

# Neonatal Apgar Score Outcomes in Spinal Versus General Anaesthesia at the University Teaching Hospital (UTH), Lusaka

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## ABSTRACT

**Background:** The knowledge gap was from the fact that the type of anaesthetic drug administered during caesarean section can have effects on a neonatal outcome like low Apgar score with most hospitals in developed countries now using more modern inhalational anaesthetic agents with fewer or no cardio-respiratory depressant effects, e.g. Isoflurane or Sevoflurane. However, at UTH, halothane is still being used for maintenance of general anaesthesia despite well documented cardio-respiratory depressant effects with very limited research done on its effects on the neonatal Apgar score. The Apgar score is a means of rapid evaluation of the physical condition of infants shortly after birth. Thus this study investigated the effects of general anaesthesia with halothane versus spinal anaesthesia on the neonatal Apgar score.

**Objective and study design:** With the view of determining the type of anaesthesia administered during caesarean section with the least effects on neonatal wellbeing shortly after birth, a prospective observational cohort study was conducted at the University Teaching Hospital between May 2015 and January 2016. The scientific objective was to determine the effects of general anaesthesia with halothane versus spinal anaesthesia on the neonatal Apgar score. This study involved 70 neonates, 54 were born from mothers that had undergone caesarean section under spinal anaesthesia and 16 from mothers that had undergone general anaesthesia.

The data was analysed using SPSS version 16.0. Inferential analysis was conducted using logistic regression.

**Results:** 20 neonates out of 54 (37%) in the spinal anaesthetic group had an Apgar score of less than 8 at 1 minute<sup>[Fig 1]</sup>. Out of the 16 neonates in the general anaesthesia group, 14 (87.5%) had an

Apgar score of less than 8 at 1 minute<sup>[Fig 1]</sup>. One (1.9%) neonate had an Apgar score of less than 8 at 5 minutes in the spinal anaesthesia group. While 4 (25%) neonates had Apgar score less than 8 in the G.A. group<sup>[Fig2]</sup>

The logistic regression at 1 minute Showed that it is over 11 times more likely to get a low Apgar with a general anaesthetic as compared to a spinal anaesthetic (OR 11.9), <sup>[Table 3]</sup>.

The Apgar score at 1 minute in the Spinal anaesthesia group was statistically significantly higher than the general anaesthesia group ( $p=0.002$ ). The logistic regression at 5 minutes Showed that it is over 17 times more likely to get a low Apgar with a general anaesthetic as compared to a spinal anaesthetic (OR 17.7), <sup>[Table 4]</sup>. The 5 minutes Apgar score in the spinal anaesthesia group was statistically significantly higher than the general anaesthesia group ( $p=0.014$ ), <sup>[Table 4]</sup>.

**Conclusion:** With the results pointing to the fact that there is a significant difference in neonatal Apgar score outcomes in spinal versus general anaesthesia, the researcher, therefore, rejected the null hypothesis. Therefore, it is inferred that the spinal anaesthesia method has better neonatal outcomes by Apgar score measure than general anaesthesia method.

**Keywords:** Apgar score, Halothane, General anaesthesia and Spinal anaesthesia

## BACKGROUND

### Introduction and literature review

Caesarean delivery cases have been steadily increasing in recent times. The national caesarean section rate in Zambia is not documented, but the University Teaching Hospital rate was 20.6% in 2007<sup>[1]</sup> and 25% in 2016. Choice of regional or general anaesthesia for caesarean delivery depends among others on the expertise of the

anesthesiologist, the past medical history of the patient, choice of the patient, indication and urgency of the caesarean section [2]. Regional anaesthesia is safer for the mother and has been highly advocated for because of difficulties in airway management in pregnant women leading to difficult intubation and thus increasing maternal mortality [3].

