceps rotational delivery with other methods of instrumental delivery in a tertiary hospital.

Methods: Retrospective review of all instrumental deliveries for singleton pregnancies 34 or more weeks gestation in a four-year birth cohort, with reference to adverse maternal and neonatal outcomes.

Results: The outcomes of 1067 attempted instrumental deliveries were analysed. Kjelland's forceps were successful in 95% of attempts. Kjelland's forceps deliveries had a rate of adverse maternal outcomes indistinguishable from non-rotational ventouse, and lower than all other forms of instrumental delivery. Kjelland's forceps also had a lower rate of adverse neonatal outcomes than all other forms of instrumental delivery.

Conclusions: Prudent use of Kjelland's forceps by experienced operators is associated with a very low rate of adverse maternal and neonatal outcomes. Training in this important obstetric skill should be reconsidered urgently, before it is lost forever.

Key words: forceps, Kjelland, retrospective, rotational delivery.

Introduction

'Delivery by Kjelland's forceps has largely been abandoned by the current generation of obstetricians', stated a commentary in the *British Journal of Obstetrics and Gynaecology* in 2002.[1] This is an understandable response to papers with such pessimistic titles as 'Should we abandon Kjelland's forceps?'[2] and 'Have Kjelland's forceps reached their "use-by" date?'[3] Guidelines published by the Royal College of Obstetricians and Gynaecologists (RCOG) caution that, 'rotational delivery with the Kielland forceps carries additional risks and requires specific expertise and training',[4] yet the references informing that recommendation were published in 1979[5] and 1987.[6] Although Kjelland's forceps are acknowledged to be a 'superbly designed instrument, ideal for treating malposition of the fetal head',[1] surveys from developed countries confirm that vacuum extraction is considerably more popular.[7,8]

The opprobrium associated with Kjelland's forceps is nothing new. A survey of Australian obstetric trainees (most of whom will be practising obstetricians by now) revealed that few receive any training in the use of Kjelland's forceps,[3] a trend noted in overseas training programs too,[9] so a decline in their use should not be a surprise. Yet much of the literature that gives Kjelland's forceps a bad name is more than 30 years old,[10,11] if isolated case reports of adverse outcomes are discounted.[12,13] More recently published series of attempted Kjelland's forceps deliveries paint a different picture and provide reassurance about the clinical utility and safety of rotational deliveries.[14–21]

Almost all of the published data regarding Kjelland's forceps is from deliveries conducted no later than 1997. In the decade since, there has been a near-doubling in the rate of caesarean delivery, reflecting high levels of 'caution' in obstetric units. As a consequence, the current generation of registrars have almost no opportunity to acquire confidence and skill in complex vaginal delivery.[22] We set out to examine the efficacy and safety of Kjelland's forceps delivery in the new century.

Methods

We examined the outcomes of instrumental delivery at the Canberra Hospital, a tertiary referral centre with level three neonatal intensive care facilities. For the four-year period from January 2002 to December 2005, all instrumental deliveries in singleton pregnancies of 34 completed weeks or more

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gestation were retrospectively reviewed. In view of the potential inaccuracies inherent in computerised data collections, the clinical notes of all mothers and babies in the group described above were retrieved and reviewed in detail to obtain the information for the survey.

Demographic variables obtained were the woman's age at delivery, history of previous caesarean section, and whether first or subsequent delivery. Also noted was presence of maternal diabetes (either pre-existing or gestational), hypertensive disease and/or pre-eclampsia. We were not able to include the duration of any stage of labour since this was subjective and often reported differently in different parts of the clinical record. The categories of instrumental delivery were: Kjelland's forceps rotation, rotational ventouse, non-rotational forceps (Neville-Barnes, Wrigley's or Lauffe), non-rotational ventouse (Mityvac or Kiwicup) and sequential instruments (sequential use of more than one instrument type, in any combination or order).

Adverse maternal outcome studies were third- or fourth-degree perineal laceration, post-partum haemorrhage (either estimated at greater than 500 mL or requirement for post-partum transfusion, or both), post-partum fever of 38.0°C or higher, or 'other significant'. This latter category included any complications that were significant and were likely to be attributable to the delivery. Examples of these include pelvic haematoma, faecal incontinence, shoulder dystocia and abnormal neurological signs in the legs. Because these complications commonly co-existed, we also looked at a composite of 'any morbidity' which meant that the woman had any one or more of the above complications.

