SUBARACHNOID BLOCK FOR CAESAREAN SECTION:
PROSPECTS AND PROBLEMS IN THE UNIVERSITY OF
BENIN TEACHING HOSPITAL, BENIN CITY.

BY

Charles Osalumese IMARENGIAYE
MBBS, DA (BENIN), FWACS

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A DISSERTATION SUBMITTED TO THE NATIONAL
POSTGRADUATE MEDICAL COLLEGE OF NIGERIA IN PART
FULFILLMENT OF THE REQUIREMENTS FOR THE
FELLOWSHIP OF THE FACULTY OF
ANAESTHESIA (FMCA)

APRIL 2006
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>i</td>
</tr>
<tr>
<td>Table of contents</td>
<td>ii</td>
</tr>
<tr>
<td>Declaration</td>
<td>iii</td>
</tr>
<tr>
<td>Certification</td>
<td>iv</td>
</tr>
<tr>
<td>Dedication</td>
<td>v</td>
</tr>
<tr>
<td>Acknowledgement</td>
<td>vi</td>
</tr>
<tr>
<td>Summary</td>
<td>1</td>
</tr>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Review of Literature</td>
<td></td>
</tr>
<tr>
<td>Methods</td>
<td></td>
</tr>
<tr>
<td>Results</td>
<td></td>
</tr>
<tr>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>Suggestions</td>
<td></td>
</tr>
<tr>
<td>References</td>
<td></td>
</tr>
</tbody>
</table>
DECLARATION

I, Charles Osalumese IMARENGIAYE, hereby declare that this study was conducted in the University of Benin Teaching Hospital, Benin City. I was personally involved in the development of the study concept, literature search, conduct of the study, data collection/analysis and preparation of the book. No part of this book has been presented to any other College for a Fellowship, nor has it been submitted elsewhere for publication.

_________________________________
Dr. C. O. IMARENGIAYE
CERTIFICATION

The study reported in this dissertation was done by Dr. Charles Imarengiaye under my supervision. I have also supervised the writing of the dissertation.

Signature ……………………………………………………………………………

Name of Supervisor: Dr. M. O. Obiaya

Status of Supervisor: Associate Professor/Consultant Anaesthesiologist

Year of Qualification: ……………………………………………………………

Date: ………………………………………………………………………………
DEDICATION

This work is dedicated to

- Ndidiakaka, my friend and wife,
- Osemudiamen, Aimuamhonose, Ese-Ose, and Ilegbenose; our children
ACKNOWLEDGEMENT

I am eternally grateful to the Almighty God for his mercies and the strength to undertake this project. I wish to thank all those who have contributed in the making of this anaesthetist especially my supervisor, Dr. M. O. Obiaya. He provided direction and leadership in the department particularly in the no distant past when the situation appeared bleak. I am also grateful to Dr. (Mrs.) N. P. Edomwonyi, Dr. F. E. Amadasun, Dr. (Mrs.) O. P. Adudu and Dr. (Mrs.) P. Igho-Pemu for the teaching and training offered at great personal and social costs.

I wish to recognize the immense support from my contemporaries in the residency training, Dr. S. O. Imasuen, Dr. O. Y. O. Asemota and Dr. (Mrs.) A. Oyekunle. They are great anaesthetists and now practicing in various challenging situations. I cherish their comradeship, dedication and the zeal for safety in anaesthetic practice.

Indeed, I remain very thankful to all those unheard and unsung helpers who have made tremendous contributions to my personal academic and professional development. My memory may fail me in recollecting their names but their efforts walk the terrains of life with me. As the mountain surrounds Jerusalem so shall the Almighty God be around them for protection.

I am grateful to my immediate family for support and encouragement. The long hours at work and call to duty at odd hours were borne with love and courage by my
wife. I acknowledge her understanding and patience. I remain indebted to my parents who have remained the cheerleaders in my pursuit for academic excellence.

**SUMMARY:**

The techniques of anaesthesia for caesarean section have undergone a dramatic change in recent years. The trend has been a move away from general anaesthesia towards subarachnoid block for caesarean section. These two techniques for anaesthesia were evaluated in a randomized fashion to determine among others the safety of subarachnoid block for caesarean section in our hospital.

Approval was sought and received from the Research and Ethics Committee of the Hospital. Women scheduled for caesarean section were approached to participate in the study and consent obtained. These patients were randomized to receive subarachnoid block or general anaesthesia for the caesarean section. All patients received mist magnesium trisilicate in accordance with departmental protocol. Intravenous access was obtained in every patient using a size 18G cannula. The patients for subarachnoid block received preload of 0.9% saline 20mL/kg over 15-20 minutes. The patients randomized to the subarachnoid block group had 2.2-3.0mL of 0.5% bupivacaine at any of L2/3 or L3/4 interspace. The sensory blockade was assessed using cotton buds in methylated spirit along the anterior axillary line. Motor blockade was assessed using the Bromage Scale.

The patients randomized to general anaesthesia were induced using rapid sequence induction with thiopentone 5mg/kg. Laryngoscopy and tracheal intubation was facilitated with succinylcholine 1mg/kg. On confirmation of correct placement of the tracheal tube,
manual ventilation was continued using oxygen, nitrous oxide, halothane, pancuronium and pentazocine.

All the patients were monitored using blood pressure, heart rate, and oxygen saturation. On delivery of the foetus, 10 units of oxytocine bolus was administered and 20 units added to 500 mL of intravenous fluid. Apgar score was obtained and resuscitation commenced as necessary. Maternal satisfaction with subarachnoid block was ascertained using anchors as poor, fair, good, excellent or don’t know. The attitude of anaesthetists, obstetricians and paediatricians were elicited using a self administered questionnaire prior to commencement of the study.

Data analysis was done using Instat Graph Pad. Continuous variables were analyzed using unpaired t-test and categorical data analyzed with Chi-square test where necessary. The level of significance was set at a probability of 5%.

A total of 83 women were randomized to receive general anaesthesia or subarachnoid block. There was no difference in the sociodemographic characteristics between women who received general anaesthesia or subarachnoid block. There was a significant difference in the time of arrival to the labour ward theatre to time to induction of anaesthesia (p < 0.0001, t-test). More babies delivered by women in the general anaesthesia group had Apgar scores less than 7 in the first minute (p = 0.0117, Fisher’s exact test). Maternal hypotension was a problem in women who received subarachnoid block (p = 0.0143, Fisher’s test). Intraoperative blood loss was more in the general anaesthesia group than in the subarachnoid group (p < 0.0001, t-test). Women who had subarachnoid block had a longer period of pain relief in the immediate postoperative period (p = 0.003, t-test). The attitude of the physician careproviders (anaesthetists, obstetricians, paediatricians) was quite favourable to the use of subarachnoid block for caesarean section.
This study shows that subarachnoid block is an effective technique for elective caesarean section with an acceptable level of complications. The safety profile was comparable to general anaesthesia. It is important therefore, that subarachnoid block should be offered to women as an alternative technique for their caesarean delivery.
INTRODUCTION:

The first spinal anaesthetic was performed by Dr. James Corning, a New York surgeon, in 1885.¹ Application of this technique in the obstetric population did not come into practice until early 20th century. The first application of subarachnoid anaesthesia in obstetrics was by Kreis, Doloris and Malartie in 1900, and this method of analgesia was condemned by obstetric authorities and therefore had very little clinical application.² The high degree of complications, poor outcome and poor understanding of the interaction between the physiological changes occurring in pregnancy and the changes associated with spinal anaesthesia were given as the reasons for concern.²

In the 1940s, when Adrian and colleagues² introduced a standardized technique, the safety of spinal anaesthesia in obstetrics was appreciated and in the late 1950s, over half a million subarachnoid blocks were being done for obstetric patients in the United States.² Subarachnoid block for obstetrical anaesthesia peaked in the 1950s when it was the most frequently used anaesthetic technique for vaginal delivery and caesarean sections.³ Sooner than later, the popularity of spinal anaesthesia for obstetrics began to wane. Reasons for this decline included the high incidence of postdural puncture headache, hypotension and inability to provide continuous analgesia without fear of neurological damage. Similarly, the critical incident involving Woolley and Roe was not only devastating for their families but also for the further use and development of spinal anaesthesia especially in the United Kingdom.⁴

However, the major trend in recent years has been a move away from general anaesthesia in favour of regional block and from epidural to spinal anaesthesia for caesarean section.⁵ There are several reasons for the decline of the general anesthetic caesarean section: Difficult/failed intubation, regurgitation/aspiration pneumonitis and hypoxaemia remain major causes of anaesthetic maternal deaths.⁶, ⁷ These complications
can be minimized largely by the use of regional techniques. Although the incidence of intraoperative awareness has dropped with the routine use of large boluses of induction drugs and higher concentration of volatile agents, it remains a problem that concerns anaesthesiologists and frightens patients, many of whom have seen recent publicity on the subject. The effect of anaesthetic drugs on the fetus and our inability to stop drugs that cross the blood/brain barrier from also crossing the placenta is becoming more apparent. Also, access to the intrathecal space gives an ideal opportunity to provide pain free recovery. Finally, social pressures upon the patient have led to a generation of parents who expect to be present (and conscious) at their child’s delivery, however it occurs. Nevertheless, spinal anaesthesia in obstetrics has some obvious advantages over epidural route: these include the speed of block and the presence of cerebrospinal fluid (CSF) as a definitive end-point which allows for a more certain outcome than with epidural anaesthesia. With the development of small gauge needles and newer bevel designs, this method has recently enjoyed a resurgence in popularity in the obstetric anaesthesia world.