General anaesthesia can be carried out using different anaesthetic drugs. Most of the drugs affect the baby in two ways: direct effect from placental drug transfer and indirect effect resulting from maternal physiological and biochemical changes, which appear to be much more important. They may produce systemic effects in the baby like sedation, resulting in a low Apgar score. Present anaesthetic techniques limit the dose of intravenous agents such that fetal depression is usually not clinically significant. Drugs used for spinal anaesthesia cause a sympathetic blockage, resulting in vasodilatation and hypotension, which can reduce maternal foetal circulation and compromise the baby and cause low Apgar scores but this hypotension treated well may reduce effects on the neonate [4].

In 1952, Dr Apgar an obstetric anaesthesiologist proposed the Apgar score as a means of rapid evaluation of the physical condition of infants shortly after the birth. When properly applied, it is a tool for standardised assessment. It also provides a mechanism to record foetal-to-neonatal transition. The scores are taken at 1 and 5 minutes after delivery. Of the two scores, the 5 minutes score is regarded as the better predictor of survival in infancy in the long term. However, the 1-minute score definitely has the value for assessing the effects of different drugs given to the mother during the Caesarean section. This method is even more appealing because it is non-invasive [4].

Both the mother and the neonate's outcome should be considered when choosing regional or general anaesthesia for caesarean delivery. The case fatality rate for Caesarean delivery was higher in the case of general anaesthesia than regional anaesthesia [5].

Most hospitals in high-income countries are now using more modern inhalational anaesthetic agents with fewer or no cardio-depressant effects, e.g. Isoflurane or Sevoflurane. However, at UTH, halothane is still widely used to maintain general anaesthesia and in much higher percentages despite

well-documented cardio depressant effects with minimal research regarding its effects on neonatal Apgar scores [4].

The type of anaesthetic administered during caesarean section can have effects on neonatal outcome. At UTH, halothane is still being used for maintenance of general anaesthesia during caesarean sections despite its well documented cardio-respiratory depressant effects. There has been limited research on neonatal Apgar score outcomes with general anaesthesia using halothane. In the study of Zagorzycki<sup>[6]</sup> and Aftab<sup>[7]</sup>, a lower percentage of halothane was used because nitric oxide was also used to maintain anaesthesia. However, at UTH there is no nitrous oxide, and thus levels of halothane used to maintain anaesthesia are higher, i.e. 1 to 2 % which increases the cardio depressant effects thus this study aims to bridge that knowledge gap, and the findings will help to give guidance to policymakers concerning the type and mode of anaesthetic agents which are safest for the mother and baby in our setting.

## MATERIALS AND METHODS

This was a prospective observational cohort study conducted at the University Teaching Hospital in Lusaka, Zambia. The study site was the department of obstetrics and gynaecology for eight months.

The American Society of Anaesthesiologists (ASA) physical status classification is a system for assessing the fitness of patients before surgery. It has six categories with ASA I being normal healthy patients and ASA II being patients with a mild systemic illness, e.g. controlled hypertension. The target population were neonates born to ASA I or ASA II mothers undergoing urgent or elective caesarean deliveries with no prior fetal compromise admitted to UTH at or greater than 37 weeks gestation. Emergency caesarean sections were excluded from the study.

Data were collected by the use of a structured questionnaire administered by the principal researcher with the help of research assistants who were trained on how to collect the data: Maternal age, gestational age, type of anaesthesia administered (spinal or general anaesthesia), and Apgar score (at 1 minute and 5 minutes), whether neonate went to the ward with mother or to neonatal intensive care were recorded.

The sample size was calculated using the power command in Stata version 13 with parameters derived from a study by Reynolds and Seed<sup>[17]</sup>:

At 80% power, two-sided T-test and 5% significance level with 8:1 ratio of spinal versus general anaesthesia, a total sample size of 54 was obtained with 48 in the spinal anaesthetic group and 6 in the general anaesthetic group.

However, the duration of the study was extended by four (4) months in order to capture more patients for the general anaesthesia group, which were less common in occurrence and thus the sample size was 70, i.e. 54 in the spinal group and 16 in the general anaesthetic group.