Neonatal data recorded were gestational age and birthweight, and the following morbidities: five-minute Apgar score of less than 7; delivery cord pH of less than 7.15; admission to neonatal intensive care (NICU) for reasons other than congenital abnormality; and 'other significant'. This latter category included complications not described above but associated with the delivery. Examples include brachial plexus injury, fractures and cephalhaematoma. A composite of 'any morbidity' was also derived, again comprising one or more of the above complications.

The information was extracted and recorded on individual results forms, and these data entered into an Excel spreadsheet and migrated into the SPSS version 15.0 (SPSS Inc., Chicago, IL, USA) for analysis. In addition to the descriptive statistics, multivariate logistic regression with Bonferroni correction for multiple tests was used to generate the findings. The study protocol was approved by the Human Research Ethics Committee of the Australian Capital Territory Health Department.

Results

A total of 1067 attempted instrumental deliveries performed in the period from January 2002 to December 2005 were identified as meeting the inclusion criteria and were included in the study group. Of those, 94 (8.8%) were attempted with Kjelland's forceps, 85 (8.0%) by rotational ventouse, 517 (53.4%) by non-rotational ventouse, 249 (23.3%) by non-rotational forceps and 122 (11.4%) with sequential instruments. The demographic characteristics of these groups are listed in Table 1. In many cases, it was not possible to discern clearly the level of experience (for example consultant or registrar) of the person actually performing the delivery as the clinical records often listed several names as the accoucheur. It was ambiguous as to who was actually involved in the procedures, who was observing, if anybody was supervising, and whether there was a change of operator during the delivery. For this reason, the level of training of the accoucheur could not be used in the analysis. However, it is safe to assume that all Kjelland's forceps deliveries were either performed or very closely supervised by consultants. The rates of failure of the various instruments to effect vaginal birth are presented in Table 2. Attempted rotational ventouse was the method least likely to lead to vaginal delivery, being unsuccessful in almost one quarter of attempts, while non-rotational ventouse was the most likely (with a success rate of more than 99%).

The rates of each individual adverse maternal outcome for the different groups of instruments are presented in Table 3. Using the composite measure of any maternal adverse event, Kjelland's forceps had the lowest rate after adjustment in the regression model (Table 4). Attempted rotational ventouse delivery was the most morbid. The rates of the individual adverse neonatal outcomes are presented in Table 5. Again, using the composite measure of any adverse neonatal outcome,

Table 1 Demographic characteristics of deliveries included in the study group

Variable	Kjelland's forceps	Rotational ventouse	Non-rotational ventouse	Non-rotational forceps	Sequential instruments
n	94	85	517	249	122
Maternal age (years)†	29 (15–42)	30 (17–39)	30 (17–46)	28 (16–42)	31 (16–39)
Gestational age (weeks)†	40 (34–42)	40 (37–42)	40 (34–42)	40 (34–42)	40 (35–42)
Nulliparous	71 (75.6%)	63 (74.1%)	406 (78.2%)	180 (72.3%)	98 (80.3%)
Previous caesarean Section	0 (–)	5 (5.9%)	33 (6.4%)	20 (8.0%)	6 (4.9%)
Maternal diabetes‡	7 (7.4%)	5 (5.9%)	29 (1.7%)	15 (6.0%)	4 (3.3%)
Maternal hypertension§	2 (2.1%)	13 (15.3%)	40 (7.7%)	26 (10.4%)	13 (10.7%)
Mean birthweight (SD)	3514 (465)	3525 (236)	3470 (501)	3627 (468)	3431 (469)

†Median (range). ‡Either pre-existing or gestational diabetes. §Pre-existing or gestational hypertension.
SD, standard deviation.

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Table 2 Success rates for vaginal delivery by different categories of attempted instrumental delivery

Instrument	*n*	Vaginal delivery not achieved	aOR (95% CI)†	*P*-value
Kjelland's forceps	94	5 (5.3%)	Ref.	
Rotational ventouse	85	20 (23.5%)	5.5 (1.9, 15.7)	0.002
Non-rotational ventouse	517	4 (0.8%)	0.1 (0.04, 0.5)	0.004
Non-rotational forceps	249	20 (8.0%)	1.4 (0.5, 3.9)	0.5
Sequential instruments	122	12 (9.8%)	2.0 (0.7, 6.0)	0.2

†Odds ratios are adjusted for maternal age, gestational age, birthweight, previous caesarean delivery, and maternal diabetes and hypertension. aOR, adjusted odds ratio; CI, confidence interval.

