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The Study of the Model to Predict Incidence of Epidural Anaesthesia Conversion to General Anaesthesia using Pulse Oximetry Technology during Lower Segment Caesarean Section Surgery

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Abstract: ***Currently lumbar epidural is considered to be the gold standard in anaesthesia practice Elements involved in epidural anaesthesia procedure were generally individual to the patient's anatomy, epidural catheter location and response to the medications.. The total of 160 parturients undergoing epidural anaesthesia for lower segment caesarean section LSCS were enrolled in this mono centric study. Parturients were in the range of age 16 -45 years old with ASA 1, II and II involved in the study. Data categorized on phenomenological, physiological, and emotional experience were measured to determine the contributing factors for epidural failure. Visual analogue pain scores VAPS, Brommage scale and perfusion index PI were used as instrument to assess epidural block. Demographic characteristic did not influenced epidural failure, while physiological factors referring to duration of labour (P < 0.05) & perfusion index PI (P < 0.05) at parameter value of 3.99 ± 0.44 contributed to the epidural failure. Elements of emotional experience such as Visual Analogue Pain Score (P < 0.05), Bromage Scale (P < 0.05), Restlessness and patchy block were significantly contributed to the epidural failure. Epidural failure of 3.8% in this study was lowered compared to previous study up to30.0%. Perhaps new heuristics in new Transition Policy Anaesthesia Analysis TAPA can be developed for bridging the gaps in determination of failure for epidural anaesthesia especially for caesarean section. Future direction Technology advances should be used as way to predict epidural failure such as Transcutaneous Electrical Nerve Stimulation (TENS). Ultrasound imaging of the spine could be proposed to facilitate identification of the epidural space and predict difficult spine score, especially in women with abnormal lumbosacral anatomy (scoliosis) and those who were obese. It should be a good level of success in the ultrasound-determined insertion point and very good agreement between ultrasound depth (UD) and needle depth (ND).***

Keywords: Pulse Oximetry/Capnograph, Perfusion Value Index SpO2, Epidural Failure, Lower Segment Caesarean Section LSCS, Epidural Anaesthesia/Lumbar Epidural Anaesthesia

1. Introduction

The controversy about the effect of epidural anaesthesia for Lower Segment Caesarean Section LSCS was perhaps the oldest in the history of obstetric anaesthesia. The provision of effective epidural anaesthesia was one of the key components of active management for LSCS and being believed the most effective method of pain relief. As pain might have adverse effects on the psychological and should not be over looked particularly due to emotional experiences for parturient mothers and their family. Parturient who would give birth within their socio cultural context, could have affectedby the psychosocial and physiologic perceptions of pain. In classical anthropologic studies of childbearing pain in labor and childbirth was expected by women in all societies, but may be interpreted, perceived, and responded to differently. Thus, pain experiences by childbearing parturient are described based on a secondary analysis of narrative data from phenomenological studies of the meaning of childbirth. Pain is a culturally defined physiologic and psychosocial experience. Pain is also considered the oldest medical problem and the universal physical affliction of mankind, yet it has been little understood in physiology until very recently. The components of philosophical, political, and religious meanings of pain defined the suffering of individuals for much of human history. The decision to have an epidural anaesthesia for caesarean section CS is usually made after discussion with anaesthetist and obstetrician and parturient. Although the choice is normally made up by parturient, the anaesthetist and obstetrician may recommend an epidural anaesthesia for medical reasons

Why did this epidural anaesthesia failure happened during LSCS surgery? Could it be managed during mid LSCS surgery, or did the anesthesiologist had their hands tied when epidural anaesthesia failure occurred?.In the context of human factor, epidural anaesthesia was preferred over general anesthesia for most caesarean-sections because birth was a special moment for the family and that most parturients would prefer to be awake for the birth of their child. A study explored by Chen et al (2013) about opinions and concerns of pregnant women on epidural anaesthesia in a relatively deprived area in the immigrant city of Shenzhen, China. Several issues were identified to reflect the current situation after epidural anaesthesia service had been implemented in this maternity and child health hospital. A prospective audit had been associated with improved rates for neuraxial anaesthesia and reduced need for conversion to general anaesthesia in all but category-1 caesarean sections. An awake parturient also allows the presence of a support person to newly born baby. In clinical context, there was no globally-accepted definition of epidural failure; this leaded to wide differences in reported failure rates. Another clinical context was the distribution of sensory blockade after epidural injection of local anaesthetic LA varies widely among individuals, and might only be partially predicted based upon known factors.

