Fetal distress, options of anesthesia, and immediate postdelivery outcome at state specialist hospital Akure

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ABSTRACT
Background: When abnormalities of the fetal heart rate are recognized promptly and dealt with, asphyxia and therefore perinatal morbidity and mortality can be reduced. The objective of fetal monitoring during labor is the prediction and diagnosis of fetal asphyxia before fetal/newborn morbidity with particular reference to brain damage occurs. Fetal distress is one of the conditions in which the obstetrician is required to hasten the process of delivery. This urgency is also usually transferred to the anesthetists, whereas the burden of adverse fetal outcome falls squarely on the pediatrician.
Objective: This study found out the form of anesthesia mostly used for caesarean sections (CS) in cases of fetal distress, its appropriateness in terms of achieving management goals, and advantages over the other form of anesthesia.
Study Design: This study is a retrospective descriptive cross-sectional study.
Materials and Methods: Records of patients that had caesarean section for suspected fetal distress over a period of 5 years were reviewed. The fetal status at the point of making diagnosis, type of anesthesia used, suite-arrival-incision-interval, and the baby’s condition after surgery were retrieved from the case notes. Data were analyzed with the Statistical Package for Social Sciences (SPSS) version 20.0. Frequencies and proportions of data from the type-of-anesthesia groups were compared. Variables were compared for significance using Chi-square.
Results: Most of the surgeries for fetal distress were done under spinal anesthesia in 90% of the patients. Suite arrival-to-incision interval which is largely affected by type of anesthesia was within 1 h 30 min in 91.6% of those that had spinal anesthesia compared to 100% for those that had general anesthesia (GA). P value = 0.000. APGAR score of <4 was more in neonates delivered with GA (61.1%) than those delivered with spinal anesthesia (14.5%). Percentage of neonatal admission into special care baby unit (SCBU) was more in those that had GA (85%) than those that had spinal anesthesia (14%).
Conclusion: The predominant type of anesthesia used for caesarean section for fetal distress from this study was spinal anesthesia which had better neonatal outcome.

Key words: Anesthesia; caesarean section; fetal distress; neonatal outcome; suite arrival-incision interval.

Introduction
Fetal asphyxia is defined as “a condition of impaired blood gas exchange leading, if it persists, to progressive hypoxemia and hypercapnia.” Obstetricians usually use the term fetal distress to indicate that the fetus is becoming hypoxic. It
is a sign of fetal asphyxia, the diagnosis of which requires a blood gas and acid–base assessment. When signs of imminent distress are noticed, oxygen is administered to the mother and she is placed in left lateral position, intravenous fluid is given to prevent fetal compromise pending delivery. In cases of fetal distress, delivery can be by caesarean section or instrumental vaginal delivery depending on stage of labor.

According to the Royal College of Obstetricians and Gynaecologists (RCOG) categorization of caesarean section, RCOG category 1 is when there is urgent threat to the life or the health of a woman or fetus. RCOG category 2 is when there is maternal or fetal compromise but not immediately life threatening. RCOG category 3 is needing earlier than planned delivery but without currently evident maternal or fetal compromise and RCOG category 4 is caesarean section done at a time acceptable to both the woman and the caesarean section team. A comprehensive communication between obstetric, anesthetic, and pediatric teams is one of the most useful ways to allow a safer approach of the management of obstetrics emergency such as caesarean section for fetal distress.

Caesarean section for fetal distress is a grade 1 caesarean section in which surgery is expected to be done within 30 min of making the diagnosis. It is therefore expedient to choose an anesthesia method that will facilitate commencement of surgery as soon as possible. General anesthesia (GA) is commonly chosen for emergency caesarean section because it can be quickly established. However, regional anesthesia techniques such as a single-shot spinal or a top-up of a well-functioning labor epidural analgesia are a good alternatives to GA in an emergency caesarean section setting. Fetal monitoring helps to detect warning signs of fetal distress and help prevent actual distress or compromise of the baby.

Ways of fetal monitoring can be manual by using the Pinard or electronic stethoscope which is noninvasive. Their limitations include the fact that abnormality of baseline variability cannot be perceived with the ear, tendency of the observer to round up figure and the shorter the period of observation, the greater the inaccuracy. It can also be affected by positioning in labor. The various modalities of electronic fetal monitoring include external fetal heart rate monitoring using ultrasound scanning, Doppler ultrasound, and cardiotocography. Advantages of external electronic monitoring are that the membrane remains intact and does not involve fetal head clips. Its disadvantages include difficulty in assessment of beat to beat variability, quality of tracing depends on patient being relatively immobile, and movement can give artifact. Internal fetal heart rate monitoring includes fetal scalp electrode which detects the electrical energy produced during cardiac cycle.

