

## Birth Asphyxia, Perinatal and Maternal Mortality Associated With Caesarean Section

Fidelis O. Njokanma, Matthias T.C. Egri-Okwaji, Chikezie A. Nwokoro, Taiwo Orebanjo and Godwin C.E. Okeke

Havana Specialist Hospital, 115 Akerele Street, Surulere, Lagos

### Abstract:

**Context:** Caesarean section is sometimes required to improve maternal and neonatal outcome but adverse results occasionally occur. A review of associated adverse consequences is useful in identifying areas requiring improvement.

**Objective:** To study the association between caesarean delivery and maternal/fetal outcome.

**Study Design, Setting and Subjects:** A descriptive, fifteen-year report (1983 through 1997) from a private hospital in Lagos, Nigeria. The subjects were mothers delivered by caesarean section and their singleton babies.

**Main Outcome Measures:** Perinatal asphyxia rate, stillbirth rate, early neonatal death rate, maternal mortality rate.

**Results:** There were 1140 total deliveries. There were 240 cases (21.2%) of birth asphyxia and 16 early neonatal deaths (14.4/1000) among the 1113 live deliveries. There were 27 stillbirths (33.68/1000) and 3 maternal deaths (2.63/1000), all from emergency caesarean deliveries. Preterm delivery was associated with higher asphyxia rate (37.3% vs 22.8%,  $p < 0.05$ ), while elective section had a lower asphyxia rate than emergency surgery (10.8% vs 24.3%,  $p < 0.05$ ). Non-booked cases had significantly higher asphyxia rate (22.8% vs 3.9%), five-fold early stillbirth rate (95.54/1000 vs 18.24/1000), four-fold early neonatal death rate (42.25/1000 vs 10.40/1000) and a 12-fold higher maternal mortality rate (12.74/1000 vs 1.02/1000). Antepartum haemorrhage and hypertensive disease were the indications for surgery most frequently associated with perinatal mortality.

**Conclusions:** The hazards of caesarean section are worse with emergency surgery but significant asphyxia occurs even following elective section. Early appropriate referral of high-risk cases will help to reduce perinatal/maternal morbidity and mortality.

**Keywords:** Caesarean Section, Maternal, Neonatal, Mortality, Birth Asphyxia [Trop J Obstet Gynaecol, 2002, 19: 00-00].

### Introduction.

Caesarean section (CS) is usually offered to by-pass or prevent a complication of pregnancy or labour. It is, however, inherently associated with alterations of body physiology<sup>1</sup> resulting from the surgical procedure itself or from anaesthesia. In addition, the primary indication for section may contribute to altered physiology especially in emergency cases<sup>2</sup>. Thus, CS is associated with morbidity and mortality in both mother and baby<sup>3,4</sup>

The main objective of this report, spanning a period of fifteen years, is to study the association between caesarean delivery on the one hand and perinatal problems (birth asphyxia, perinatal mortality and maternal mortality) on the other.

### Methods.

The study was conducted at the Havana Specialist Hospital (HSH), a privately owned institution in Lagos, Nigeria. It has well staffed obstetric and

neonatal units, with facilities for specialised perinatal care of women and their babies.

A review of caesarean deliveries covering a 15-year period (1983 through 1997) was done to identify infants with moderate and severe degrees of birth asphyxia. Only singleton deliveries of gestational maturity  $\geq 28$  weeks were considered.

Birth asphyxia was classified using the one-minute Apgar scores as follows - severe asphyxia: aggregate score of  $\leq 3$  and moderate asphyxia: aggregate score of 4 or 5. A five-minute score  $\leq 5$  was also regarded as severe asphyxia<sup>5</sup>. Apgar scoring is done routinely at HSH by the midwife or doctor receiving the baby and is recorded both in the neonatal chart and in the delivery register.

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**Correspondence:** Dr. O.F. Njokanma, Havana Specialist Hospital, 115 Akerele Street, P.O. Box 4631, Surulere, Lagos

The terms 'live birth' and 'early neonatal death' were defined according to the recommendations of the World Health Organization<sup>6</sup>. Data obtained from the records included Apgar scores at one and five minutes, gestational age, birthweight, fetal or neonatal outcome, underlying pre-pregnancy or perinatal maternal illness, complications of pregnancy and labour as well as indications for caesarean section.

