

A case-control study of primary caesarean section at the Port Moresby General Hospital, Papua New Guinea, to identify epidemiological predictors of abdominal delivery

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SUMMARY

A retrospective study of 274 consecutive primary caesarean sections and 274 unmatched controls was carried out at Port Moresby General Hospital from January to December 1992. The primary caesarean section rate was 3.5%. Stepwise logistic regression analysis showed that primary caesarean section was significantly associated with maternal height of less than 150 cm; nulliparity; symphysis-fundal height of more than 38 cm at admission in labour; cervical dilatation of less than 4 cm at admission in labour; and the level of fetal head at admission in labour of 3/5 or higher.

Introduction

In the past couple of years, the number of deliveries at the Port Moresby General Hospital (PMGH) has increased to over 9000 per year. Of this number, about 450 are primary caesarean sections and 50 are repeat sections, which gives a total caesarean section rate of 5-6% and a primary caesarean rate of about 4.5%. This represents a slight but significant increase in our caesarean section rate (1).

Within the past 3 decades, the caesarean section rate has risen in most countries; in some the rate has even quadrupled. For example, in the United States of America the incidence increased from 4.5% in 1965 to 23% in 1985 (2,3). In the United Kingdom the incidence rose from less than 5% in 1973 to about 10% in 1986 (4,5). Some of this large increase can be explained by changes in the characteristics of the pregnant population, eg, more elderly primigravidae; some is due to a desire to avoid a vaginal delivery which may be traumatic and which may thereby produce a

baby which is intellectually and physically less than how nature endowed it, eg, when there is a flexed or a big breech. These may be legitimate indications, but a large number of caesarean deliveries are performed for less sound reasons. A rising trend in the primary caesarean section rate is inevitably paralleled by increasing total caesarean section rate. This is because in many places a previous caesarean scar is the chief reason for a subsequent abdominal delivery. Between 1980 and 1985, history of previous caesarean birth was the sole indication in 30-40% of all caesarean sections performed in the USA (3,6).

The increased incidence of caesarean section in many countries is a matter of great concern because apart from the financial and psychosocial disadvantages, the immediate and long-term maternal morbidity and mortality rates of caesarean section are much higher than those of vaginal delivery. The rate of maternal death associated with caesarean section is four times that associated with vaginal delivery (40 vs 10 per 100,000 births). The rate attributable to the caesarean section per se, ie, after

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controlling for the complications that required the caesarean delivery in the first place, is at least twice that of vaginal delivery (7). The major complications which contribute to the higher maternal morbidity and mortality are haemorrhage, anaesthetic complications, postoperative infection, thromboembolism and the complications of a scarred uterus in a subsequent delivery, namely, scar rupture and repeat caesarean section for the sole reason that there is a scar in the uterus (8-10). It is therefore vitally important that a primary caesarean section should be performed when it is the only procedure which can save the life or preserve the health of mother or child. This applies especially to countries of the third world, such as Papua New Guinea, where many women deliver outside health institutions and where they may not attend for antenatal care at all in the index pregnancy and cannot therefore be screened. In addition to these, most health centres in remote stations do not have facilities for operative delivery.

Some of the risk factors associated with caesarean delivery which other workers have identified include maternal age, weight, height, shoe size, sex of baby, hypertensive disease at booking antenatal visit and geographic origin (5). If the indicators for primary caesarean section exist during antenatal care or at the time of admission in labour, and if these risk factors could be determined, it might be possible to identify patients at greatest risk for caesarean delivery. It might further be possible to reduce the chance of abdominal delivery; or, failing that, anticipate and make preparations for it. It was for these reasons that this study was undertaken.

Patients and Methods

Objective of the study

The objective of this study was to determine if certain sociodemographic and obstetric characteristics were risk factors for primary caesarean delivery at the PMGH.

Study design

This was a retrospective case-control study. For each caesarean delivery (case) an unmatched control was randomly selected.

Study population and setting

The study population included patients delivered at the PMGH who, before this delivery, had not had a caesarean section. The cases were patients whose index delivery was by caesarean section. The controls were patients delivered vaginally.