Most centres in Western Europe and the United States of America consider regional anaesthesia as the preferred method of anaesthesia for caesarean section because of its safety and advantages. Subarachnoid block is a simple technique which requires a small dose of local anaesthetic to provide surgical anaesthesia, with rapid, intense and reliable block without missed segments, greater muscle relaxation and minimal risk of drug toxicity to the mother as well as to the foetus. Despite these advantages of subarachnoid block for caesarean section, general anaesthetic caesarean section still accounts for over 90% of caesarean sections performed in this hospital. This should not be the case especially in the current climate of restraint with respect to hospital cost. It is the purpose of this study therefore, to investigate the safety, efficacy and relative advantages of this
technique over general anaesthesia in our environment and to assess any factors that may limit the routine use of subarachnoid block for elective caesarean section in this hospital.
REVIEW OF LITERATURE

Several studies have been carried out to evaluate the safety of spinal anaesthesia for caesarean section. These studies are mainly on the prevention or elimination of the major complications of the technique like postdural puncture headache, hypotension and effect on the foetus. Also, various local anaesthetic agents have been evaluated for their spread and block characteristics. The qualities of the local anaesthetics are further modified by the physiological changes associated with pregnancy.

PHYSIOLOGICAL CHANGES ASSOCIATED WITH PREGNANCY

During pregnancy, the maternal physiology is altered as result of the increased hormonal concentration, mechanical effects of the gravid uterus and increased metabolic demands. These alterations in maternal physiology exert extensive systemic effects.

Cardiac output increases by approximately 35-40% by the end of first trimester of pregnancy. This continues to increase in the rest of the pregnancy until it reaches approximately to a level 50% greater than that of non-pregnant women. There are other haemodynamic changes related to pregnancy. The blood pressure usually falls during pregnancy because of the progesterone induced vasodilatation and the low resistance placental bed. The pulse pressure widens due to the greater reduction in diastolic compared to the systolic blood pressure.

Supine hypotensive syndrome is closely related to the haemodynamic changes of pregnancy. In the supine position, the gravid uterus compresses the aorta and inferior vena cava resulting in decreased venous return and consequent drop in cardiac output. Although upper extremity blood pressure may be maintained by compensatory vasoconstriction and tachycardia, uteroplacental perfusion is significantly reduced. Approximately 8% of women at term experience bradycardia and a substantial drop in blood pressure when they assume the supine position. It may take several minutes for the bradycardia and
hypotension to develop, and the bradycardia usually is preceded by a period of tachycardia. This supine hypotensive syndrome results from a profound drop in venous return for which the cardiovascular system cannot compensate.\textsuperscript{18}

Alveolar ventilation increases throughout pregnancy to 45\textendash{}70\% above pre-pregnancy levels at term. This results in hypocarbia and respiratory alkalosis. In addition, functional capacity begins to decrease by the 5\textsuperscript{th} month of pregnancy.\textsuperscript{16, 18} The net effect of these respiratory changes is the rapid development of hypoxaemia and acidosis during periods of hypoventilation or apnea.

Other important changes in pregnancy include increases in plasma volume by 40\textendash{}50\%. The raised plasma volume exceeds the increase in red cell mass, resulting in a relative dilutional anaemia. Pregnancy also results in hypercoagulable state. The pregnancy related increases in coagulation factors (fibrinogen, factors VII, VIII, X, and XII) put the obstetric patient at risk of thromboembolic complications.\textsuperscript{16, 18}

The gastrointestinal system is also altered by pregnancy. Pregnant women are at risk for oesophageal reflux, regurgitation of gastric contents, and aspiration pneumonitis from lower oesophageal sphincter incompetence, distortion of gastric and pyloric anatomy, and increased gastric pressure from the gravid uterus.\textsuperscript{16}

During pregnancy, compression of the inferior vena cava by the gravid uterus increases venous pressure below the obstruction and diverts venous blood through the vertebral plexus within the epidural space. This diversion distends the epidural veins and reduces the spinal cerebrospinal fluid volume.\textsuperscript{18} More extensive neural blockade is usually obtained after neuraxial anaesthesia, possibly as a result of a decreased epidural space capacity and an enhanced response to neural blockade due to hormonal changes of pregnancy.\textsuperscript{16}
Ueland et al\textsuperscript{19} performed haemodynamic studies on 12 patients who received spinal anaesthesia in an early evaluation of the safety of subarachnoid block. The authors demonstrated an average reduction in blood pressure from 124/72 to 70/38 mmHg with patients in the supine position 5-10 min after the block had been instituted. The cardiac output decreased 34\%, stroke volume 44\%, and heart rate increased 17\%. If the patients’ position were changed from supine to lateral, the cardiac output and stroke volume increased and the heart rate decreased. The arterial pressure also improved.

In 1992, Robson et al\textsuperscript{20} using Doppler ultrasonography and echocardiographic methods of determining cardiac output, compared the haemodynamic changes in parturients receiving spinal or epidural anaesthesia. In the spinal group, 15 of 16 patients developed hypotension of less than 80 mmHg and in 2 of these cases, hypotension lasted for more than five minutes. All patients sustained a decrease in stroke volume and a decrease in cardiac output was observed in 12 of 16 patients. The haemodynamic changes associated with spinal anaesthesia were more profound than those associated with epidural anaesthesia. In 1993, in a similar study, incremental doses of local anaesthetic through an indwelling spinal catheter were found to be associated with greater haemodynamic stability than a single bolus injection of local anaesthetic.\textsuperscript{21} However, reports of neurological injury with the use of spinal catheters have led to the abandonment of this method.

In an attempt to eliminate hypotension occurring during subarachnoid anaesthesia, Wollman and Marx,\textsuperscript{22} employed prehydration with 1000 mL of lactated Ringer’s solution infused rapidly in 15-30 min before induction of spinal anaesthesia. When the prehydration was combined with left uterine displacement, there was no case of hypotension.

Clark et al\textsuperscript{23} challenged the value of volume expansion in the prevention of hypotension. They demonstrated that without preventive measures, the incidence of hypotension was as high as 82\%.\textsuperscript{23} Patients who received prophylactic fluid loading and
lateral displacement did have a decreased incidence of hypotension (52%). In the authors’ opinion, the problem of hypotension was not abolished with or without volume expansion.

There has been discordant opinion with the use of volume expansion. Rout and co-workers\textsuperscript{24} demonstrated that rapid infusion of crystalloid over ten minutes did not affect the incidence of hypotension in parturients receiving spinal anaesthesia for caesarean section and causes an increase in central venous pressure. In another study,\textsuperscript{25} the authors compared no preload with preloading with 20mL/kg crystalloid solution over 15-20 minutes before spinal anaesthesia in 140 patients undergoing elective caesarean section. Hypotension was defined as systolic pressure of less than 100mmHg or a decrease in systolic pressure to less than 80% of baseline. Hypotension occurred in 55% of preloaded patients and 71% of the unpreloaded patients. Mathru and colleagues\textsuperscript{26} randomized 87 patients to receive either 15mL/kg of albumin 5% in Ringer’s lactate with dextrose 5% or same volume of dextrose 5% Ringers Lactate without albumin over 15-20min before spinal anaesthesia. There was a zero incidence of hypotension in the albumin treated group and better clinical and biochemical scores in the neonates. Similarly, Karinen et al\textsuperscript{27} evaluated the effects of crystalloid 1000mL (lactated Ringer’s) or colloid 500mL (hydroxyethyl starch) preloading in 26 healthy parturients undergoing elective caesarean section under spinal anaesthesia. A high incidence of maternal hypotension was observed during spinal anaesthesia in the crystalloid group (62%) but the incidence was lower in the colloid group (38%). Central venous pressure was elevated significantly in both groups after preload but decreased shortly after induction of spinal anaesthesia. These results suggest that preloading with either solution is ineffective in preventing maternal hypotension. They therefore called for re-evaluation of preventive measures for minimizing maternal hypotension.
Gutsche\textsuperscript{28} long before now had compared preload alone or preload in combination with prophylactic ephedrine in healthy patients having caesarean section with spinal anaesthesia. They found that the administration of prophylactic ephedrine decreased the incidence of hypotension as well as of nausea and vomiting. There were no adverse maternal or foetal effects.

Alternative methods have also been evaluated in the management of spinal induced hypotension. Bhagwanjee\textsuperscript{29} studied 24 parturients undergoing elective caesarean section under spinal anaesthesia. The patients were allocated randomly to have legs wrapped with elasticated Esmarch bandages immediately following spinal anaesthesia or to serve as controls. Significant hypotension (systolic arterial pressure < 100mmHg and < 80\% of baseline value) was treated with IV ephedrine in 5mg boluses. Leg-wrapped patients had a significantly lower incidence of hypotension (16.7\%) than controls (83.3\%). Only two patients in the leg-wrapped group required ephedrine compared with 10 in the control group. They concluded that the incidence of hypotension can be reduced by the use of simple leg wrapping with elasticated Esmarch bandages with a subsequent reduction in the use of potent vasopressor agents. Rout et al\textsuperscript{30} improved on the previous study by the addition of leg elevation. The patients scheduled for spinal anaesthetic caesarean section were randomized into three groups. The first group had their legs elevated to 30\(^\circ\) on pillows; the second group had Esmarch bandages applied in conjunction with leg elevation and the third group had their legs wrapped. All patients received a crystalloid preload of 20mL/kg over 30 minutes and every patient had left lateral tilt ensured. The incidence of hypotension in the control group was 53\%, in the leg elevation alone, 39\% and in the group who had their legs wrapped 18\%. They concluded that relatively simple procedures should be used often to avoid the hypotension associated with spinal anaesthesia in the parturient presenting for elective caesarean section.
It has been shown severally that postdural puncture headache could be a problem with subarachnoid anaesthesia for caesarean section.\textsuperscript{31, 32} Hart and Whitacre\textsuperscript{33} suggested that a needle that would ‘separate’ the dural fibres rather than one that ‘cuts or tears’ might reduce leakage by allowing closer apposition of the dural fibres on withdrawal of the needle. 