Statistical computations included rates of asphyxia (% of live births), stillbirth (per 1000 births), early neonatal death (per 1000 live births), overall perinatal mortality (per 1000 births) and maternal mortality (per 1000 total births). Analysis involved comparison of findings with respect to gestational age, birthweight, booking status of the mother and degree of urgency of caesarean section (i.e. elective or emergency). Odds ratios and 95% confidence limits were calculated using standard formulae.<sup>7</sup> Confidence limits not embracing unity (1) were regarded as statistically significant at the 5% level ( $p < 0.05$ ).

## Results.

There were 1140 singleton caesarean deliveries during the study period; 1113 were live births and 27 stillbirths. There were 240 cases of moderate and severe birth asphyxia among the 1113 live births (21.2%). There were 18 cases with incomplete data set: data on gestational age and urgency of surgery were missing in 9 while the other nine were emergency cases without data on gestational age. All 93 preterm babies with complete data sets were born by emergency CS. Of this number, 35 (37.3%) were asphyxiated. This was significantly higher than the 20.1% (201 of 1002) observed among term subjects [odds ratio (OR): 2.40; 95% confidence interval (CI): 1.54 – 3.76]. Term babies born by elective CS fared better than those born by emergency surgery with an asphyxia rate of 10.8% (34 of 316) vs 24.3% (167 of 686) [OR: 2.67, 95% CI: 1.80 – 3.97].

Of the 686 emergency CS deliveries at term, 567 were booked mothers, 129 (22.8%) of whose babies experienced birth asphyxia. This was significantly lower than 31.9% (38 of 119) among non-booked emergency CS patients [OR: 1.64, 95% CI: 1.06 – 2.54]. Among those 567 booked mothers, 526 were allowed prior trial of labour while 41 who had earlier been scheduled for elective CS required emergency intervention before the appointed date. The prevalence of birth asphyxia in the latter subgroup (12 of 41; 29.3%) was comparable to that of non-booked emergencies [29.3% vs 31.9%, OR: 1.13, 95% CI: 0.52 – 2.56].

Five indications for emergency CS - antepartum haemorrhage, maternal hypertension, malpresentation,

failure to progress in labour (including obstructed labour) and fetal distress - accounted for 88.3% (181 of 205) of birth asphyxia in the study. The asphyxia rates associated with these factors were 54.5%, 36%, 31.5%, 23.9% and 21.5% respectively.

There were 16 early neonatal deaths (END) among 1113 live deliveries, giving a rate of 14.38 per 1000. This was significantly higher than a figure of 6.13 per 1000 vaginal deliveries during the same period [OR: 2.36, 95% CI: 1.21 – 4.61]. Table 1 shows the early neonatal death rate in booked and non-booked subjects as well as indications for surgery in both subgroups. The END rate for booked subjects was four times lower than for their non-booked counterparts [OR: 4.20, 95% CI: 1.50 – 11.74]. Also, emergency CS was associated with an early neonatal death rate twice that of elective section. There were nine cases in which data on booking status and urgency of surgery were missing. Table 1 also shows that hypertension and antepartum haemorrhage were the leading factors associated with early neonatal death in both the booked and non-booked subjects.

**Table 1**

### Early Neonatal Death Rates in Booked and Non-Booked Cases

| Type of Caesarean | <u>Booked</u> |        |          | <u>Non-Booked</u> |        |          |
|-------------------|---------------|--------|----------|-------------------|--------|----------|
|                   | Live Births   | END No | END Rate | Live Births       | END No | END Rate |
| Elective          | 316           | 2      | 6.33     | --                | --     | --       |
| Emergency         | 646           | 8      | 12.38    | 142               | 6      | 42.25    |
| Total             | 962           | 10     | 10.40    | 142               | 6      | 42.25    |

| Indication for CS | <u>Booked</u> |          | <u>Non-Booked</u> |          |
|-------------------|---------------|----------|-------------------|----------|
|                   | Live Births   | END Rate | Live Births       | END Rate |
| FTP               | 404           | 7.43     | 64                | 46.88    |
| Hypertension      | 65            | 61.54    | 10                | 100.00   |
| APH               | 25            | 40.00    | 8                 | 125.00   |
| Others            | 152           | 0.00     | 60                | 16.67    |

END: *Early Neonatal Death* (per 1000 live births)

CS: *Caesarean Section*

FTP: *Failure to Progress in Labour / Obstructed Labour*

APH: *Antepartum haemorrhage*

The early neonatal death rate was fairly stable for booked subjects across the five-yearly time divisions (1983 – 1987, 1988 – 1992, 1993 – 1997): 11.49, 11.73 and 9.47 per 1000 live births respectively. On the contrary, non-booked subjects experienced a progressive increase in END rate: 0.00, 16.67 and 63.29 per 1000 live births respectively during the same three quinquennial periods from 1983 to 1997.