Recruitment

The labour ward register was used to identify the cases and select the controls. The first vaginal delivery after the case was the unmatched control. Enrolment was sequential.

Data sources

The data were retrieved from the labour ward register and patients' hospital records.

Data recording

A standardized questionnaire was used to record the abstracted data.

Variables

The dependent (outcome) variable was primary caesarean delivery. The independent (predictor) variables included the following.

Maternal sociodemographic characteristics

Ethnic region: Southern (yes, no), Islands (yes, no), Highlands (yes, no), Momase (yes, no).

Age: mean, age <20 years (yes, no), age >35 years (yes, no).

Height: mean, height <150 cm (yes, no).

Past obstetric history

Parity before index delivery: mean, para 0 (yes, no), para >4 (yes, no).

Past perinatal death (yes, no).

Index antenatal history

Antenatal care (yes, no).

Last symphysis-fundal height (sfh): mean, sfh >38 cm (yes, no).

Hypertensive disease (yes, no).

Gestational age (GA) at delivery: mean, GA at delivery <37 weeks (yes, no), GA at delivery

>41 weeks (yes, no).
Antepartum haemorrhage (yes, no).

Labour

Onset of labour induced (yes, no).
Findings at admission in labour:
Symphysis-fundal height (sfh): mean, sfh >38 cm (yes, no).
Level of fetal head: 3/5-5/5 (yes, no).
Cervical dilatation: mean, <4 cm (yes, no).

Data analysis

Univariate analyses were performed with the Epi Info version 5 statistical package. The means of continuous variables were analyzed by the Kruskal-Wallis H test whilst the frequencies of categorical variables were compared by the chi squared test and odds ratio. Significant variables were modelled by means of stepwise forward logistic regression, using the SPSS PC+ software. Differences were taken as significant if the p value was <0.05 or if the 95% confidence interval of the odds ratio did not enclose 1.

Results

During the study period, January to December 1992, there were 274 primary caesarean sections out of a total of 7904 deliveries, giving a primary caesarean section rate of 3.5%. 22 (8%) of the cases were elective and the rest emergency caesarean sections. The main indications for operative delivery were fetal distress 27%, prolonged first stage 22%, cephalopelvic disproportion (CPD) 10%, cord accidents 7%, placenta praevia 5% and breech presentation 3%.

Table 1 shows the sociodemographic characteristics by delivery mode. There was no significant difference in the proportion of cases and controls whose ethnic origins were Highlands, Islands or Momase regions. However, Southern Region origin was noted to have a negative association with caesarean delivery (64% vs 72%), which means that Southerners were less likely to have caesarean delivery than subjects from other regions. There was no significant difference between the cases and the controls in the mean age nor in the proportions aged more than 35 years or less than 20 years. The mean height of the

cases, 158.2 cm (sd 8.5), was significantly lower than in the controls, 160.8 cm (sd 6.9), and there were significantly more cases whose height was less than 150 cm (10% vs 4%).

Table 2 shows past and index obstetric characteristics by delivery mode. There was no difference between the cases and the controls as far as booking status, the proportion of grandmultiparas and mean parity were concerned. The following variables were shown to be significantly associated with caesarean delivery: nulliparity (48% vs 39%); antepartum haemorrhage in this pregnancy (4% vs 0.4%); last antenatal symphysis-fundal height of more than 38 cm (38% vs 25%); and mean antenatal symphysis-fundal height (37.3 cm vs 36.6 cm). There were more patients with hypertensive disease in this pregnancy among the cases (9% vs 5%); the p value was 0.044 but because the 95% confidence interval of the odds ratio enclosed 1 the difference was not considered to be significant.