The data was analysed using SPSS version 16.0. Inferential analysis was conducted using logistic regression.

The dependent variable was the Apgar score, and the independent variables were spinal anaesthesia and general anaesthesia.

Ethical clearance was gotten from ERES CONVERGE.

## RESULTS

A total of 70 neonates were included in the study (54 in the spinal anaesthetic group and 16 in the general anaesthetic group) 20 neonates out of 54 (37%) in the spinal anaesthetic group had an Apgar score less than 8 at 1 minute<sup>[Fig 1]</sup>. Out of the 16 neonates in the general anaesthesia group, 14 (87.5%) had an Apgar score of less than 8 at 1 minute (Fig 1). One (1.9%) neonate had an Apgar score of less than 8 at 5 minutes in the spinal anaesthesia group. While 4 (25%) neonates had Apgar score less than 8 in the G.A. group<sup>[Fig 1]</sup>.

The logistic regression at 1 minute Showed that it is over 11 times more likely to get a low Apgar with a general anaesthetic as compared to a spinal anaesthetic (OR 11.9), [Table 3].

The Apgar score at 1 minute in the Spinal anaesthesia group was statistically significantly higher than the general anaesthesia group ( $p=0.002$ ). The logistic regression at 5 minutes Showed that it is over 17 times more likely to get a low Apgar with a general anaesthetic as compared to a spinal anaesthetic (OR 17.7), [Table 4]. The 5 minutes Apgar score in the spinal anaesthesia group was statistically significantly higher than the general anaesthesia group ( $p=0.014$ ), [Table 4].

## DISCUSSION

In the spinal anaesthetic group, at 1 minute, 37% of the neonates had Apgar scores less than 8<sup>[Fig 1]</sup>. For the 5 minute Apgar score, in the G.A. group, 25% of neonates had an Apgar score of less than eight compared to 1.9% neonates with an Apgar score less than 8 in the S.A. group, <sup>[Fig 2]</sup>.

The 5 minute Apgar score is regarded as a better predictor of survival in infancy in the long term. Thus S.A. has lesser effects on the neonatal Apgar score at 5 minutes.

In this study, G.A. resulted in a higher number of neonates with Apgar score less than 8 at 1 minute<sup>[Fig 1]</sup> and 5 minutes<sup>[Fig 2]</sup>, i.e. 87, 5% and 25% respectively compared to S.A. which had 1 minute<sup>[Fig 1]</sup> Apgar scores of less than 8 of 37% at 5 minutes<sup>[Fig 2]</sup> and 1.9%.

The logistic regression at 1 minute Showed that it is over 11 times more likely to get a low Apgar with a general anaesthetic as compared to a spinal anaesthetic (OR 11.9), [Table 3].

The Apgar score at 1 minute in the Spinal anaesthesia group was statistically significantly higher than the general anaesthesia group ( $p=0.002$ ). The logistic regression at 5 minutes Shows that it is over 17 times more likely to get a low Apgar with a general anaesthetic as compared to a spinal anaesthetic (OR 17.7), [Table 4]. The 5 minutes Apgar score in the spinal anaesthesia group was statistically significantly higher than the general anaesthesia group ( $p=0.014$ ), [Table 4].

This finding is different from the study that compared G.A. anaesthetic with halothane versus epidural anaesthesia on neonatal Apgar score outcome by Zagorzycki<sup>[6]</sup> in which it was concluded that there was no difference in terms of mean Apgar score at 1 minute and 5 minutes in both the G.A. and S.A. groups.

The difference in the research outcomes of this study and the study carried out by Zagorzycki <sup>[6]</sup> in the G.A. group can be attributed to a higher percentage of halothane, 1-2% was used in the maintenance of anaesthesia in this study despite its well-documented cardio depressant effects.