There were 27 stillbirths among 1140 singleton deliveries, giving a rate of 23.68 per 1000. All CS deliveries associated with stillbirth were emergency procedures. Thus, the stillbirth rate for the 815 emergency CS deliveries was 33.13 per 1000: 18.24 for booked patients and 95.54 for non-booked ones [OR: 5.69, 95% CI: 2.61 – 12.41]. Antepartum haemorrhage (74.07 per 1000), maternal hypertension (44.12 per 1000) and failure to progress in labour (12.22 per 1000) were the indications for emergency CS associated with the highest stillbirth rates among the booked subjects.

Altogether, there were 43 perinatal deaths, giving a rate of 37.72 per 1000/births. This was significantly higher than 22.22 (70 of 3150) for vaginal deliveries [OR: 1.72, 95% CI: 1.17 – 2.54]. Table 2 shows the perinatal mortality rates in relation to gestational maturity and birthweight. One half of the perinatal deaths in booked subjects occurred in term babies, which was significantly lower than 85.7% in non-booked subjects [OR: 6.0, 95% CI: 1.36 – 26.38].

**Table 2**  
**Perinatal Deaths in Booked and Non-Booked Subjects According to Gestational Maturity and Birthweight**

| Gestation          | Number of Perinatal Deaths* |                   |
|--------------------|-----------------------------|-------------------|
|                    | Booked                      | Non-Booked        |
| < 37 weeks         | 11 (50.0)                   | 3 (14.3)          |
| ≥ 37 weeks         | 11 (50.0)                   | 18 (85.7)         |
| <b>Birthweight</b> |                             |                   |
| < 2500g            | 12 (54.5)                   | 3 (14.3)          |
| ≥ 2500g            | 10 (45.5)                   | 18 (85.7)         |
| Overall            | <b>22 (100.0)</b>           | <b>21 (100.0)</b> |

\*Figures in Parentheses are Percentages of Overall Perinatal Deaths.

Similarly, 45.5% of perinatal mortality in booked subjects occurred in full-size babies compared to 85.7% of non-booked emergencies [OR: 7.2, 95% CI: 1.63 – 31.71].

There were three maternal deaths, a rate of 2.63 per 1000 deliveries. This was twice the figure of 1.27 per 1000 vaginal births but the difference was not statistically significant ( $p > 0.1$ ). All maternal deaths in the study were emergency cases: two were not booked (12.74 per 1000) and one was booked (1.02 per 1000). The particulars of the fatal maternal

subjects are shown in Table 3. One of the babies (booked) was salvaged but fetal death had already occurred in the two referred cases before they were brought to the hospital.

**Table 3**  
**Maternal Mortality: Particulars of the Three Fatal Cases.**

| Initials           | IO               | VO                | PO                |
|--------------------|------------------|-------------------|-------------------|
| Booked?            | Yes              | No                | No                |
| Age (years)        | 28               | ?                 | 26                |
| Parity             | 1 <sup>+0</sup>  | 0 <sup>+2</sup>   | 1 <sup>+0</sup>   |
| Underlying Illness | Hb SS            | Hypertension      | Hepatitis         |
| Cause of Death     | Aplastic Anaemia | Endotoxic Shock   | ARF/Acute Hepatic |
| Atrophy            |                  |                   |                   |
| Indication for CS  | APH              | Obstructed Labour | APH               |
| Gestational Age    | 34 weeks         | 40 weeks          | 36 weeks          |
| Birthweight        | 2800g            | 3500g             | ?                 |
| Condition of Baby  | Alive            | Fetal Death       | Fetal Death       |

Hb SS: Sickle Cell Anaemia  
ARF: Acute Renal Failure  
APH: Antepartum Haemorrhage

**Discussion**

The asphyxia rate in any institution will necessarily depend on the clinical state of the women presenting to its maternity services, the quality of perinatal care offered and the definition of asphyxia used in the report <sup>14</sup>. In this study, we were concerned with moderate and severe asphyxia (Apgar scores ≤ 5), being degrees of depression associated with the most profound perinatal effects <sup>5</sup>. The rate of 21.2% herein reported is less than 30.3% (Apgar score < 6) previously observed in Benin-City <sup>14</sup>.