Table 3 shows the index delivery characteristics by delivery mode. There was no difference between the cases and the controls as far as preterm (<37 completed weeks) delivery and delivery after 41 weeks were concerned. The following variables were significantly more frequent amongst the caesarean deliveries: induced labour (13% vs 4%); level of the fetal head at admission in labour of 3/5 or more (71% vs 39%); symphysis-fundal height (L.SFH) of more than 38 cm at admission in labour (34% vs 21%); and cervical dilatation of less than 4 cm at admission in labour (55% vs 29%). The indications for caesarean delivery were analyzed among the cases whose cervixes were less than 4 cm dilated at admission in labour. The main indications for this subgroup were fetal distress 30%, prolonged first stage 29% and cephalopelvic disproportion (CPD) 12%. Mean cervical dilatation at admission in labour among the cases - 3.1 cm (sd 2.2) - was significantly lower than among the controls - 5.2 cm (sd 3.0). The mean L.SFH of the cases was significantly larger - 37.4 cm (sd 3.3) - than that of the controls - 36.5 cm (sd 2.9).

When the variables that were significantly associated with caesarean delivery were modelled by forward stepwise logistic regression analysis, the following remained

significant (Table 4): level of fetal head 3/5 or higher at admission in labour; cervical dilatation of less than 4 cm at admission in labour; symphysis-fundal height of more than 38 cm at admission in labour; maternal height of less than 150 cm; and nulliparity. The other variables proved redundant.

Discussion

It is difficult to determine what the optimal caesarean section rate should be for a particular institution. With the trend towards

regionalization of perinatal care and referral of high-risk obstetric patients, caesarean section rates for the tertiary-care centres should theoretically rise while those of the referring hospitals should decrease. The character of the patient population served influences caesarean section rate by factors such as parity, age and socioeconomic status. It is difficult to isolate caesarean section from other changes in obstetric practice and the technological advances that have occurred. However, it must be borne in mind that an increase in the primary caesarean rate for a period of time will

TABLE 1

SOCIODEMOGRAPHIC CHARACTERISTICS BY DELIVERY MODE

Panel A: Categorical variables

Cases	Controls	M-H p value	OR (95% CI)
Southern Region origin: Yes 63.5% (174/274)	72.3% (198/274)	0.028	0.67 (0.46-0.97)*
Highlands Region origin: Yes 20.1% (55/274)	19.3% (53/274)	0.830	1.05 (0.67-1.63)
Momase Region origin: Yes 9.1% (25/274)	4.7% (13/274)	0.044	2.02 (0.96-4.27)**
Islands Region origin: Yes 7.3% (20/274)	3.6% (10/274)	0.061	2.08 (0.90-4.87)
Age >35 years: Yes 5.1% (14/274)	3.7% (10/272)	0.410	1.41 (0.58-3.49)
Age <20 years: Yes 15.7% (43/274)	12.1% (33/272)	0.230	1.35 (0.81-2.26)
Height <150 cm: Yes 9.9% (19/192)	3.7% (8/219)	0.011	2.90 (1.17-7.40)*

Panel B: Continuous variables

	Cases Mean (sd)	Controls Mean (sd)	K-W p value
Height (cm)	158.2 (8.5)	160.8 (6.9)	0.0013*
Age (years)	25.2 (5.9)	24.7 (5.1)	0.837

M-H = Mantel-Haenszel chi squared test

OR = odds ratio

CI = confidence interval

sd = standard deviation

K-W = Kruskal-Wallis H test

* Statistically significant

** p value <0.05 but the 95% confidence interval of the odds ratio encloses 1 and therefore the difference was not considered significant

result in an increase in the repeat section rate in succeeding years, even though the primary rate may have decreased (11). The caesarean section rate at the PMGH has been maintained at 3 to 5% for many years. In this study, the rate was 3.5%.

A height of 150 cm or less was shown to be associated with primary caesarean section. This means that an antenatal mother with a height of less than 150 cm was more likely to have a caesarean section. This could be due to a contracted pelvis, a big baby or a malposition of the head. It is not being suggested that all patients with a height of less than 150 cm should be delivered abdominally. They all deserve a trial of labour for it is a frequent

clinical experience that many patients with short stature go on to deliver average-size babies; and a diagnosis of cephalopelvic disproportion is usually associated with the birth of a normal sized baby at caesarean section. The message is that they need to be monitored closely.