Drugs for spinal anaesthesia include bupivacaine, lidocaine, and tetracaine. Bupivacaine remains the main drug of choice for subarachnoid block for caesarean section worldwide. Bupivacaine is a potent agent capable of producing prolonged anaesthesia.\textsuperscript{34} The major limitation to the use of bupivacaine is the associated cardiotoxicity, which manifests as severe ventricular arrhythmias and myocardial depression. Bupivacaine binds to the sodium channels in the heart like lidocaine during systole but dissociates much more slowly during diastole.\textsuperscript{35} This has led to the development of the levobupivacaine which is less cardiotoxic.\textsuperscript{36} In most cases, anaesthetists administer spinal local anaesthetic agents as hyperbaric solutions. Studies have suggested that the interaction between gravity and baricity is the primary determinant of spread of the hyperbaric solutions in the CSF.\textsuperscript{37} In the supine position, after the administration of a subarachnoid block, hyperbaric local anaesthetic pools in the thoraco-lumbar column which slopes 8-12 degrees cephalad.\textsuperscript{38} The lowest part of the thoracic spine represent a level of T\textsubscript{5}-T\textsubscript{6}. This may then account for the improved anaesthetic reliability of hyperbaric solution.\textsuperscript{39} Lidocaine has also been employed for subarachnoid block for caesarean section. Kumar et al\textsuperscript{40} demonstrated reliability with isobaric lidocaine 2\% in 2.5-3mL which produced a rapid and clinically satisfactory spread of analgesia. Spinal lidocaine is associated with transient neurologic symptoms (TNS),\textsuperscript{41} though rare in obstetric anaesthesia, it should not be ignored. 

Abouleish\textsuperscript{42} in a double blind randomized study; the effects of the addition of epinephrine to hyperbaric spinal bupivacaine were evaluated in 63 patients having elective
repeat caesarean section. In the study group (32 patients), 0.2mg epinephrine was added to bupivacaine, whereas in the control group (31 patients), no additive was used. He found that the addition of 0.2mg epinephrine improved the sensory and motor quality of hyperbaric bupivacaine spinal anaesthesia for caesarean section. The use of additives was evaluated in another study. Morphine 0.2mg was added to subarachnoid bupivacaine 0.75% for patients having caesarean section. The results indicate that spinal morphine provided excellent postoperative analgesia with acceptable incidence of side effects.

Age, height, weight and body mass index have been suggested as variables with relation to the requirement for drugs in the subarachnoid space. Norris examined the relationship between height and sensory spread of analgesia in patients receiving spinal anaesthesia for caesarean section with 12-15mg of hyperbaric bupivacaine. The result showed no difference in the spread of analgesia in patients with a range of height from 147-174cm. Vertebral column length was also noted and was found not to be predictive of the spread of sensory analgesia. Hartwell however demonstrated a correlation between vertebral column length and level of sensory analgesia.

Kuhnert et al studied bupivacaine disposition in mother, foetus and neonate after anaesthesia for caesarean section. The uptake of bupivacaine from the subarachnoid space and its placental transfer was measured in six patients undergoing elective caesarean section. The results demonstrated that bupivacaine crosses the placenta and reaches the foetus, but in very low amounts. The authors concluded that this transplacental passage occurs despite injection of only small doses of a very highly lipid bound drug into the subarachnoid space. The implications of this transplacental transfer was examined by Hodgkinson and colleagues. The foetal neurobehavioural function was assessed using the Scanlon Early Neonatal Neurobehavioural Scale (ENNS) in two groups of women having caesarean section under general or spinal anaesthesia. The neonates from the spinal
anaesthesia group were associated with better neurobehavioural assessment as evidenced by higher ENNS scores.

Amata\textsuperscript{17} studied 100 mothers receiving spinal anaesthesia for caesarean section in a regional hospital. The study was aimed at evaluating the safety of spinal anaesthesia for caesarean section in developing countries especially at the rural general hospital. Prehydration was conducted with at least 1000mL of 0.9\% saline and performed lumbar puncture using 22G spinal needle. The result indicated that spinal anaesthesia for caesarean section was safe, reliable, cheap and technically easy. He concluded that the technique should be encouraged.

In spite of this encouragement, general anaesthetic caesarean section is still a common event. This study aims at establishing the safety and efficacy of subarachnoid anaesthesia for elective caesarean section in a tertiary hospital in Nigeria. Other factors that may limit the use of the technique such as the attitude of doctors and other miscellaneous factors will be evaluated. Subarachnoid block, if found useful, may become a routine and safe alternative technique for elective caesarean section in this hospital.
AIM AND OBJECTIVES

AIM: To evaluate subarachnoid block for operative obstetric with a view to determining its place in obstetric anaesthetic practice in University of Benin Teaching Hospital.

OBJECTIVES:

1. To demonstrate the efficacy of subarachnoid block as an alternative technique for obstetric anaesthesia.
2. To evaluate the effects of general anaesthesia or subarachnoid block on mother and baby
3. To illustrate the problems and complications of subarachnoid block in operative obstetrics
4. To evaluate the attitude of mothers presenting for caesarean section under spinal anaesthesia
5. To evaluate the attitude of doctors (anaesthetist, obstetricians, paediatricians) involved in surgical delivery to spinal block for caesarean section
6. Subsequently, to outline the place of subarachnoid block in obstetric practice in University of Benin Teaching Hospital.

METHOD:

This prospective, randomized study was conducted in the University of Benin Teaching Hospital, a 550-bed hospital. The average annual delivery is about 1200 per annum with 5% elective caesarean section rate.

Approval was sought and received from the Hospital Research and Ethics Committee. (Appendix A) Self-administered questionnaire (Appendix B) was used to evaluate the attitude of anaesthetists, paediatricians and obstetricians to routine use of subarachnoid block for elective caesarean section. Patients scheduled for elective caesarean section were approached to participate in the study. The study protocol and intraoperative expectations were discussed. Women who consented to the study were randomized, using computer generated numbers, to receive general anaesthesia or subarachnoid block for the caesarean section. Patients with abnormal lumbar spaces due to deformities of the spine or obesity were excluded from the study. Other exclusion criteria included hypovolaemia, coagulopathy, severe pre-eclampsia, eclampsia, septicaemia and fixed cardiac output states. Patients known or found to be sensitive or allergic to amide local anaesthetics or drugs for general anaesthesia were also excluded.
SUBARACHNOID BLOCK

All patients received freshly prepared mist magnesium trisilicate in accordance with departmental protocol. Baseline vital signs were obtained and recorded. A venous access was secured using a size 18G cannula and the patient prehydrated with 0.9% saline 20ml/kg over 15-20 minutes prior to injection of local anaesthetic. Each patient was cleaned and draped in sitting position. The lumbar puncture was performed with 25G cutting needle, using the midline approach, at L2/3 or L3/4 interspace. The subarachnoid space was identified with reflux of clear cerebrospinal fluid and bupivacaine 0.5% (heavy) injected slowly. A volume of 2.2 – 3.0mL was used as determined by patient’s height. The patient was thereafter returned to the supine position with a left lateral tilt. The pulse rate and blood pressure were recorded immediately while keeping verbal contact with the patient.

The sensory blockade was assessed using cotton buds in methylated spirit along the anterior axillary line bilaterally every 3 minutes for the first 15 minutes. Motor block of the lower limbs was assessed using the Bromage Scale: 48

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
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<tr>
<td>0</td>
<td>No paralysis (full flexion of the knees and feet)</td>
</tr>
<tr>
<td>1</td>
<td>Inability to raise extended leg (just able to move knees)</td>
</tr>
<tr>
<td>2</td>
<td>Inability to flex knees (able to move feet only)</td>
</tr>
<tr>
<td>3</td>
<td>Inability to flex knees (unable to move knees or feet)</td>
</tr>
</tbody>
</table>

Monitoring included pulse and blood pressure check every 3 minutes for the first 15 minutes and thereafter every 10 minutes. Hypotension, defined as systolic arterial pressure of > 30% of the baseline value was treated with intravenous ephedrine boluses and/or rapid infusion of 0.9% saline.
Immediately after delivery of the neonate, the umbilical cord was clamped and cut, intravenous oxytocin 10 units was given and 20 units added to intravenous fluid to run slowly as per hospital protocol for the management of third stage. The condition of the foetus was assessed using the Apgar score by the attending paediatrician. Verbal contact with the patient was maintained throughout the intraoperative period.

Efficacy of the sensory blockade or surgical analgesia was assessed by the anaesthetist, the surgeon and patient. Analgesia was assessed by the anaesthetist using the criteria set by Michie et al.\textsuperscript{49}

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<thead>
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<th>Category</th>
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<tr>
<td>A</td>
<td>No discomfort at all</td>
</tr>
<tr>
<td>B</td>
<td>Mild discomfort but do not require systemic analgesic</td>
</tr>
<tr>
<td>C</td>
<td>Pain that requires additional analgesia</td>
</tr>
<tr>
<td>D</td>
<td>Requires general anaesthesia after commencement of surgery</td>
</tr>
<tr>
<td>E</td>
<td>Require general anaesthesia before commencement of surgery</td>
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</tbody>
</table>

Muscular relaxation was assessed by the surgeon as very good, good, fair or poor. Patients graded the intraoperative experience as excellent, good, fair or poor.

All patients were evaluated daily for the first five days of the hospital stay and interviewed for presence of headache, nausea and vomiting, or any other complication. Headache was categorized as postdural puncture headache (PDPH) if it was exacerbated on sitting or standing and relieved or reduced by reclining. PDPH was graded as described by Sharma.\textsuperscript{50}

<table>
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<th>Severity</th>
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<tr>
<td>Mild</td>
<td>No limitation of activity, treated with oral analgesics and fluid</td>
</tr>
<tr>
<td>Moderate</td>
<td>Limited activity, treated with oral analgesics and intravenous fluid</td>
</tr>
<tr>
<td>Severe</td>
<td>Confined to bed, treated with oral analgesics, intravenous fluid or epidural blood patch</td>
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Maternal satisfaction was elicited for every patient using anchors such as poor, fair,
good, excellent or don’t know.