Other supplementary assessments include the assessment of the fetal electrocardiographic waveform, laboratory examination of the effect of hypoxemia, and acidosis on the ST segment, the ratio of T – wave height to the height of Q wave, R wave and S wave complex (QRS) complex increase with increase in acute hypoxemia, and ST waveform analysis. Others include pulse oximetry, near-infrared spectroscopy which is developed as a means of continuous, noninvasive real time measurement of change in fetal cerebral oxygenation and hemodynamics during labor.

Distressed fetus will require intensive resuscitative care and monitoring at delivery. APGAR scoring is used to categorize asphyxia that may have occurred. The APGAR score at 1 min usually determines the resuscitative measure to be employed. This, by necessity, has to be carried out in the delivery room of a newborn infant.

| Sign | Parameter | Score 0 | Score 1 | Score 2 |
|------|-----------|---------|---------|---------|
| A    | Appearance (color) | Blue, pale | Body pink | Completely pink |
| B    | Pulse (heart rate) | Absent | Below 100 ppm | Over 100 ppm |
| G    | Grimace | No response | Grimace | Cry (reflex irritability in response to stimulation) |
| A    | Activity (muscle tone) | Limp | Some flexion | Active motion |

The vigorous infant usually has 1 min APGAR score of 7 and above. The infant who is breathing well needs only brief and gentle suction of mouth, nose, and pharynx. The patency of the esophagus is checked by nasogastric aspiration. The infant who is dusky but whose respiratory effort is satisfactory additionally gets oxygen administered through a face mask.

Moderate asphyxia is when 1 min APGAR score is 4–6. Oxygen is administered by face mask after mouth and nose have been sucked out. If initial heart rate of less than 100 promptly accelerates, the infant probably does not need more than oxygen by face mask. If bradycardia or weak respiratory effort persists, intermittent positive pressure ventilation (IPPV) with Ambu-bag, mask, and 100% oxygen at 30–40 breaths per minute and 30–40 cm water pressure is administered. Severe asphyxia is when one minute APGAR score 0–3. Brief suction, intubation (nasotracheal or orotracheal), and IPPV administration with 100% oxygen via Ambu-bag, to the tube at 30–40 breaths per min and pressure of 30–40 cm of water. If heart rate is less than 60/min after 1 min of IPPV,
external cardiac massage at 60/min. Acidosis is usually of the combined type and may require sodium bicarbonate if it is mainly metabolic. If cardiac rate does not rise after 5 min, consider intracardiac administration of 1 ml of 1:10,000 dilution of adrenaline.

Breakthrough in anesthesia, the triumph over replacing blood loss, and the conquest of infection have been the tripod on which surgical field and advancement stands till date. Therefore, the role of anesthesia in life-saving surgical procedures cannot be over emphasized. Anesthesia-related death is as low as 1.3 per million life births.[9]

GA is a classical technique for emergency situation like fetal distress.[10] This is so because it is believed to be faster regarding the required urgency. When GA is to be done, rapid sequence method[11] is adopted in which a calculated dose of anesthetic agent is used and the induction agent is given fast. Cricoid pressure is applied and maintained until correct placement of the endotracheal tube is confirmed. To ensure induction to delivery is < 10 min; therefore, rapid sequencing GA should be done. This is in contrast to the sleeping dose of induction agent given in elective cases.

However, GA is a leading cause of anesthetic maternal mortality which is majorly due to difficult intubation and Mendelson syndrome.[12] The main anesthetic considerations are the risk of aspiration of acidic gastric contents (as little as 25 ml with pH < 2.5 may lead to a 50% mortality rate) and hypoxemia resulting from airway difficulties.[12] GA also affects uterine contractility especially in the use of halothane. In America, from 1980–1990, case fatality of GA in obstetrics increased from 20 to 32.3 deaths/million GA administered.[13] However, for regional anesthesia fatality decreased from 8.6 to 1.9 per million regional anesthesia administered. This may be probably because GA is reserved for urgent critical situations. In 1982, more than 50% of c/s in USA is done under GA. By 1998, rate had dropped to 10% of all caesarean sections, others are by regional anesthesia and spinal block which has become more common than epidural in last few years.[14]

GA may be chosen in some conditions like coagulopathy, infection, hypovolemia, urgency of surgery, or patient request.[15] However, need for neonatal resuscitation, problem associated with full stomach of emergency patients, and possibility of difficult intubation are challenges to the above.[16] Therefore, spinal anesthesia, extension of preexisting epidural are viable alternative anesthesia methods for caesarean section. There has been a move toward caesarean sections been performed under spinal compared with other regional anesthesia.[17]