Nulliparity was significantly associated with caesarean section. Nulliparous patients constitute an increasing proportion of labouring women, thereby increasing the likelihood of dystocia and other medical complications such as hypertensive disease of pregnancy that further increase the likelihood of caesarean birth. It is well known that caesarean delivery rate increases with

TABLE 2

PAST AND INDEX OBSTETRIC CHARACTERISTICS BY DELIVERY MODE

Panel A: Categorical variables

Cases	Controls	M-H p value	OR (95% CI)
Booked (had antenatal care in this pregnancy): No 10.9% (30/274)	7.3% (20/274)	0.138	1.56 (0.83-2.94)
Nulliparity (para 0) before index pregnancy: Yes 47.8% (131/274)	38.0% (104/274)	0.020	1.50 (1.05-2.14)*
Grandmultiparity (para >4) before index pregnancy: Yes 7.7% (21/274)	6.6% (18/274)	0.618	1.18 (0.59-2.38)
Hypertensive disease in this pregnancy: Yes 9.1% (25/274)	4.7% (13/274)	0.044	2.02 (0.96-4.27)**
Antepartum haemorrhage in this pregnancy: Yes 4.4% (12/274)	0.4% (1/274)	0.002	12.50 (1.68-259.28)*
Last antenatal symphysis-fundal height (ANSFH) >38 cm: Yes 37.6% (77/205)	24.7% (59/239)	0.003	1.84 (1.20-2.82)*

Panel B: Continuous variables

	Cases Mean (sd)	Controls Mean (sd)	K-W p value
Parity	1.4 (1.8)	1.5 (1.7)	0.068
ANSFH (cm)	37.3 (3.4)	36.6 (3.1)	0.007*

M-H = Mantel-Haenszel chi squared test

OR = odds ratio

CI = confidence interval

sd = standard deviation

K-W = Kruskal-Wallis H test

* Statistically significant

** p value <0.05 but the 95% confidence interval of the odds ratio encloses 1 and therefore the difference was not considered significant

advancing age and since many women are delaying childbirth we are likely to see more caesarean births for this reason alone. In fact between 1980 and 1985 the number of births in patients at least 30 years of age increased from 20 to 25 per cent of all deliveries in the United States of America (3). A nulliparous patient in labour who does not achieve 5-6 cm dilatation probably has a non-compliant cervix. The patient whose cervix fails to continue to dilate after 6 cm or more is likely to have a relative cephalopelvic disproportion (CPD). If the first labour is a learning experience for the cervix one might expect that the greater the dilatation reached, at least to 5-6 cm, the more likely is a vaginal delivery to occur the next time (12).

A symphysis-fundal height of more than 38 cm at admission in labour was also associated with caesarean delivery. It was not stated in the case notes what the large symphysis-fundal height was due to, be it polyhydramnios or twins; we can only presume that it was due to a big baby. Whilst it has to be conceded that caesarean births most often involve normal sized fetuses, the larger the baby the more likely it is that abdominal delivery will be required as a result of CPD and failure to progress in labour (13-15). In a survey of singleton livebirths at the PMGH to identify a single fundal height which can predict high birthweight, Klufio et al. showed that symphysis-fundal height of >38 cm was the most useful cut-off value for predicting

TABLE 3

INDEX DELIVERY CHARACTERISTICS BY DELIVERY MODE

Panel A: Categorical variables

Cases	Controls	M-H p value	OR (95% CI)
Preterm (<37 completed weeks) delivery: Yes 18.2% (43/236)	19.4% (48/247)	0.733	0.92 (0.57-1.50)
Delivery at >41 weeks gestational age: Yes 6.4% (15/236)	6.6% (17/256)	0.898	0.95 (0.44-2.06)
Labour induced (elective caesarean sections excluded): Yes 13.5% (34/252)	4.4% (12/274)	0.000	3.35 (1.62-7.03)*
Level of fetal head 3/5-5/5 on abdominal palpation at admission in labour (analysis restricted to spontaneous labours): Yes 70.6% (137/194)	39.1% (91/233)	0.0000	3.75 (2.44-5.77)*
Cervical dilatation <4 cm at admission in labour (analysis restricted to spontaneous labours): Yes 54.5% (96/176)	29.2% (68/233)	0.0000	2.91 (1.89-4.48)*
At admission in labour, symphysis-fundal height (L.SFH) >38 cm: Yes 34.0% (71/209)	21.2% (48/226)	0.003	1.91 (1.22-3.00)*