GENERAL ANAESTHESIA:

All patients randomized to general anaesthesia were given mist magnesium trisilicate 30mL prior to induction. An intravenous access was secured with 18G cannula. There was no preinduction volume expansion. Baseline vital signs were obtained and recorded. The patient was preoxygenated in the supine position for five minutes. Thiopentone 5mg/kg was used for the induction of anaesthesia with cricoid pressure. Laryngoscopy and tracheal intubation was facilitated with succinylcholine 1mg/kg. On successful tracheal intubation, the cuff was inflated and cricoid pressure relieved. The endotracheal tube was connected to the circle breathing system. Ventilation was performed manually to achieve or simulate normocarbia.

Nitrous oxide in oxygen and halothane were used to maintain general anaesthesia at a fresh gas flow rate of 3L/min each. Halothane was titrated at concentration of not more than 0.5%. Pancuronium (0.08mg/kg) was used to augment muscle relaxation. Analgesia was provided with pentazocine 30mg on delivery of the baby. The third stage was managed as earlier described. Monitoring included heart rate, blood pressure, and estimated blood loss.

Data entry was done on SPSS 10.0. Data analysis was done using Instat GraphPad. Continuous variables (age, height, weight) were analyzed using unpaired t-test. Categorical data were analyzed with Chi-square test or other tests as were deemed necessary. The level of significance was set at a probability of 5%.
RESULT:

A total of 83 women had caesarean section within the study period. 40 parturients were randomized to receive general anaesthesia and 43 to subarachnoid block group. There was difficulty with subarachnoid insertion in 2 of the parturients and failed block in another. They were consequently converted to general anaesthesia. These patients were excluded from analysis.

SOCIODEMOGRAPHICS

Table 1: The sociodemographic characteristics of the patients for caesarean section

<table>
<thead>
<tr>
<th>Features</th>
<th>Subarachnoid block</th>
<th>General anaesthesia</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>32.5 ± 3.7</td>
<td>31.8 ± 4.0</td>
<td>0.4190</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>162.4 ± 6.6</td>
<td>163.0 ± 6.6</td>
<td>0.6854</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>78.2 ± 11.2</td>
<td>75.6 ± 11.4</td>
<td>0.3067</td>
</tr>
<tr>
<td>Nulliparity (n)</td>
<td>12/40</td>
<td>7/40</td>
<td>0.2933</td>
</tr>
</tbody>
</table>

The sociodemographic features of these women were similar (Table 1). The women who received subarachnoid block appeared older and heavier but these differences did not achieve statistical significance. The age of the patients ranged from 22-39 yr (subarachnoid group) and 20-38 yr in the general anaesthesia group. The number of nulliparous women was similar in both groups. Most of the women were multiparous in both groups as against nulliparous counterparts.
Table 2: Initial haemodynamic variables prior to induction of subarachnoid block or general anaesthesia

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Subarachnoid block</th>
<th>General anaesthesia</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic Blood Pressure (mmHg)</td>
<td>123.8 ± 9.5</td>
<td>124.5 ± 9.9</td>
<td>0.7478</td>
</tr>
<tr>
<td>Diastolic Blood Pressure (mmHg)</td>
<td>78.0 ± 6.9</td>
<td>77.8 ± 6.7</td>
<td>0.8972</td>
</tr>
<tr>
<td>Pulse rate (n)</td>
<td>86.1 ± 5.9</td>
<td>87.3 ± 7.4</td>
<td>0.5493</td>
</tr>
<tr>
<td>Oxygen saturation (SaO₂%) **</td>
<td>99</td>
<td>99</td>
<td>-</td>
</tr>
</tbody>
</table>

** Data presented as median

Table 2 shows that the initial haemodynamic parameters in the patients studied were similar. The systolic blood pressure ranged between 100-150mmHg while the diastolic blood pressure varied between 70-90mmHg. The mean pulse rate was within normal value though there were isolated initial pulse rate greater than 100 beats per minute. There was no case of preoperative desaturation prior to induction of subarachnoid block or general anaesthesia. This indicates that there was no haemodynamic difference within the population studied.
Table 3: Indications* for caesarean sections

<table>
<thead>
<tr>
<th>Indications</th>
<th>Subarachnoid block (%)</th>
<th>General anaesthesia (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous caesarean section</td>
<td>21</td>
<td>52.5</td>
</tr>
<tr>
<td>Abnormal lie</td>
<td>9</td>
<td>22.5</td>
</tr>
<tr>
<td>Cephalopelvic disproportion</td>
<td>7</td>
<td>17.5</td>
</tr>
<tr>
<td>Previous infertility</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>Fetal concerns</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>Elderly primipara</td>
<td>2</td>
<td>5.0</td>
</tr>
<tr>
<td>Prolonged pregnancy</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Placental praevia</td>
<td>2</td>
<td>5.0</td>
</tr>
</tbody>
</table>

* Percentages are not adding to 100% because there may be more than one indication for caesarean section in a particular patient

There were various indications for caesarean sections in the hospital. Repeat caesarean section was the leading indication for surgery in both groups accounting for over half of the reasons for elective caesarean section in our patients. Abnormal lie, cephalopelvic disproportion previous reproductive difficulties were other indications for elective caesarean section in the hospital (table 3).
Table 4: Intraoperative clinical variables during caesarean section

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Subarachnoid block</th>
<th>General anaesthesia</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival to induction time (min)</td>
<td>30.1 ± 8.6</td>
<td>18.8 ± 5.9</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Duration of surgery (min)</td>
<td>79.9 ± 23.4</td>
<td>75.6 ± 15.4</td>
<td>0.3346</td>
</tr>
<tr>
<td>Apgar @ 1min &lt;7 (n)</td>
<td>0</td>
<td>7</td>
<td>0.0117*</td>
</tr>
<tr>
<td>Apgar @ 5min &lt;7 (n)</td>
<td>0</td>
<td>2</td>
<td>0.4937</td>
</tr>
<tr>
<td>Hypotension (n)</td>
<td>9</td>
<td>1</td>
<td>0.0143*</td>
</tr>
<tr>
<td>Estimated blood loss (mL)</td>
<td>502.3 ± 182.9</td>
<td>746.3 ± 240.8</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Total fluid during surgery (mL)</td>
<td>2675.0 ± 487.7</td>
<td>1962.5 ± 511.3</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Time to first analgesia (min)</td>
<td>195.3 ± 47.1</td>
<td>163.9 ± 46.7</td>
<td>0.003*</td>
</tr>
</tbody>
</table>

* Significant difference observed

Time of arrival in the operating room to time of commencement of induction of anaesthesia was significantly different in both groups (p < 0.0001, t-test). The time spent in preparation for subarachnoid block was longer than time for preparation for general anaesthesia. Time spent on prophylactic intravenous fluid loading may be responsible for this observation.

The duration of surgery in both groups was similar. The caesarean section done under general anaesthesia appeared to be shorter than time under spinal anaesthesia. This, however, did not achieve statistical significance (p = 0.3346, t-test).
More babies delivered by women who received general anaesthesia had Apgar scores less than 7 in the first minute of life (p = 0.0117, OR = 18.1, Fisher’s exact test). Apgar score in 5 minutes was similar in both groups.

Maternal hypotension occurred more in women who had subarachnoid block than women in the general anaesthesia group (p = 0.0143, OR = 11.3, Fisher’s exact test). These cases of symptomatic hypotension were transient and were treated using rapid infusion of intravenous 0.9% saline according to study protocol.

The patients receiving general anaesthesia for caesarean section were more likely to have higher blood loss intraoperatively (p < 0.0001, t-test). 12.5% (n = 5) had blood transfusion in the general anaesthesia group compared to none in the subarachnoid group. Total fluid used in the intraoperative period was more in the subarachnoid group than in the general anaesthesia group. The fluid for preloading was contributory to the total fluid therapy.

The women who had subarachnoid block for caesarean section had a longer pain free immediate postoperative period than the general anaesthesia group (p = 0.003, t-test). The pain free period ranged between 110–300 minutes and 90–285 minutes in the subarachnoid group and general anaesthesia group respectively.

Table 5: Intravenous fluid preloading and characteristics of the subarachnoid block
Table 5 shows the prophylactic fluid therapy and the quality of subarachnoid block. The mean volume of preloading with crystalloid was 1262.5 ± 200.9mL. The success rate on first pass of the spinal needle was 62.5% (n = 25/40) and over 85% of the patients had successful identification of the subarachnoid space on second attempt. The median sensory level of anaesthesia prior to incision was T4. All the women had dense motor blockade for the surgery (grade 3). A total of 6 women (15%) had diaphragmatic irritation in the course of surgery and anaesthesia.

Table 6: Common perioperative problems associated with the techniques of anaesthesia
Postdural puncture headache (PDPH) was the commonest complication seen in the study population (17.5%). Non postdural puncture headache, backache and vomiting were common to both SAB and GA groups. Nausea occurred in the SAB group. Five of the patients (12.5%) who had general anaesthesia received blood transfusion.

Table 7: Maternal satisfaction with subarachnoid block

<table>
<thead>
<tr>
<th>Satisfaction</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>7 (17.5)</td>
</tr>
</tbody>
</table>
Table 7 shows that over 70% of the mothers rated their satisfaction with subarachnoid block for caesarean section as good or excellent. 5% (n = 2) rated the technique as poor and one mother did not rate the procedure.