Controlling for the other variables in the multiple logistic regressions at 5 minutes<sup>[Table 5]</sup> for this research was considered inappropriate and attempted to demonstrate results thereof were only for information's sake to highlight the limitation of this study. The main problem was that of very small numbers of patients in the category groupings,

i.e. low APGAR group at 5 minutes, five patients with Spinal Anaesthesia and low APGAR; only four with a General Anaesthesia and low APGAR score. This was considered from the general understanding that you need at least ten patients in each group per factor to attempt the multiple regressions. Therefore, no conclusions could be inferred from this regard at 5 minutes.

### Conclusion

With the results pointing to the fact that there is a significant difference in neonatal Apgar score outcomes in spinal versus general anaesthesia, the researcher, therefore, rejected the null hypothesis. Therefore, it is inferred that the spinal anaesthesia method has better neonatal outcomes by Apgar score measure than general anaesthesia method.

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## TABLES AND FIGURES FOR THE STUDY DATA ANALYSIS

Table 1: Ratio of general anaesthesia versus spinal anaesthesia

Type of Anaesthesia		
	Frequency	Per cent (%)
General Anaesthesia	16	22.9
Spinal Anaesthesia	54	77.1
<b>Total</b>	<b>70</b>	<b>100</b>

Table 2: Type of Anaesthesia – Indication for caesarean section Cross tabulation

Urgent		Indication for caesarean section		Total
		Elective		
Type of Anaesthesia	GA	13 (81.2%)	3 (18.8%)	16 (100.0%)
	SA	39 (72.2%)	15 (27.8%)	54 (100.0%)
Total		52 (74.3%)	18 (25.7%)	70 (100%)

Table 3: Logistic regression at 1 minute

	B	Std. Error	p-value	OR	95% C.I. for OR	
					Lower	Upper
Anaesthesia	2.477	0.807	0.002	11.900	2.448	57.843

Note: OR=Odds ratio

Table 4: Logistic Regression at 5 minutes

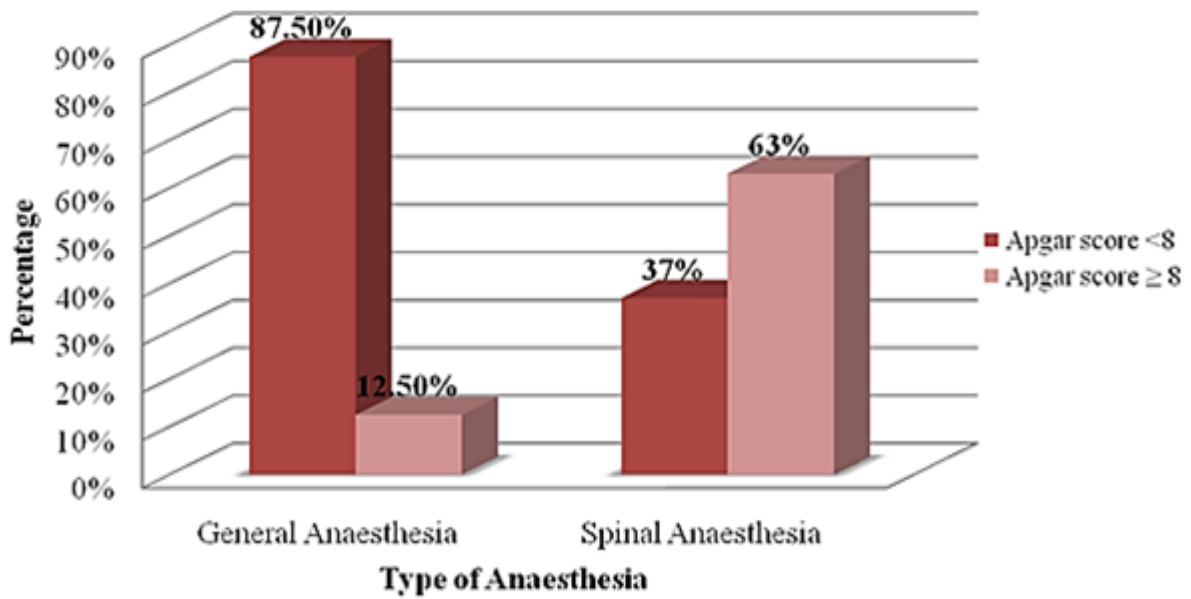
	B	Std. Error	p-value	OR	95% C.I. for OR	
					Lower	Upper
Anaesthesia	2.872	1.163	0.014	17.667	1.809	172.571