Advantages of spinal block include no loss of consciousness, no waiting period, no hazards of endotracheal intubation, less metabolic response to stress, enhance participation of mother in birth process, less risk of transmission to baby, and early recovery of bowel function. Disadvantages of spinal block include hypotension, postspinal headache[18] which may last 2 to 7 days, may even continue for 6 weeks. Management is bed rest, fluid, and analgesia. High spinal block undesired excessive level of block manifests by difficulty breathing, apnea leading to hypoxemia and hypercarbia. It is due to ischemic paralysis of medullary ventilation centers due to profound hypotension and decreased cerebral flow.

Materials and Methods

Objective
This study intends to find out the form of anesthesia mostly used for caesarean section in cases of fetal distress, its appropriateness in terms of meeting the acceptable theatre arrival-incision time and advantages on neonatal outcome over GA.

Study design
This study is a retrospective descriptive cross-sectional study.

Sample Size
Total number of caesarean section due to fetal distress in the period under review was determined and all were analyzed.

Methodology
Records of patients that had caesarean section for fetal distress in the State Specialist Hospital Akure over a period of 5 years (January 2013–December 2017) were reviewed by going through their case notes, ward, and theater registers. There were 8710 deliveries over the 5-year period 2390 were caesarean sections. A total of 209 caesarean sections were for fetal distress over the study period. A structured study proforma was used to extract the information which included the biodata of the patient, the diagnosis of the patient, the indication for caesarean section, and vital signs of the patient before surgery and after surgery. The fetal status at the point of making diagnosis of suspected fetal distress, type of anesthesia used, suite-arrival-incision interval, and the fetal condition after surgery (APGAR score) were retrieved from the case notes. Any complications from the anesthesia were also recorded. Data were analyzed with the Statistical Package for Social sciences (SPSS) 20.0.

Display of Results

Majority of the patients 104 (49.8%) were in the age group 30–39 years, only 7 (3.3%) were teenagers.
Almost half 104 (49.8%) of the patients were business women, whereas 55 (26.3%) were artisans [Table 1]. A total of 22 (10.5%) were full housewives and only 29 (13.9%) were civil servants. More than 199 (95.2%) were married, whereas only 10 (4.8%) were single. Majority of the respondents i.e., 197 (94.3%) were of the Yoruba ethnic group. Majority of the respondents i.e., 195 (93.3%) presented at term, only 3 (1.4%) were postterm. A total of 45 (20.6%) of the respondents were primigravida, 118 (54.5%) were multipara, whereas 46 (22%) were grand multipara. Out of the 211 neonates including 2 sets of twins, 115 (54.5%) were females, whereas 96 (45.5%) were males [Table 1].

The fetal heart rate at time of decision for surgery was <120 (bradycardia) in 44 (21.1%) of the patients, whereas it was >160 (tachycardia) in 165 (78.9%) [Table 2]. Only 2 (1%) of the patients had abnormal vital signs before surgery due to eclampsia, vital signs of all the others were normal before surgery. Surgery was done and babies delivered under spinal anesthesia for 190 (90.0%) of the neonates, 21 (10.0%) babies were delivered under GA [Table 2].

Only five (2.4%) of the patients had their surgery commenced within 30 min of arrival in the theater. The suite-arrival-incision interval was between 30 min and 1 h in 79 (37.8%) of the patients. All others (59.8%) had suite arrival-incision interval more than 1 hr [Table 2].

The incision-delivery interval was <5 min in the majority i.e., 143 (68.4%) of the patients. In 48 (23%) of the patients it was between 5 min and 10 min. others had incision-delivery interval of more than 10 minutes [Table 2].

None of the patients was delivered within 30 min of making decision for surgery [Table 2]. Majority of the patients 85 (40.7%) had their caesarean section 3 h-3 h 30 min after decision for surgery. Eight (3.8%) of the patients had their surgery at >4 h after the decision for surgery [Table 2].

The APGAR score at 1 min was 4–7 in 150 (71.1%) of the patients, 34 (16.1%) had APGAR score of 1–3. Only 24 (11.4%) of the neonates had score of 8–10, whereas 3 (1.4%) were stillbirths APGAR1 = 0 [Table 3]. The APGAR score at 5 min was 8–10 in 183 (87.6%) of the patients [Table 3].

Only 14 (6.7%) of the live neonates were admitted to Special Care Baby Unit (SCBU) out of which 12 were delivered with GA and 2 with spinal anesthesia [Table 3] The estimated blood loss was less than 500 mls in 186 (89.0%) of patients.