ATTITUDE OF PHYSICIAN CARE PROVIDERS TO ANAESTHESIA FOR ELECTIVE CAESAREAN SECTION

Questionnaires were distributed to all specialists and trainees in the Departments of Anaesthesia, Obstetrics/Gynaecology and Paediatrics. The response rate for the completed questionnaires were Anaesthesia (12/15, 75%), Obstetrics and Gynaecology (18/25, 72%), and Paediatrics (10/18, 55.6%).
Table 8: Sociodemographic characteristics of specialist medical doctors caring for patients for elective caesarean section

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Anaesthetists (n = 12)</th>
<th>Obstetricians (n = 18)</th>
<th>Paediatricians (n = 10)</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>36.5 ± 6.1</td>
<td>33.6 ± 5.3</td>
<td>31.1 ± 2.9</td>
<td>0.0572</td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>5/3</td>
<td>15/3</td>
<td>4/3</td>
<td>-</td>
</tr>
<tr>
<td>Years in specialty (yr)</td>
<td>5.0 ± 3.2</td>
<td>4.1 ± 1.9</td>
<td>3.1 ± 1.9</td>
<td>0.1853</td>
</tr>
<tr>
<td>Period as doctor (yr)</td>
<td>11.5 ± 5.4*</td>
<td>10.2 ± 4.0</td>
<td>6.7 ± 2.8</td>
<td>0.0337</td>
</tr>
</tbody>
</table>

Grades of doctors

<table>
<thead>
<tr>
<th></th>
<th>Trainees</th>
<th>Obstetricians</th>
<th>Paediatricians</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaesthetists</td>
<td>10</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Specialists</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 8 shows that the Anaesthetists appeared older chronologically (p = 0.0572, ANOVA) and professionally (p = 0.0337, ANOVA) than the Obstetricians and Paediatricians respectively.

Table 9: Knowledge and rating of various methods of anaesthesia for caesarean section by physician healthcare providers

<table>
<thead>
<tr>
<th>Features</th>
<th>Anaesthetists</th>
<th>Obstetricians</th>
<th>Paediatricians*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of methods</td>
<td>12</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Methods seen in use</td>
<td>12</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>Rating of methods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA infiltration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤ 5</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>-------</td>
<td>-----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>&gt; 5</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

Ketamine anaesthesia

<table>
<thead>
<tr>
<th></th>
<th>≤ 5</th>
<th>4</th>
<th>5</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 5</td>
<td>8</td>
<td>13</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

General anaesthesia

<table>
<thead>
<tr>
<th></th>
<th>≤ 5</th>
<th>0</th>
<th>0</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 5</td>
<td>12</td>
<td>18</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Subarachnoid block

<table>
<thead>
<tr>
<th></th>
<th>≤ 5</th>
<th>0</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 5</td>
<td>12</td>
<td>18</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Epidural block

<table>
<thead>
<tr>
<th></th>
<th>≤ 5</th>
<th>0</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 5</td>
<td>12</td>
<td>18</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

*2 paediatricians did not rate LA infiltration, ketamine anaesthesia and epidural block

All the physician perioperative care providers were aware of the various methods of anaesthesia for caesarean section. Some Paediatricians have not seen all the listed methods in use as against their colleagues in Anaesthesia and Obstetrics and Gynaecology.

Infiltration with local anaesthetic agent and the use of ketamine as sole anaesthetic agent were rated low by the physician perioperative care providers (table 9). General anaesthesia, subarachnoid block and epidural block were highly rated by a majority of respondents.
Table 10: Comparisons of opinions of physician healthcare provider to general anaesthesia and subarachnoid block

<table>
<thead>
<tr>
<th>Features</th>
<th>Anaesthetists</th>
<th>Obstetricians</th>
<th>Paediatricians</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most efficacious technique (GA / Others)</td>
<td>11/1</td>
<td>16/2</td>
<td>10/0</td>
</tr>
<tr>
<td>Desires change of practice Yes/No</td>
<td>10/2</td>
<td>16/2</td>
<td>9/1</td>
</tr>
<tr>
<td>Perceived superiority (GA / SAB)</td>
<td>0/12</td>
<td>2/16</td>
<td>2/8</td>
</tr>
</tbody>
</table>

Opinion on routine use of SAB

Agree                  | 10 | 14 | 7
Disagree              | 1  | 3  | 2
Don’t know            | 1  | 2  | 1

General anaesthesia was rated by most anaesthetists (91.6%), Obstetricians (88.9%) and Paediatricians (100%) as the most efficacious technique for caesarean section. Respondents perceived subarachnoid block to be superior to general anaesthesia in terms of advantages. Opinion on the routine technique of anaesthesia for caesarean section favoured subarachnoid block (Table 10).

Table 11: Attitude of physician healthcare providers to subarachnoid block

<table>
<thead>
<tr>
<th>Features</th>
<th>Anaesthetists</th>
<th>Obstetricians</th>
<th>Paediatricians</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reasons for none routine use of SAB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited manpower</td>
<td>3</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Limited materials</td>
<td>4</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>
Limited manpower, lack of relevant materials and time to the conduct of subarachnoid block were the leading reasons for its non-routine use for caesarean section in this hospital (Table 11). Most respondents perceived subarachnoid block to be more beneficial than general anaesthesia for caesarean delivery. Similarly, general anaesthesia was viewed to be associated with more rigorous neonatal resuscitation when compared with subarachnoid block.

Table 12: Outcomes following anaesthesia for caesarean section as perceived by doctors in the different specialties providing perioperative care

<table>
<thead>
<tr>
<th>Features</th>
<th>Anaesthetists</th>
<th>Obstetricians</th>
<th>Paediatricians</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of anaesthesia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GA / SAB / Don’t know</td>
<td>12//0/0</td>
<td>14/2/2</td>
<td>7/1/2</td>
</tr>
<tr>
<td>Fetomaternal toxicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effect of technique on morbidity (GA/SAB)</td>
<td>11/1</td>
<td>14/2/2</td>
<td>8/1/1</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>Yes / No/Don’t know</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower morbidity/mortality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GA / SAB</td>
<td>1/11</td>
<td>2/16</td>
<td>8/2</td>
</tr>
<tr>
<td>Personal preference of technique</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GA / SAB</td>
<td>1/11</td>
<td>8/10</td>
<td>3/7</td>
</tr>
</tbody>
</table>

General anaesthesia was rated to be more expensive than subarachnoid block. Table 12 shows further that general anaesthesia was perceived to put mother/baby at greater risk of toxicity than subarachnoid block. The respondents were of the view that the technique of anaesthesia can affect the pattern of morbidity following caesarean section and that subarachnoid block may result in lower morbidity and mortality. Irrespective of these perceived advantages, the Obstetricians were almost even on the preferred technique of anaesthesia for their patients. Conversely, the anaesthetists and Paediatricians favoured subarachnoid anaesthesia as personal preference for their patients.
DISCUSSION:

This study, amongst others, indicates that subarachnoid block is an effective technique for elective caesarean section with an acceptable rate of complications. Subarachnoid block provided a reliable degree of anaesthesia for elective caesarean section and was highly acceptable to obstetricians and patients. It provided a comparable safety profile with general anaesthesia for caesarean section. The attitude of physician health care providers for perioperative care of mother and child indicates willingness to embrace routine use of subarachnoid block for elective caesarean section for its perceived advantages: low level of fetomaternal toxicity, reliable dense block and minimal cost. In spite of their preference for subarachnoid block for their patients, the limited anaesthetic manpower and materials were of concern.

The results indicate that subarachnoid block is a safe and effective alternative technique for caesarean section, at least, for our patients. This observation is valid as the
sociodemographic characteristics and perioperative haemodynamic variables of these patients were similar in both groups. This is quite similar to the global shift towards the use of subarachnoid block for caesarean section.\textsuperscript{6, 11} Indeed, the growth of subarachnoid block for caesarean section worldwide has been phenomenal. Not long ago, Hawkins et al\textsuperscript{51} reported the progress with regional technique for caesarean section in the United States. Similar reports abound in the literature on the development and growth of subarachnoid block for caesarean section worldwide.\textsuperscript{52-55}

**MATERNAL SAFETY**

The effects of anaesthesia on mother and child have been the major drive for the changes in the techniques for caesarean section in the recent past. There was no maternal mortality in this series. However, some complications due to the anaesthetic techniques were observed. Maternal safety following caesarean has always been a topical issue. In the past, general anaesthesia was considered the technique of choice because it was quick, not because it was thought to be particularly good.\textsuperscript{56} The opinion of various physician care providers in our hospital also point to this claim. The speed of the technique was the uppermost consideration irrespective of the serious questions of safety and efficacy. Several reports of the Confidential Enquiry into Maternal Deaths have implicated general anaesthesia in maternal morbidity and mortality.\textsuperscript{57-59} Thus, there has been a decline in the use of general anaesthesia for caesarean section.\textsuperscript{60, 61} The reasons for this decline include to difficult/failed intubation, regurgitation/aspiration of pneumonitis and hypoxaemia.\textsuperscript{6, 7, 56} Consequently, regional anaesthesia with emphasis on subarachnoid block became a re-invigorated approach to caesarean delivery.

Is subarachnoid anaesthesia really superior to general anaesthesia in terms of maternal safety? The data from this study is not sufficiently powered to provide an answer to this question. Nevertheless, evidence from the Confidential reports into Maternal Deaths
and the literature indicate the superiority of subarachnoid block over general anaesthesia in terms of maternal safety. The considerable reduction in anaesthesia related maternal mortality has been linked to a drop in the use of general anaesthesia for caesarean section by many anaesthetists. To some, this explanation as evidence for the safety of subarachnoid block for caesarean section is rather simplistic. They argue that general anaesthesia for caesarean section has evolved over time with improved knowledge of the potential life threatening risks associated with it. To others, subarachnoid block is the technique of choice. This position have been canvassed and sustained by agencies like Obstetric Anaesthesia Association and editorial board of the Confidential Enquiry into Maternal Deaths. Indeed, this is the prevailing concept shaping the practice of anaesthesia for caesarean section worldwide. Although there was no maternal death in this series, the acceptance rate of the technique and the safety profile seen with the technique makes it attractive for routine use in caesarean section.