Table 3 Incidence of maternal complications by different categories of attempted instrumental delivery. The proportions are presented on the upper line, with adjusted odds ratios and 95% confidence intervals italicised on the lower line

Instrument	Third/fourth degree tear	PPH	Febrile	Other
Kjelland's forceps	4 (4.3%)	16 (17.0%)	6 (6.4%)	3 (3.2%)
	Ref.	*Ref.*	*Ref.*	*Ref.*
Rotational ventouse	3 (3.5%)	24 (28.2%)	16 (18.8%)	10 (11.8%)
	0.7 (0.2–3.5)	*1.8 (0.9–3.7)*	*3.7 (1.4–10.1)**	*4.3 (1.1–16.2)*
Non-rotational ventouse	32 (6.2%)	93 (18.0%)	52 (10.1%)	53 (10.3%)
	1.6 (0.5–4.6)	*1.0 (0.6–1.9)*	*1.7 (0.7–4.2)*	*3.7 (1.1–12.0)*
Non-rotational forceps	22 (8.8%)	68 (27.3%)	42 (16.9%)	54 (21.7%)
	1.8 (0.6–5.4)	*1.6 (0.9–3.0)*	*3.1 (1.3–7.7)**	*9.0 (2.7–29.8)**
Sequential instruments	15 (12.3%)	34 (27.9%)	24 (19.7%)	24 (19.7%)
	3.2 (1.0–10.1)	*1.9 (0.9–3.7)*	*4.1 (1.6–10.7)**	*7.7 (2.2–26.6)**

**P*-value < 0.05. *P*-values are Bonferroni adjusted.
Odds ratios are adjusted for maternal age, gestational age, birthweight, previous caesarean section, and maternal diabetes or hypertension. Febrile, temperature of ≥ 38°C in post-natal period; PPH, post-partum haemorrhage.

Table 4 Incidence of composite measure 'any adverse maternal event', which is one or more complications in the same woman

Instrument	*n*	Any maternal adverse event	aOR (95% CI)†	*P*-value
Kjelland's forceps	94	25 (26.6%)	Ref.	
Rotational ventouse	85	40 (47.1%)	2.4 (1.3–4.5)	0.008
Non-rotational ventouse	517	176 (34.0%)	1.5 (0.9–2.4)	0.1
Non-rotational forceps	249	134 (53.8%)	3.0 (1.8–5.1)	< 0.0001
Sequential instruments	122	72 (59.0%)	4.1 (2.3–7.4)	< 0.0001

†Odds ratios are adjusted for maternal age, gestational age, birthweight, previous caesarean section, and maternal diabetes or hypertension. aOR, adjusted odds ratio; CI, confidence interval.

Kjelland's forceps were associated with the least neonatal morbidity after adjustment for gestation, birthweight and other variables (Table 6). It should be noted that there were no catastrophic adverse outcomes attributable to any instrumental delivery in the study period.

Discussion

This study has revealed that, after adjustment for potentially influential factors such as the gestation at delivery and size of the baby, Kjelland's forceps were associated with the lowest rate of adverse neonatal outcomes of any form of instrumental delivery in our hospital. Similarly, the use of Kjelland's forceps yielded rates of maternal morbidity statistically indistinguishable from non-rotational ventouse deliveries, and both of these were significantly less likely to be associated with maternal morbidity than all other forms of instrumental delivery. Importantly, attempted ventouse rotational delivery was five times more likely to fail than attempts with Kjelland's forceps, and had high levels of maternal and neonatal morbidity.

There are a number of important points to consider from this study. In the first instance, it is very likely that the indication for instrumental delivery will confound the outcome. The most important example of this is that a non-reassuring fetal heart trace might be the indication for an instrumental delivery, rather than being a consequence of it. It is very likely that concerns about fetal well-being would prompt non-rotational instrumental delivery if the station of the head is low and the position occipito-anterior, whereas a malposition would be likely to discourage such attempts and lead to caesarean delivery.