Only 5 (2.4%) had blood loss that was greater than 1 L [Table 4]. A total of 207 (99.0%) patients had normal vital signs after the surgery. The two (1.0%) patients that had abnormal vital signs after surgery were eclamptic patients. None of the 209 patients had any major anesthetic complications [Table 4].

Out of 193 neonates from surgery with spinal anesthesia, 165 (85.5%) had APGAR score greater than 4, 28 (14.5%) had score less than 4 whereas out of 18 neonates from surgery with GA, 11 (61.1%) had APGAR score greater than 4, and 7 (38.9%) had score less than 4. The relationship between the type of anesthesia and APGAR score at 1 min is statistically significant with P value = 0.001 [Table 5].

On cross-tabulation of the suite arrival-incision-interval and the type of anesthesia, 91.6% of those that had spinal

Table 1: Biodata of patients

| Frequency | Percentage (%) |
|-----------|----------------|
| **Age**   |                |
| <20       | 7              | 3.3          |
| 20-29     | 92             | 44.0         |
| 30-39     | 104            | 49.8         |
| 40-49     | 6              | 2.9          |
| Total     | 209            | 100          |
| **Occupation** |            |              |
| Full housewife | 22       | 10.5         |
| artisan    | 55             | 26.3         |
| Business   | 103            | 49.3         |
| public servant | 29        | 13.9         |
| Total      | 209            | 100          |
| **Marital status** |    |              |
| Single     | 10             | 4.8          |
| married    | 199            | 95.2         |
| Total      | 209            | 100          |
| **Ethnicity**     |            |              |
| Yoruba     | 197            | 94.3         |
| Hausa      | 8              | 3.8          |
| Igbo       | 4              | 1.9          |
| Total      | 209            | 100          |
| **Gestational age** | |             |
| 28-<37     | 11             | 5.3          |
| 37-42      | 195            | 93.3         |
| >42        | 3              | 1.4          |
| Total      | 209            | 100          |
| **Parity** |                |
| 0          | 45             | 20.6         |
| 1-4        | 118            | 54.5         |
| >4         | 46             | 22.0         |
| Total      | 209            | 100          |
| **Baby’s sex** |        |              |
| Female     | 115            | 54.5         |
| Male       | 96             | 45.5         |
| Total      | 211            | 100          |

Values given are absolute number of patients (frequency) and the corresponding percentages
anesthesia had surgery commenced and babies delivered within 1 h 30 min of suite arrival, whereas all those that had GA had their surgery commenced and babies delivered within same period $P$ value = 0.000 [Table 6].

On cross-tabulation of type of anesthesia and special care baby unit (SCBU) admission, 85% of the neonates admitted to special care baby unit (SCBU) were those delivered by GA, whereas only about 14% were those delivered by spinal anesthesia $P$ value = 0.000 [Table 7].

**Discussion**

Majority of the patients were Yoruba because the study area was a Yoruba area. Most (93.3%) of the deliveries occurred at term. This is consistent with the findings of a London study that found average gestational age at delivery of 39 weeks in blacks.$^{19}$ There were more female neonates (54.5%) delivered than male neonates (45.5%), this is not consistent with findings of a previous study at Wesley guild hospital that revealed male:female ratio at birth of 102.7:100$^{20}$ Tachycardia was the commoner fetal heart rate pattern that preceded diagnosis of suspected fetal distress (78.9%), whereas bradycardia was seen in 21.1%. This findings is different from that of another Nigerian study on fetal distress that reported 50.1% bradycardia and 49.9% tachycardia.$^{21}$

Spinal anesthesia was used to deliver 190 (90%) of the babies and only 21 (10%) were delivered with GA. This is far higher than the value reported by a Malaysian study where 174 of 240 patients operated on account of fetal distress had spinal anesthesia.$^{22}$ A study done at Abakaliki, Nigeria

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**Table 2: Preoperative circumstances**