**NEONATAL SAFETY**

The condition of the neonate is of relevance in the assessment of techniques of anaesthesia for obstetrics. The Apgar score was used to assess neonatal wellbeing. The 10-point Apgar score was proposed about 50 years ago as a means of evaluating the physical condition of infants shortly after delivery. In this study, there were more recorded Apgar scores of less than 7 at one minute in the general anaesthesia group. This finding is similar to reports from other studies in Nigeria and elsewhere. This indicates the neonatal depressive effects of drugs employed for general anaesthesia. The superiority of regional technique over general anaesthesia for caesarean section with respect to neonatal effect is limited. Ong et al in a retrospective study evaluated the outcome of infants delivered by caesarean section. The findings were essentially: increased incidence of low 1-minute Apgar score among infants exposed to general anaesthesia and many of these infants
required intubation and positive pressure ventilation. However, there was no difference in
the neonatal outcome on the long term. Bupivacaine, unlike most drugs use for general
anaesthesia, does not cross the placental barrier in significant amount.45

Several approaches have been described towards ameliorating these untoward effects
of general anaesthesia on the neonate during caesarean section. Indeed, the departmental
protocol for general anaesthesia abhors the use of opioid analgesic and other drugs like the
benzodiazepines until the delivery of the fetus. This notwithstanding, the lower incidence
of one minute Apgar scores less than 7 in the subarachnoid block group may suggest the
superiority of spinal anaesthesia over general anaesthesia for caesarean section.

Assessment of neonatal safety following caesarean section is not only dependent on the
use of Apgar score. The Apgar score can detect obvious outcome like severe neonatal
depression. With the development of obstetric anaesthesia, the concern of subtle effects
and the impact of these effects were raised. The Apgar score is neither sensitive nor specific
enough to detect such subtle injury or mild depression.68 Against the background of these
challenges, several assessment tools were designed to evaluate the effects of obstetric
medications on the neonate. These include the Early Neonatal Neurobehavioral Scale
(ENNS),69 the Neurologic and Adaptive Capacity Scores (NACS) and Umbilical artery pH.
Although not assessed in this study, several clinical studies have investigated the usefulness
of these assessment tools on the neonate. The ENNS was reported to be useful in earlier
reports.46, 69 but involves the use of noxious stimuli, complicated and time consuming.
NACS on the other hand, emphasizes muscle tone. Abboud and colleagues70 evaluated 52
neonates at 15 minutes, 2 hours and 24 hours after caesarean section. Neonates delivered
with general anaesthesia scored significantly lower than neonates delivered with either
epidural or spinal anaesthesia.70 These observations notwithstanding, the significance of
the information derived is at best, unvalidated.68
The umbilical cord blood gas and pH has been the most widely evaluated and applied neonatal assessment tool after the Apgar score. There is a plethora of evidence in the literature supporting the usefulness or otherwise of umbilical cord gas studies. However, a recent meta-analysis showed a significant difference in the funic pH between spinal and general anaesthesia, and a consistent adverse effect on base deficit. These differences were however, not large. It is imperative therefore that emphasis should be on factors that may cause fetal hypoxaemia and acidosis. These factors that require close attention include (1) providing left uterine displacement and prevention of aortocaval compression, (2) ensuring adequate maternal oxygenation, (3) avoiding maternal hyperventilation, (4) avoiding excessive doses of anaesthetic agents, and (5) treating hypotension promptly. Indeed, it has been speculated that the physiology may be more important than pharmacology. Design and implementation of anaesthetic plans with these factors would lead to good outcome.

SUBARACHNOID BLOCK: PROBLEMS AND COMPLICATIONS

Timing

It is often perceived that regional techniques are time consuming. The results of this study indicate same. The time of arrival to induction time was longer in the subarachnoid group than the general anaesthesia. Prehydration is always needed to ameliorate the incidence of maternal hypotension. This could take some time to achieve. However, there is a limitation to the interpretation of this time difference. The time taken to prepare the medications for general anaesthesia was not considered in this study. Rather timing was assessed from drug administration to tracheal intubation. This notwithstanding, general anaesthesia could still be less time consuming than subarachnoid block. Timing may be a significant factor in emergency obstetric anaesthesia and probably not in elective cases, the
subject of this study. The time from induction of anaesthesia to point of readiness for surgery, though not measured in this study, appears to be more relevant. Nevertheless, timing can always be improved upon with suitable planning and preparation. Therefore, timing should not be a hindrance to the use of subarachnoid block routinely for elective caesarean section.

**Maternal hypotension**

Maternal hypotension remains a major problem with subarachnoid anaesthesia. This serious complication following spinal anaesthesia for caesarean section has incidence as high as 83-90% reported in the literature.\(^73,74\) The consequences of spinal induced maternal hypotension are enormous. It could be a threat to maternal safety as well as optimal neonatal outcome. Thus, several prophylactic measures have been described and evaluated.\(^75,76\) These include one or combination of the following; left uterine displacement, intravenous prehydration with crystalloids/colloids, leg wrapping, leg elevation and administration of vasopressors. However, the most widely employed techniques which have undergone the most critical evaluations are preloading with intravenous fluid and administration of vasopressors.

Volume loading with crystalloid solution, which was the prophylactic measure in this series, has been taught and practiced over the years. This position was probably influenced by earlier studies demonstrating the importance of preloading in prevention of maternal hypotension.\(^22,23,77\) However, evidence abounds in the literature indicating otherwise.\(^24,25,78\) Jackson and colleagues did not show any advantage in preloading with 1 litre of crystalloid compared with 200mL to reduce the incidence and severity of hypotension after spinal anaesthesia for elective caesarean section.\(^24\) Similarly, Rout et al\(^25\) compared preload and no preload using sequential analysis design. The result showed a significant reduction in the incidence of hypotension from 71% in the unpreloaded patients
to 55% in preloaded group. Although there was a reduction, it was not as expected or anticipated from existing evidence. The implications of these findings do not preclude the usefulness of volume preloading. It shows that maternal hypotension is ameliorated but not eliminated by volume preloading. Indeed, Rocke and Rout suggest continuous use of volume preloading as time may allow but the clinician should be prepared to monitor and manage timeously any decreases in maternal blood pressure.

The seeming inefficiency of volume preloading to address the problem of maternal hypotension has prompted the use of prophylactic vasopressors. The choice, dose and route of prophylactic vasopressors have been well documented. Understandably, ephedrine is the most studied. It has the inherent property of alpha- and beta- activities and thus preserves uteroplacental perfusion. In contrast, alpha adrenergic agonists are avoided because they increase uterine vascular resistance and reduce uteroplacental perfusion. Neither of these vasopressors were used in this study. Early report suggests the efficacy of intramuscular ephedrine as prophylaxis against spinal induced maternal hypotension. However, some evidence suggests that prophylactic intravenous ephedrine is not very effective in preventing spinal hypotension. The authors evaluated the use of either a bolus or an intravenous infusion of ephedrine during administration of spinal anaesthesia for caesarean section. Neither of the regimen reduced the incidence of maternal hypotension compared with untreated group. Recently, Desalu and Kushimo compared prophylactic ephedrine infusion and volume preloading in African parturients. Their results suggest that standard infusion of ephedrine is superior to crystalloid prehydration in the prevention of spinal-induced maternal hypotension. Could the administration of ephedrine have changed the incidence of hypotension in this series? This is highly conjectural as ephedrine was of limited availability at the time of this study for such evaluation. Indeed, the use of high volume preloading may have mitigated against severe maternal hypotension.
Irrespective of the prophylactic measures, the incidence of spinal-induced maternal hypotension is not zero. Anyway, spinal-induced maternal hypotension does occur and is expected whenever spinal anaesthesia is administered. It is important therefore, that treatment modalities should be available. In this study, rapid infusion of fluid was the mainstay of therapy. However, prompt administration of vasopressor is the standard care. The commonly used vasopressors in contemporary practice are phenylephrine and ephedrine. Clinical studies have suggested that phenylephrine in small doses may be given safely for the prevention or treatment of hypotension during administration of regional anaesthesia for caesarean section.\textsuperscript{82} In addition, it has been shown that ephedrine maintains or restores uterine blood flow when it is given to maintain maternal blood pressure.\textsuperscript{83} Some clinicians prefer ephedrine because of the beta-effects on uteroplacental circulation. However, phenylephrine may be a better choice when tachycardia caused by ephedrine is undesirable.

Historically, the choice of vasopressor for spinal induced maternal hypotension had favoured ephedrine.\textsuperscript{84} Several sheep studies showed that large doses of vasoconstricting drugs decreased uterine blood flow.\textsuperscript{85,86} However, ephedrine maintained uterine blood flow much better than other vasopressors that are primarily vasoconstrictors and have little beta-agonist effect. Therefore, ephedrine became the ‘gold standard’ for prophylaxis and treatment of spinal hypotension. However, there has been renewed interest in the use of phenylephrine. This interest was rekindled by Ramanathan and Grant in 1988.\textsuperscript{87} Recently, Ngan Kee and colleagues\textsuperscript{88} provided evidence indicating the efficacy of phenylephrine in the management of spinal-induced maternal hypotension. In this study, the authors maintained maternal arterial pressure at 80\%, 90\% or 100\% of baseline. The primary outcome of interest was the umbilical artery pH. They found that maintaining the arterial blood pressure at 100\% of baseline was associated with the best outcome for the baby and
mother. Indeed, this finding has affected the long held notion that ephedrine is superior to phenylephrine for the management of maternal hypotension after spinal anaesthesia. 

Expectedly, phenylephrine will displace ephedrine as the first line vasopressor for the spinal-induced maternal hypotension.

In sum, maternal hypotension is a major complication during spinal anaesthesia for caesarean section. The limitations with prophylactic measures notwithstanding, left uterine displacement, volume preloading and prompt treatment of hypotension remain the benchmark for good clinical care for spinal anaesthesia for caesarean section.