Table 5 Incidence of neonatal complications by different categories of attempted instrumental delivery. The proportions are presented on the upper line, with adjusted odds ratios and 95% confidence intervals italicised on the lower line

Instrument	Apgar < 7	Cord pH < 7.15	NICU admission	Other
Kjelland's forceps	0 (0%)	2 (2.1%)	4 (4.3%)	2 (2.1%)
	Ref.	*Ref.*	*Ref.*	*Ref.*
Rotational ventouse	1 (1.2%)	7 (8.2%)	8 (9.4%)	15 (17.6%)
		3.4 (0.7–17.3)	*3.1 (0.8–12.9)*	*9.9 (2.2–45.1)**
Non-rotational ventouse	14 (2.7%)	32 (6.2%)	53 (10.3%)	97 (18.8%)
		3.0 (0.7–12.7)	*3.2 (0.9–10.8)*	*10.4 (2.5–43.3)**
Non-rotational forceps	5 (2.0%)	25 (10.0%)	26 (10.4%)	35 (14.1%)
		4.4 (1.0–19.4)	*3.9 (1.1–13.7)*	*7.6 (1.8–32.6)**
Sequential instruments	0 (0%)	18 (14.8%)	37 (30.3%)	37 (30.3%)
		6.9 (1.5–31.0)	*12.8 (3.7–44.8)**	*20.0 (4.6–86.3)**

**P*-value < 0.05. *P*-values are Bonferroni adjusted.
Odds ratios are adjusted for maternal age, gestational age, birthweight, previous caesarean section, and maternal diabetes or hypertension. Apgar < 7, Apgar score of < 7 at five minutes; NICU admission, admission to neonatal intensive care unit for reasons other than congenital abnormality.

Table 6 Incidence of composite measure 'any adverse neonatal event', which is one or more complications in the same baby

Instrument	*n*	Any neonatal adverse event	aOR (95% CI)†	*P*-value
Kjelland's forceps	94	7 (7.4%)	Ref.	
Rotational ventouse	85	24 (28.2%)	5.6 (2.1–15.0)	0.001
Non-rotational ventouse	517	144 (27.9%)	5.4 (2.3–12.9)	< 0.0001
Non-rotational forceps	249	70 (28.1%)	5.8 (2.4–14.2)	< 0.0001
Sequential instruments	122	73 (59.8%)	20.9 (8.3–52.9)	< 0.0001

†Odds ratios are adjusted for maternal age, gestational age, birthweight, previous caesarean section, and maternal diabetes or hypertension. aOR, adjusted odds ratio; CI, confidence interval.

In general, attempted rotational forceps delivery is reserved for cases of malposition not complicated by concerns about fetal well-being. Perhaps most importantly, all Kjelland's forceps rotational deliveries are performed (or at least closely supervised) by motivated and experienced consultants, whereas other forms of instrumental delivery are performed by a mix of junior and senior trainees and consultants.

The published literature regarding Kjelland's forceps delivery dates from an era well before that of high caesarean section rates, and makes interesting reading. For example, a review of 145 Kjelland's forceps deliveries conducted in 1984 analyses those performed for 'fetal distress' (67 babies) compared with those 'without fetal distress'.[6] In the 'modern era', it is very unlikely that challenging rotational deliveries would be undertaken where there is already a suspicion of fetal compromise.[4] Notwithstanding, those studies reported that Kjelland's forceps deliveries are no more likely to result in adverse outcomes than other instrumental births and all of them conclude that prudent use of the forceps in experienced hands imparted no more risk than other instrumental deliveries.[6,14–21] Furthermore, studies comparing attempted rotation with Kjelland's forceps to caesarean section at full dilatation report that forceps deliveries had the lower risk of adverse outcomes.[17] A caesarean section performed at full dilatation with an impacted head is a challenging procedure with a high rate of maternal complications.[23]

At our institution, Kjelland's forceps deliveries are performed by a group of consultants who are experienced in, and enthusiastic about, their use. There is no doubt that such deliveries demand scrupulous attention to assessment of the position and station of the fetal head, its relationship to the pelvic diameters and the degree of asynclitism. Attempts at rotational delivery also require appropriate analgesia (usually in the form of a regional block), and are discouraged in the presence of concerns about fetal acid-base status. Our study suggests that careful use of Kjelland's forceps exposes women and their babies to no more risk that might be expected from any other type of instrumental delivery. It appears that ventouse delivery is perceived as 'safe' and is delegated to more junior staff, offering a potential explanation for the major difference in outcomes between rotation deliveries with ventouse and Kjelland's forceps.

Although the proportion of deliveries attempted with Kjelland's forceps was small, less than one in ten at our institution, we believe that the role of any intervention that might help reduce the rate of caesarean birth needs to be carefully examined. We hope the results of our study will inspire a re-examination of the role of Kjelland's forceps in the modern obstetric unit. Olah has made the plea that, 'Obstetricians who possess the skill of Kjelland's forceps delivery should impart this skill to the next generation before it is lost'.[1] We can only agree.