|                 | Frequency | Percentage |
|-----------------|-----------|------------|
| FHR before surgery |           |            |
| <120            | 44        | 20.9       |
| >160            | 167       | 79.1       |
| Total           | 211       | 100        |
| Mother vital signs before anesthesia |           |            |
| Normal          | 207       | 99.0       |
| Abnormal        | 2         | 1.0        |
| Total           | 209       | 100.0      |
| Type of anesthesia under which babies delivered |           |            |
| Spinal          | 190       | 90.0       |
| General anesthesia | 21     | 10.0       |
| Total           | 211       | 100.0      |
| Suite arrival-incision interval |           |            |
| <30 min         | 5         | 2.4        |
| 30 min-<1 h     | 79        | 37.8       |
| 1 h-<1 h 30 min | 102       | 48.8       |
| 1 h 30 min-<2 h | 22        | 10.5       |
| >2 h            | 1         | 0.5        |
| Total           | 209       | 100        |
| Decision-delivery interval |           |            |
| ≤30 min         | 0         | 0          |
| >30 min-1 h     | 1         | 0.5        |
| >1 h-1 h 30 min | 4         | 1.9        |
| >1 h 30 min-2 h | 9         | 4.3        |
| >2 h-2 30 min   | 23        | 10.9       |
| >2 h 30 min-3 h | 60        | 28.4       |
| >3 h-3 h 30 min | 85        | 40.3       |
| 3 h 30 min-4 h  | 20        | 9.5        |
| >4 h            | 9         | 4.3        |
| Total           | 211       | 100        |
| Incision-delivery interval |           |            |
| <5 min          | 145       | 68.7       |
| 5-10 min        | 48        | 22.7       |
| 10-15 min       | 14        | 6.6        |
| 15-20 min       | 4         | 1.9        |
| Total           | 211       | 100        |

**Table 3: Management outcome for babies**

|                 | Frequency | Percentage |
|-----------------|-----------|------------|
| APGAR score at 1 min |         |            |
| 0               | 3         | 1.4        |
| 1-3             | 34        | 16.1       |
| 4-7             | 150       | 71.1       |
| 8-10            | 24        | 11.4       |
| Total           | 211       | 100        |
| APGAR score at 5 min |         |            |
| 1-3             | 2         | 1.0        |
| 4-7             | 22        | 10.6       |
| 8-10            | 184       | 88.5       |
| Total           | 208       | 100        |
| SCBU admission |           |            |
| No              | 194       | 93.3       |
| Yes             | 14        | 6.7        |
| Total           | 208       | 100.0      |

**Table 4: Management outcome for mothers**

|                 | Frequency | Percentage |
|-----------------|-----------|------------|
| Estimated blood loss at surgery |         |            |
| ≤500 ml         | 186       | 89.0       |
| >500-1 L        | 18        | 8.6        |
| >1-1.5 L        | 2         | 1.0        |
| >1.5-2 L        | 3         | 1.4        |
| Total           | 209       | 100.0      |
| Mothers vital signs after anesthesia |         |            |
| Normal          | 207       | 99.0       |
| Abnormal        | 2         | 1.0        |
| Total           | 209       | 100.0      |
| Anesthetic complications |         |            |
| No              | 209       | 100.0      |
| Yes             | 0         | 0.0        |
| Total           | 209       | 100.0      |

Values given are absolute number of patients (frequency) and the corresponding percentages
The number of neonates with good APGAR score was more in those delivered with spinal anesthesia as revealed in this study and the relationship between the type of anesthesia and APGAR score at 1 min was statistically significant $P$ value $= 0.001$. This is consistent with the study of Algert et al. who earlier reported increased risk of adverse outcome including low APGAR score for caesarean sections with GA over those of regional anesthesia.\[26\]

The percentage of patients that had their suite arrival-incision interval within 1 h 30 min in spinal anesthesia group was very close to that of GA group (90.6% and 100% respectively) indicating that spinal anesthesia especially in good hands can be done for patients in good time close to that of GA. Scrutton et al. in a UK study described a new approach to the provision of spinal anesthesia for urgent obstetrics cases called “rapid sequence spinal anesthesia.”[27] A case series had also reported that the use of rapid sequence spinal anesthesia gave a considerable shorter period of establishing spinal block of about 6–8 min and an average decision-delivery interval of 22.5 min.[28] Admission of neonates to the SCBU was found to be more in neonates delivered by GA than those delivered by spinal anesthesia and the relationship between type of anesthesia and SCBU admission was found to be significant $P$ value $= 0.000$.

**Conclusion**

The predominant type of anesthesia used for caesarean section for fetal distress from this study was spinal anesthesia which had better neonatal outcome. Because the goal of management of suspected fetal distress is to have a viable baby to a happy mother; therefore, even in the race and haste to deliver, the safety of both mother and fetus should not be endangered in any way by our choice of the type of anesthesia. The choice of regional anesthesia seems to be taking over GA with increasing improvement in technique and time at which spinal block is established.

**Recommendation**

In coping with the reality of the shift toward spinal anesthesia as choice of anesthesia in emergency situations like fetal distress, all efforts must be made to continue to improve and propagate its technique, skills, and efficiency.

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Conflicts of interest

There are no conflicts of interest.

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