Panel B: Continuous variables

	Cases Mean (sd)	Controls Mean (sd)	K-W p value
Cervix at admission in labour (cm)	3.1 (2.2)	5.2 (3.0)	0.0000*
L.SFH (cm)	37.4 (3.3)	36.5 (2.9)	0.003*

M-H = Mantel-Haenszel chi squared test

OR = Odds ratio

CI = confidence interval

sd = standard deviation

K-W = Kruskal-Wallis H test

* Statistically significant

TABLE 4

FORWARD STEPWISE LOGISTIC REGRESSION ANALYSIS SHOWING THE EFFECTS OF THE PREDICTOR VARIABLES ON CAESAREAN DELIVERY

Variable	-2 Log likelihood ratio	p value
Level of fetal head 3/5 or higher at admission in labour	32.392	0.0000
Cervix less than 4 cm at admission in labour	21.616	0.0000
Symphysis-fundal height >38 cm at admission in labour	13.138	0.0014
Height less than 150 cm	10.871	0.0044
Nulliparity	7.292	0.0261

high birthweight, irrespective of gestational age (16).

If a fetal head was at 3/5 or higher it was more likely that the delivery would be by the abdominal route. A high fetal head may just be due to the fact that the patient is in early labour. On the other hand if the head is not in the pelvis it could mean that there may be varying degrees of CPD. Such patients need careful monitoring to see if the head will descend in reasonable time to indicate a likely vaginal outcome. If there is no descent with good contractions then there is some disproportion and the patient is likely to end up having abdominal delivery.

Cervical dilatation of less than 4 cm at admission to the labour ward also had a significant association with caesarean birth. The main indications for abdominal delivery in this group of patients were fetal distress 30%, delay in the first stage 29% and cephalopelvic disproportion 12%. At the PMGH, any delay of labour due to desultory uterine action is promptly managed with syntocinon acceleration of labour. However, emergencies such as cord prolapse, severe preeclampsia, placental abruption and fetal distress, needing immediate delivery, would almost certainly be by the abdominal route in this group of patients. Cervical dilatation of less than 4 cm at admission that does not improve substantially could be due to a non-compliant cervix or a relative disproportion that could not be overcome with augmentation of labour. This is particularly applicable to the nullipara. It is not surprising, therefore, that the combined indications of prolonged first stage and

cephalopelvic disproportion were the major reasons for abdominal delivery in this group of patients. These indications are closely related and accounted for 41% of the abdominal deliveries. Like the patient who presents in labour with a high fetal head, these patients also deserve careful monitoring of their progress in labour so that timely intervention can be undertaken.

In conclusion, the findings from this study have demonstrated that the following features are more likely to lead to a caesarean birth than vaginal birth: height of less than 150 cm; nulliparity; symphysis-fundal height of more than 38 cm at admission in labour; cervical dilatation of less than 4 cm at admission in labour; and a high fetal head in labour. Many patients with these features will undoubtedly go on to have successful vaginal deliveries. It is important to emphasize, however, that in health centres and peripheral hospitals where facilities for abdominal delivery may be rudimentary or nonexistent, it would be wise for such patients to be observed carefully using the partogram. When progress is not satisfactory, they should be referred to hospitals where facilities for abdominal delivery exist. Even when such patients are managed in labour in a referral centre they still require close monitoring to ensure that the need for intervention is recognized early so as to avoid unnecessary maternal and infant morbidity and mortality.

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