References

1 Olah KS. In praise of Kjelland's forceps. *Br J Obstet Gynaecol* 2002; **109**: 492–494.
2 Cardozo LD, Gibb DM, Studd JW, Cooper DJ. Should we abandon Kjelland's forceps? *Br Med J (Clin Res Ed)* 1983; **287**: 315–317.
3 Robson S, Pridmore B. Have Kielland forceps reached their 'use by' date? *Aust N Z J Obstet Gynaecol* 2000; **40**: 226–227.
4 Royal College of Obstetricians and Gynaecologists (RCOG). *Operative Vaginal Delivery* (Green top guideline number 26). London: RCOG, 2005.
5 Chiswick ML, James DK. Kjelland's forceps: Association with neonatal morbidity and mortality. *Br Med J* 1979; **1**: 7–9.
6 Chow SL, Johnson CM, Anderson TD, Hughes JH. Rotational delivery with Kjelland's forceps. *Med J Aust* 1987; **146**: 616–619.
7 Bofill JA, Rust OA, Perry KG *et al.* Operative vaginal delivery: A survey of fellows of the ACOG. *Obstet Gynecol* 1996; **88**: 1007–1010.
8 Stephenson PA, Bakoula C, Hemminki E *et al.* Patterns of use of obstetrical interventions in 12 countries. *Paediatr Perinat Epidemiol* 1993; **7**: 45–54.
9 Bofill JA, Rust OA, Perry KG, Roberts WE, Martin RW, Morrison JC. Forceps and vacuum delivery: A survey of North American residency programs. *Obstet Gynecol* 1996; **88**: 622–625.
10 O'Driscoll K, Stronge JM. Active management of labour in the occipito-posterior position. *Aust N Z J Obstet Gynaecol* 1975; **15**: 1–4.
11 Chez RA, Ekbladh L, Friedman EA, Hughey MJ. Mid-forceps delivery: Is it an anachronism? *Contemp Obstet Gynaecol* 1980; **15**: 82–100.
12 Craig S, McClure G. A preterm infant with upper cervical spinal cord injury, following delivery with Kjelland's forceps. *J Perinat Med* 1997; **25**: 502–504.
13 Gei AF, Smith RA, Hankins GDV. Brachial plexus paresis associated with fetal neck compression from forceps. *Am J Perinatol* 2003; **20**: 289–291.
14 Healy DL, Quinn MA, Pepperell RJ. Rotational delivery of the fetus: Kjelland's forceps and two other methods compared. *Br J Obstet Gynaecol* 1982; **89**: 501–506.
15 Traub AI, Morrow RJ, Ritchie JW, Dornan KJ. A continuing use for Kjelland's forceps? *Br J Obstet Gynaecol* 1984; **91**: 894–898.
16 Herabutya Y, O.-Prasertsawat P, Boonrangsimant P. Kjelland's forceps or ventouse–Acomparison. *Br J Obstet Gynaecol* 1988; **95**: 483–487.
17 Leo MV, Odibo A, Ling PY, Rodis J, Borgida A, Campbell W. Transverse arrest: A review of outcomes of rotational forceps and cesarean delivery at a single center. *Prim Care Update Ob Gyn* 1998; **5**: 186.
18 Feldman DM, Borgida AF, Sauer F, Rodis JF. Rotational versus nonrotational forceps: Maternal and neonatal outcomes. *Am J Obstet Gynecol* 1999; **181**: 1185–1187.
19 Krivak TC, Drewes P, Horowitz GM. Kielland vs. nonrotational forceps for the second stage of labor. *J Reprod Med* 1999; **44**: 511–517.
20 Schiff E, Friedman SA, Zolti M *et al.* A matched controlled study of Kjelland's forceps for transverse arrest of the fetal vertex. *J Obstet Gynaecol* 2001; **21**: 576–579.
21 Hinton L, Ong S, Danielian PJ. Kjelland's forceps delivery – quantification of neonatal and maternal morbidity. *Int J Gynecol Obstet* 2001; **74**: 289–291.
22 Chinnock M, Robson S. Obstetric trainees' experience in vaginal breech delivery: Implications for future practise. *Obstet Gynecol* 2007; **110**: 900–903.
23 Selo-Ojeme D, Sathiyathasan S, Fayyaz M. Caesarean delivery at full cervical dilatation versus caesarean delivery in the first stage of labour: Comparison of maternal and perinatal morbidity. *Arch Gynecol Obstet* 2008; **278**: 245–249.