Note: OR=Odds ratio

Table 5: Multiple Logistic Regression at 1 minute

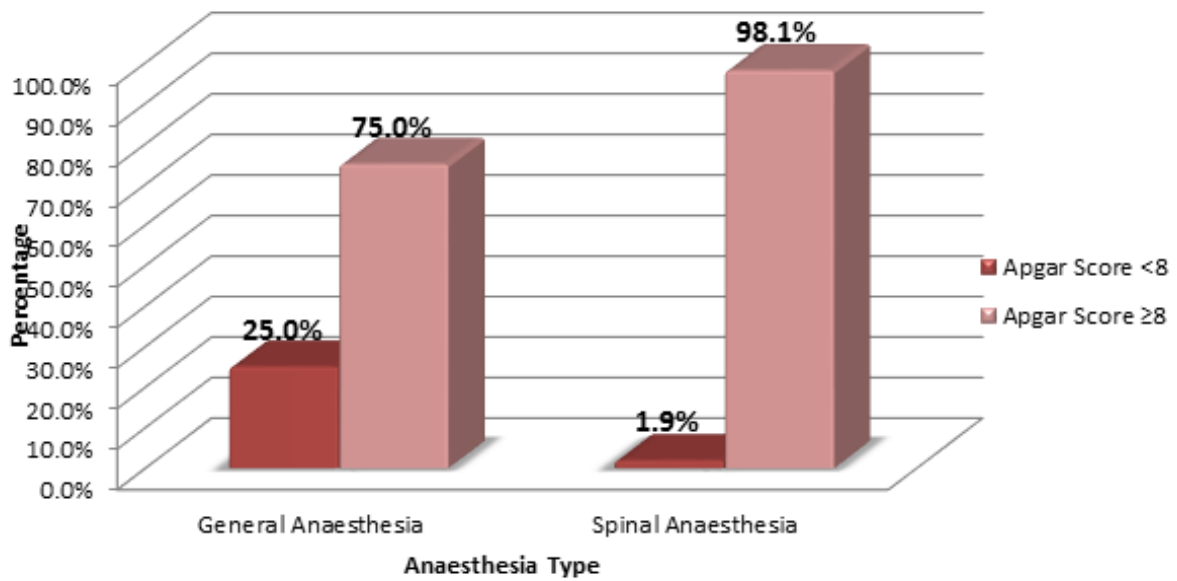
	B	St.Error	Wald	p-value	Exp(B)	95.0% C.I. for EXP(B)	
						Lower	Upper
Type of Anaesthesia	2.872	0.875	10.777	0.001	17.666	3.181	98.108
Time (Incision to Delivery)	-0.126	0.107	1.390	0.238	0.881	0.714	1.087
Gestation Age	0.127	0.141	0.804	0.370	1.135	0.861	1.496
Age of Mother	0.064	0.062	1.042	0.307	1.066	0.943	1.204
Indication for surgery	0.010	0.631	0.000	0.987	1.010	0.293	3.483
Parity	-0.103	0.249	0.172	0.679	0.902	0.553	1.470
Constant	-10.978	6.212	3.123	0.077	0.000		

**Apgar Score at 1 minute versus Type of Anaesthesia**



**Figure 1: Apgar score at 1 minute versus type of anaesthesia**

**Apgar Score at 5 minutes versus Type of Anaesthesia**



**Figure 2: Apgar score at 5 minutes versus the type of anaesthesia**