Maternal hypotension is not exclusive to subarachnoid block. It occasionally occurs in patients receiving general anaesthesia for caesarean section as was seen in this study. However, the spinal-induced maternal hypotension is unique and different from that caused by general anaesthesia. Characteristically, spinal induced maternal hypotension occurs in the early minutes after induction of subarachnoid block. In contrast, maternal hypotension following general anesthesia can occur at any time in the course of the caesarean section. Most often, this is related to the use of high concentration of volatile agent or other factors.

It is important to note the place of overzealous administration of oxytocin for the management of third stage in maternal hypotension. Although not specific to any of the techniques, oxytocin administration could cause maternal hypotension. Nevertheless, general anaesthesia with halothane is more likely to result in uterine atony and consequent need for additional oxytocin. Indeed, the penultimate UK Confidential Enquiry into Maternal Deaths (Why Mothers Die 1997-1999) implicated oxytocin in one of the anaesthesia related maternal deaths. In the report, oxytocin 10mg came under critical scrutiny. Although this is the commonly employed dosage in this centre, the appraisal by the confidential report is instructive. Ergometrine, another commonly used uterotonic
agent, is often avoided in the awake patient. This may be of use during general anaesthesia if additional doses of oxytocin become necessary.

**Post Dural Puncture Headache**

Postdural puncture headache is a common problem with subarachnoid block for caesarean section.\textsuperscript{31, 32} The finding in this study indicates an incidence of postdural puncture headache of 12.5%. This incidence appears higher than the often reported incidence of PDPH with Quincke needle.\textsuperscript{91, 92} The Quincke needle is a cutting needle and is often associated with high incidence of postdural puncture headache. Vallejo and colleagues compared 5 different types of needles (2 cutting and 3 pencil point) in a prospective randomized trial. The incidence of PDPH with the Quincke needle was 8.7%, the highest incidence among the needles investigated.\textsuperscript{92} Similarly, Devcic and colleagues reported a lower incidence of PDPH.\textsuperscript{91} The authors stated the orientation of the bevel of the needle tip to the dural fibres. This may account for the difference in our observations. Another factor of interest is the experience of the physician performing the procedure.\textsuperscript{93} Could the incidence of PDPH have been lower in the hands of a more experienced operator? Certainly, the use of spinal anaesthesia for caesarean section was at an experimental stage at the time of this study. Nevertheless, Flatten and associates could not demonstrate any effect of experience and training on the incidence of PDPH after subarachnoid blockade.\textsuperscript{94}

The classic description of PDPH is that of frontal or occipital headache that is present or aggravated by assuming the upright position and essentially relieved when returning to the supine position. These were the criteria used for the definition of PDPH in this study. It could be a debilitating morbidity to the young mother. Therefore, prevention that is cost-effective and without risk to the patient is often emphasized. Probably the most important preventive measures that should be taken when planning SAB for caesarean
Delivery are needle choice and possibly configuration of needle tip. Traditionally, this has been accomplished by using smaller gauge needles, cutting bevels longitudinally to prevent transverse cutting of longitudinally oriented dural fibres, and using pencil point needles to part instead of cut dural fibres.\textsuperscript{95, 96} Indeed the conclusion of a meta-analysis by Halpern and Preston emphasizes that “non cutting needles for spinal anaesthesia produce a lower incidence of PDPH than cutting needles. In addition, smaller needles produce less headache than larger needles of the same type.”\textsuperscript{97} In this study, cutting needle was used as against pencil point needles. Perhaps, the needle orientation to avoid transverse cutting of the dural fibres could have reduced the rather high incidence of PDPH. Furthermore, employing small gauge needles with pencil point, which were not available in our centre at the time of design and conduct of this study, can ameliorate the problem of PDPH.

Despite current knowledge and understanding of prophylactic measures, PDPH remains a problem for a small percentage of young mothers after SAB for caesarean delivery. PDPH can be extremely incapacitating and often requires treatment. Therapeutic measures could be conservative; including use of intravenous fluid and simple analgesics as seen in this study. However, other conservative approaches involve hydration (liberal oral fluid or intravenous), caffeine, sumatriptan or the proposed use of adrenocorticotropic hormone (ACTH).\textsuperscript{96, 98} Unfortunately, conservative measures are often inadequate. Lumbar epidural blood patch remains the most effective treatment for refractory PDPH. None of the patients who had PDPH in this study required epidural blood patch. However, other suggested invasive treatment modalities include epidural saline, epidural fibrin glue and surgical repair.\textsuperscript{96}

**Nausea and vomiting**

There have been major advances in the use of subarachnoid block for caesarean section. Yet intraoperative nausea and vomiting are not uncommon with regional
anaesthesia for caesarean section, reaching up to 80%.

Nausea was seen in 12.5% of the patients who had SAB and 7.5% of them vomited. This is rather low when compared with evidence in the literature. Several factors affect the incidence of nausea and vomiting during caesarean section under regional anaesthesia. This could be classified as anaesthetic and non-anaesthetic factors. Maternal hypotension, neuraxial opioids, parenteral opioids and increased vagal activity are the anaesthetic factors. It is not clear if the same patients who had maternal hypotension also developed nausea or vomiting in this study.

Furthermore, sympathetic block secondary to spinal anaesthesia may result in nausea and vomiting induced by gastrointestinal hyperactivity due to relative overactivity of the vagus. The efficacy of vagolytic agents in relieving spinal induced nausea and vomiting during caesarean section has been taken as evidence of support for this causation. However, the impact of these various factors on the incidence of nausea and vomiting in our series is not clear. Perhaps, noting the time of nausea or vomiting in relation to surgical events as described by some authors, could have explained the role played by anaesthetic factors in this study. In this study, intrathecal opioids were not added to the bupivacaine. This may explain in part the low incidence of nausea and vomiting in this study.

The non-anaesthetic factors (surgical stimulation, uterotonic agent, motion) are also of importance in the causation of intraoperative nausea or vomiting. Surgical stimuli appear to have been a major factor with respect to this study. Exteriorization of the uterus, intra-abdominal manipulation or exploration and peritoneal traction are known surgical stimuli that could provoke nausea and vomiting. In particular, exteriorization of the uterus is the standard of care during caesarean section in our centre and it is associated with high incidence of intraoperative nausea and vomiting. It may be difficult changing the departmental protocol on intraoperative repair of the uterus. However, it is important that
the operating obstetric surgeon is careful with the handling of the uterus and minimize intraperitoneal manoeuvres.

**Estimated blood loss**

The estimated blood loss was significantly different between the general anaesthesia and subarachnoid group. In fact, 12.5% of the patients in the general anaesthesia group received blood transfusion. The technique of anaesthesia employed in caesarean section is a determinant of the blood loss. The amount of blood loss during operation is less with spinal anaesthesia than when the same operation is done under general anaesthesia. General anaesthesia is associated with higher blood loss than spinal anaesthesia for caesarean section\textsuperscript{104,105} as was seen in this study. This is because of a fall in blood pressure, heart rate and improved venous drainage with resultant decrease in oozing.\textsuperscript{106} In fact, this advantage of spinal anaesthesia over general anaesthesia for caesarean section could be maximized in our setting, where blood and blood products are scarce resources.

**Time to first analgesia**

There was a clear difference in the time to request for analgesia in the two groups studied. Spinal anaesthesia offered a longer time to first analgesia than general anaesthesia. Time of regression of subarachnoid block is longer than recovery from general anaesthesia. Hence, it may take longer for the mother to perceive pain and request for analgesia. Conversely, recovery form general anaesthesia is rapid. Although supplemental analgesic is a component part of general anaesthesia, the efficacy of pentazocine the commonly available analgesic is suspect.

Over the years, postoperative pain control after caesarean section under spinal anaesthesia has been improved with the addition of opioids. The addition of morphine or
diamorphine to local anaesthetic for subarachnoid block has become the standard of practice elsewhere.\textsuperscript{107, 108} However, postcaesarean section pain has remained a problem in our centre and elsewhere in Nigeria. Recently, Kolawole and Fawole\textsuperscript{109} prospectively evaluated postoperative pain in 88 women after general anaesthetic caesarean section. 79.6\% and 54.6\% of the parturients reported moderate to severe pain respectively in the post anaesthetic care unit (PACU).\textsuperscript{109} The method of pain assessment by the authors notwithstanding, the study does indicate that Nigerian parturients experience a great deal of pain post caesarean section. Interestingly, pain in the first 24 hours after caesarean section is highly amenable to intrathecal opioids.\textsuperscript{110} This should be the future direction in our research and practice.

\textbf{MATERNAL SATISFACTION WITH SUBARACHNOID BLOCK}

Maternal satisfaction with spinal anaesthesia was very high. Unfortunately, it was not possible to compare maternal satisfaction between the subarachnoid block and general anaesthesia groups. Understandably, the asleep patient unlike the awake patient may not be able to provide information on the intraoperative course of anaesthesia and surgery. Patient satisfaction may be an indicator of quality care.\textsuperscript{111} Thus, institutions have encouraged physicians to elicit patient satisfaction as outcome measure of healthcare delivery. The high rating of satisfaction with the spinal anaesthetic care is similar to previous reports.\textsuperscript{112, 113} Satisfaction is a multifaceted, multidimensional entity. Therefore, the single item questions (as used in this study) lack sufficient discriminatory power to distinguish the various aspects of anaesthetic care from the general treatment. The use of single global instrument to evaluate a multidimensional problem would result in high satisfaction ratings.\textsuperscript{114, 115} However, it is salutary that most patients were satisfied with their
anaesthetic experience. This could improve the acceptance of spinal anaesthesia for caesarean section.

ATTITUDE OF ANAESTHETISTS/OBSTETRICIANS AND PAEDITRICIAN TO SAB FOR CAESAREAN SECTION.

The attitude of the care providers during caesarean section was favourable. Attitude is often shaped by knowledge. Generally, all the physician care providers were knowledgeable about the various techniques available for caesarean delivery. All the practitioners rated the efficacy of the various techniques especially general anaesthesia, spinal and epidural anaesthesia above average. Interestingly, all rated the use of ketamine as a sole anaesthetic, abysmally low.