As cited by Lirk (2014). failure of epidural anaesthesia and analgesia occurs in up to 30% in clinical practice. As described by Thangamuthuetal (2013) there was no globally-accepted definition of epidural failure; this leads to wide differences in reported failure rates. A heuristic epidural failure was standardised based on emergency situations and non-obstetric anaesthesiologists that could be responsible for epidural anaesthesia failure. Switching to general anaesthesia (GA) and failure to use labour epidural for surgical anaesthesia during LSCS is considered a failure of epidural anaesthesia. At this stage there is a need to develop a predictive model for the epidural failure among parturients who are undergoing lower segment caesarean section LSCS. The utilitarian philosophy of pain perception also from the religious writer perspectives, had called anesthesia as a violation of God's law.

The philosophical group and clergy whom believed inflicted pain to strengthen faith and to teach the parturients the need for self-sacrifice. But then in this new paradigm, anaesthesia for much of the 21st century, the practice of epidural was a "calculus" to determine the correct benefit from the use of anesthesia. Pain was the oldest medical/surgical problem and the universal physical affliction of mankind. Yet it had been little understood in epidural anaesthesia physiology that pain contributed to agony of epidural failure. The introduction of epidural anesthesia was one of the great revolutions of modern anaesthesia practice and also there was an extended debate on successful rate. This salience of pain during epidural anaesthesia was a problem which needs new theoretical perspective as well as innovation in predicting failure model. In bigger prospective, epidural anaesthesia as one of technique in regional anaesthesia could be regarded as superior to general anaesthesia for caesarean section for both the parturient and the baby.

With a greater understanding and further research, obstetric epidural anaesthesia for caesarean section would play an even greater role to optimise the care of the parturient during caesarean delivery. Perhaps at the same time, the metaphor of the utilitarian dialectic pleasure was balanced against pain to determine the good of society in epidural anaesthesia practice rejected. A part from that, speculation that the Roman dictator Julius Caesar was born by the method now known as caesarean section C-section is apparently false. Nonetheless, even if the etymological hypothesis linking the caesarean section to Julius Caesar is a false etymology, it had been widely believed. Therefore, the aim of this study was to explore incidence and predictors for epidural anaesthesia failure in the contemporary practice base on clinical biometrics, anthropometric and specifically perfusion index for early recognition of reliable assessment and epidural surgical anaesthesia adequacy.

2. Material and Methods

This study was conducted inLabour Room Hospital Raja PermaisuriBainun to evaluate the value of perfusion index PI in early detection of epidural anaesthesia failure for parturient mothers scheduled for lower segment caesarean section LSCS surgery. Parturient mothers planned for elective and emergency LSCS and undergoing epidural anaesthesia chosen as samples of this study. The sample size was calculated based on Yamane formula $n = N / (1 + Ne^2)$ Where n = corrected sample size, N = population size, and e = Margin of error (MoE), e = 0.05 based on the research condition. The calculated sample size and the power of study was achieved a power of 80% and detected a difference of p-value less than 0.05.The total population of parturients undergoing lower segment caesarean section LSCS during the study period was 271parturients. Hence the required samples size were160parturients calculated using Yamane formula. LSCS Surgery would not been begun until loss of sensation to ethyl chloride spray/pin prick/fine touch with cotton achieved bilaterally to maximum level T7.The parturient would be accepted for this the study if the block did not reach the level T7 within 30 min or with an additional study drug injected and 45 min after the 3rd dose. For this perspective, both successful and epidural anaesthesia failure groups were accepted for this study. World Federation of Societies of Anaesthesiologists (2001) recommended that height of block suitability for LSCS surgery at T6-T7. Motor block been assessed bilaterally using the modified Bromage scale: 1 = no paralysis (full flexion of hip, knee and foot), 2 = unable to flex hip (able to flex knee and ankle), 3 = unable to flex knee (able to flex foot only), 4 = unable to flex hip, knee or ankle joint. Motor block assessments will not be made during LSCS surgery.