Expectedly, preterm babies and those born following emergency CS had relatively higher rates of asphyxia. It is noteworthy that asphyxia occurred in as many as 10.8% of babies born by elective CS. This buttresses the fact that CS is not entirely free of adverse consequences and underlines the need to keep CS rates down to the necessary barest minimum.

Table 4 shows perinatal and maternal mortality data from selected studies<sup>8,9,10,11,12,13</sup>

**Table 4**

**Comparison of Perinatal & Maternal Mortality Figures from Selected Studies**

| <i>First Author</i>        | <i>Year</i> | <i>SBR</i> | <i>ENDR</i> | <i>MMR</i> | <i>CSR</i> |
|----------------------------|-------------|------------|-------------|------------|------------|
| Adeleye <sup>8</sup>       | 1981        | --         | --          | 6.9        | 19.8       |
| Adinma <sup>9</sup>        | 1993        | 55.4       | 40.3        | 2.5        | 11.4       |
| Bolaji <sup>10</sup>       | 1993        | --         | --          | 0.11       | 8.7        |
| Njokanma <sup>11</sup>     | 1994        | 142.9      | 53.7        | --         | 11.4       |
| Oye-Adeniran <sup>12</sup> | 1998        | --         | --          | 16.5       | 32.1       |
| Onwuhafua <sup>13</sup>    | 1999        | 96.7       | 72.8        | --         | 10.2       |
| <b><i>Index Study</i></b>  | 2000        | 23.7       | 14.4        | 2.6        | 26.6       |

SBR: *Stillbirth Rate (per 1000 births)*

ENDR: *Early Neonatal Death Rate (per 1000 live births)*

MMR: *Maternal Mortality Rate (per 1000 deliveries)*

CSR: *Caesarean Section Rate (per 100 deliveries)*

The stillbirth rate, early neonatal death rate and maternal mortality rate in our center were better than those reported from other Nigerian studies although our CS rate was the second highest among those compared (Table 4). This is very likely a reflection of the demography and clinical state of the clientele as well as infrastructure and intervention strategies in the various centers. The other studies were conducted either in Teaching hospitals<sup>8,11,12,13</sup> or in a mission hospital<sup>9</sup>. These hospitals have very wide latitude in terms of catchment area for patients.

Ours is a private hospital catering mainly to the elite and upper socio-economic strata of society. Although there are no restrictions in our acceptance policy, the cost of services excludes most of the patients likely to be in dire clinical and socio-economic straits as a result of late presentation to appropriate health institutions or due to mismanagement in unorthodox

or ill-equipped maternity centers. It may therefore, be correctly argued that our findings are from a biased population, not representing the national average. There is however, an important point to note. This study was done in Nigeria involving Nigerian subjects. To this extent, it gives an indication of goals/standards that are achievable under improved socio-economic conditions and health-seeking attitudes in this country.

In spite of the foregoing, 13.8% of CS operations done at HSH were emergencies in non-booked patients and this group was at a distinct disadvantage. They had the a higher asphyxia rate, four-fold higher early neonatal death rate, five-fold higher stillbirth rate and 12-fold maternal mortality rate compared to their booked counterparts. This is in keeping with earlier reports showing that booked emergency cases fared better than non-booked ones<sup>12,15</sup>

A number of attendant tragic consequences need mentioning. First, some women had to cope, not only with the physical pain of surgery, but also with the emotional trauma of a dead baby. Then there is the fact that most of the fatal cases occurred in term, full size babies who may have been salvaged with earlier intervention. Also, there is the question of hospital and national statistics that are adversely affected by preventable fatalities.

The problems presented by non-booked emergencies have been well documented in earlier Nigerian studies<sup>9,11,12</sup>. It is not surprising that antepartum haemorrhage and hypertension are closely associated with adverse fetal and maternal consequences<sup>12,16</sup>. It is however, tragic that diagnosis and referral to, or presentation at competent centers are delayed. The place of antenatal care, competent clinical evaluation of cases and referral to centers with facilities for special care of high-risk cases cannot be stressed enough. Also, more work needs to be done through health education and family support, to encourage pregnant women to utilize available orthodox maternity services.

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