In spite of the low use of subarachnoid block at the time of the study, the efficacy of the technique was not in doubt. The perceived advantages of the subarachnoid block were well recognized. General anaesthesia was considered more efficacious for caesarean section. However, the overriding opinion of the physician care givers was for the routine conduct of caesarean section under subarachnoid block.

One of the main limitations to proposed routine use of subarachnoid block is the timely conduct of subarachnoid block. This was a peculiar concern of the obstetricians. Delay between induction of general anaesthesia and delivery of the foetus is a major trouble with neonatal safety during caesarean section under general anaesthesia. Extrapolation of such fears to subarachnoid block for caesarean section is unwarranted. Although the result of this study showed time lag between induction of subarachnoid block and general anaesthesia, time of arrival and induction of anaesthesia may be crucial only in emergency caesarean section. This contrasts sharply with the subject of this study, elective caesarean section. Other factors considered to be problems with the routine use of subarachnoid block.
for elective caesarean section include limited personnel and materials. In fact, these problems can be surmounted with personnel training and improved budgeting.

All care givers recognized the proven benefits of subarachnoid block. The cost of anaesthesia is of importance in developing countries. Subarachnoid block as opined by the physician care provider has been shown to be cheaper than general anaesthesia. The cost effectiveness of subarachnoid block for caesarean section cannot be overemphasized in an emerging nation with financial constraints and poor resource allocation to health. The minimal fetomaternal toxicity is an advantage. Similarly, the care providers perceive subarachnoid block as safer than general anaesthesia for caesarean section.

**SUGGESTIONS/RECOMMENDATIONS:**

1. Subarachnoid block can be used as an alternative technique for elective caesarean sections.

2. Recruitment and retention of consultant anaesthetists should be encouraged in order to facilitate a comprehensive training programme.

3. Workshops and seminars to engender learning and acquisition of the relevant skills in obstetric anaesthesia.

4. Provision of the materials including appropriate size needles will help in minimizing complications and encourage acceptance of this technique by women.

5. Development of subspecialty unit as a policy thrust of the department may enhance further hands-on training of resident doctors.

6. Routine use of subarachnoid block for caesarean section would also expand the scope of patients amenable to subarachnoid block for caesarean section. For example, pregnancies complicated by preeclampsia were excluded from this study. This is no longer a contraindication to subarachnoid block.
7. Anaesthesia and labour analgesia should become topics in antenatal classes. Such interactive sessions would encourage the acceptance of subarachnoid block for caesarean section and the development of obstetric analgesia service.

**STUDY LIMITATIONS:**

The interpretation of the findings in this study should be made within certain limitations to the conduct of the study. First, this study was conducted using cutting needles and hence, the incidence of postdural puncture headache is higher than with pencil point needles in contemporary practice. Similarly, the use of vasopressors for the prevention and management of spinal induced maternal hypotension were not fully evaluated due to the absence of these drugs at the time of conduct of this study. In addition, it would have been clinically expedient to compare maternal satisfaction in the group receiving general anaesthesia as well as the subarachnoidal group. These limitations notwithstanding, the finding that subarachnoid block is a cheap and safe alternative to general anaesthesia for caesarean section is instructive. Further development of this technique would meet the anaesthetic needs for caesarean section in our environment.

**RELEVANCE OF THE STUDY AND IMPORTANCE IN THE SUBREGION**

The routine use of subarachnoid block for caesarean section is of relevance to the overall management of the surgical obstetric patient. There are well established problems
associated with general anaesthesia for caesarean section. Routine use of subarachnoid block for caesarean section would reduce if not eliminate these problems. In addition, airway management in the surgical obstetric patient is a major factor in anaesthesia related maternal morbidity. Furthermore, with the limited devices for airway management in our environment routine use of subarachnoid block for caesarean section becomes a welcome development.

Moreover, the cost of general anaesthesia for caesarean section is well over that for subarachnoid block. This is an advantage in emerging nations like Nigeria with limited health budgeting. The net implication is the availability of more resources for greater number of expectant mothers. This goes further to improve the poor maternal health indices in Nigeria. Indeed, anaesthesia can and will continue to play a significant role in the quest for a reduced maternal mortality rate.

There has been a tremendous change in the scope of anaesthesia for caesarean section. The global trend has been a change from general anaesthesia to subarachnoid block for caesarean section. Routine use of subarachnoid block for caesarean section puts Nigeria in the rightful place in contemporary anaesthetic practice.

There are clear benefits to the neonate. Bupivacaine crosses the placental barrier in insignificant amount. Hence, the early neonatal depression associated with agents used for general anaesthesia is uncommon with subarachnoid block. Indeed, the profile of good neonatal outcome has provoked discussion elsewhere on the need for the presence of a paediatrician at every caesarean delivery. The good neonatal outcome may put less burden on the paediatricians in our centre and the limited facilities in the special care baby unit. This is an advantage in our hospital and the West African subregion in terms of materials and personnel.

CONCLUSION:
This study evaluated the place of subarachnoid block for operative obstetric with a view to determining its place in obstetric anaesthetic practice in our hospital. General anaesthesia and subarachnoid block were compared in a prospective, randomized fashion to demonstrate the efficacy of subarachnoid block as an effective and safe alternative for caesarean section. The attitude of mothers and perioperative physician-care providers were also evaluated. Subarachnoid block resulted in better Apgar scores in neonates, lower maternal blood loss and longer period to request for analgesia than general anaesthesia. Maternal hypotension and postdural puncture headache were associated with subarachnoid block. The perioperative physician care providers and mothers were favourably disposed to the use of subarachnoid block for caesarean section. The findings indicate that subarachnoid block is a safe and effective alternative to general anaesthesia for caesarean section. Therefore, women for caesarean section should be offered subarachnoid block as an alternative technique for caesarean section.
REFERENCES:
1. Vandam LD. On the origin of intrathecal anaesthesia. International Anesthesiology Clinic 1987; 27: 2-7
14. Imarengiaye CO, Otoide VO, Ande AB, Obiaya MO. Anaesthesia Related Complications following Caesarean Delivery necessitating Intensive Care Unit


30. Rout CC, Rocke DA, Gouws E. Leg elevation and wrapping in the prevention of hypotension following spinal anaesthesia for elective caesarean section. Anaesthesia 1993; 70: 672-22.
31. Vandam LD, Dripps RD. Long term follow-up of patients who received 10098 spinal anaesthetics: Syndrome of decreased intracranial pressure headache and ocular and auditory difficulties. JAMA 1956; 161: 586-91

61
63. McLure J, Cooper G. Fifty years of Confidential enquiries into maternal deaths in the United Kingdom: Should anaesthesia celebrate or not? IJOA 2005; 14: 87-9
71. Reynolds F, Seed PT. Anaesthesia for caesarean section and neonatal acid-base status: a meta-analysis
75. Emmett RS, Cyna AM, Andrew M, Simmons SW. Techniques for preventing hypotension during spinal anaesthesia for caesarean section. Cochrane Database Syst Rev 2001; 3: CD 002251.0


89. Riley ET. Spinal anaesthesia for caesarean delivery: keep the pressure up and don’t spare the vasoconstrictors Br J Anaesth 2004; 92: 459-61.


95. Liu SS, McDonald SB. Current issues in spinal anaesthesia. Anesthesiology 2001; 94: 888-906.


APPENDIX A
Dear Colleagues,

This questionnaire survey is meant to document your views on the subject of study. Please, provide honest responses. Thank you for your cooperation.

1. Age…………………………………………………………
2. Sex…………………………………………………………
3. Specialty………………………………………Position………………
4. Qualification(s)/Dates(s)…………………………………………………
5. Number of years practice in your specialty………………………………
6. What do you perceive to be the commonest complaints of women coming for caesarean section…………………………………………………………
7. What methods of anaesthesia have you heard or read about?
   a. Local infiltration
   b. Ketamine anaesthesia
   c. General anaesthesia
   d. Subarachnoid (spinal) anaesthesia
   e. Epidural anaesthesia
8. What method have you seen in use (tick as appropriate) a, b, c, d, e,
9. How do you rate these methods? (0—useless, 10—most useful)
   a.  
   b.  
   c.  
   d.  
   e.  

10. Which method do you think is most efficacious? a, b, c, d, e,

11. Would you like to try other methods? Yes / No

12. What is your opinion about the use of subarachnoid (spinal) anaesthesia for elective caesarean section routinely? Agree/disagree/strongly disagree/no opinion

13. Why do you feel this way?........................................................................

14. Why do you think subarachnoid block is not routinely used in UBTH
   a. No personnel/manpower
   b. No materials
   c. Too many complications
   d. Too expensive
   e. Time consuming

15. (a). Do you think there are benefits from the use of subarachnoid block for caesarean sections? Yes / No
   (b). Specify……………………………………………………………………

16. Which neonates have a faster/smooth period of neonatal resuscitation? (Tick as appropriate) (a) General anaesthesia (b) Spinal anaesthesia

17. Which of these techniques do you perceive to be more expensive? (Tick as appropriate) (a) General anaesthesia (b) Spinal anaesthesia

18. From your experience, in which of these techniques do you think toxicity to mother or neonate is more likely? (Tick as appropriate) (a) General anaesthesia (b) Spinal anaesthesia

19. Do you think the technique of anaesthesia affects morbidity and mortality pattern following caesarean section? Yes / No

20. Which of these techniques has poorer mortality or morbidity? (Tick as appropriate) (a) General anaesthesia (b) Spinal anaesthesia

21. Are there advantages of general anaesthesia?
   Specify……………………………

70
22. Do you think subarachnoid (spinal) anaesthesia has advantages?
   Specify……………………………………………………………………………………

23. Which of these techniques will you prefer for your patients? (a) General anaesthesia (b) Spinal anaesthesia.