Sampling of the study was done through wide range of age group of all parturient mothers undergoing epidural anaesthesia. The researcher used combination of clinical observational and interventional methods for parturient mothers undergoing for LSCS and examined achievable of satisfactory level of epidural anaesthesia after epidural puncture plus insertion of Tuohy epidural needle and catheter including the injection of drugs used. The Universal Convenience Sampling was used to gather a valid representing of the total populations within the time frame of collecting data. The total population of parturient mothers undergone LSCS were 271 within the period of 1st January to 12th July 2017.

3. Instrumentation

A checking list as an observation proforma for LSCS Epidural Anaesthesia was used to collect the data in exploring factors contribute to the satisfactory level of epidural anaesthesia for parturient mothers planned for elective and emergency LSCS. As clinical practice, a pulse oximeter also been used as continuous monitoring plus as predictor to measure values of peripheral capillary oxygen saturation SpO_2 for the epidural anaesthesia effectiveness. The perfusion index PI was monitored and recorded at 0, 5, 10, 15, and 20 min after epidural anaesthesia commenced.

4. Statistics

Statistical analyses were performed using SPSS® version 24.0. Data that collected and computed were represented as mean (±standard deviation) for quantitative variables and percentages for qualitative variables. Distribution of perfusion index PI was subjected to normality test ($P < 0.05$). The point-biserial correlations were used for examining the association between mean PI and epidural

failure incidence/successful epidural anaesthesia using independent T Test. Three variables Bilateral Somatosensory Block Evaluation, Visual Analogue Scale VAS. Bromage Scale were tested with Chi Square in relation to epidural failure and successful epidural anaesthesia.

5. Results and Discussion

A total of hundred and sixty (n = 160) parturient involved in this study. This was from N = 271 of the total population of parturient undergone epidural anaesthesia during the period of data collection 21st January till 10 of July 2017. The mean age of parturient participated in this study was 28.03 with a standard deviation of ± 5.48. The minimum and maximum ages were 16 and 45 years respectively. Parturient with successful epidural anaesthesia reported to have mean age of 27.96 ± 5.47 where as those with epidural failure that needed conversion to general anaesthesia was 29.83 ± 6.11.

At this particular incident, it was observed also that mean parity was 0.86 ± 1.22. On the other hand, successful epidural group had mean parity of 0.76 ± 1.17 and epidural conversion group to general anaesthesia was 1.00 ± 1.10. The mean epidural needle inserted was 4.45 ± 0.75 cm with minimum of 4.00 and maximum of 10.00 cm. The mean epidural needle insertion for successful group was 4.45 ± 0.76 and for epidural conversion group 4.50 ± 0.45 cm.

Table 1: Mean for Contextual Predictors for successful and failure group of epidural – Independent T -Test

Contextual Predictors - Mean	Successful epidural (n = 154, 96.2%) Mean ± SD	Epidural Conversion to GA (n = 6, 3.8%) Mean ± SD	Mean Difference and 95% confidence interval	*P*-value
Mean maternal age	27.96 ± 5.47	29.83 ± 6.11	1.87(-0.64 to 6.38)	0.41
Parity	0.76 ± 1.17	1.00 ± 1.10	0.24(-0.71 to 1.20)	0.62
Epidural needle depth to skin (cm)	4.45 ± 0.76	4.50 ± 0.45	0.05(-0.57 to 0.67)	0.87

Only three (n = 3, 1.9%) cases of parturient having bony obstruction from successful epidural group and non from conversion group. There were all together 20 cases that having difficulty in threading epidural needle. It comprised of eighteen (18) cases, (11.2%) from successful epidural group and two (2) cases, 1.3%) from conversion group. Therefore it brought together 140 cases without difficulty in threading needle catheter whereby (n = 136, 85.0%) from successful group and (n = 4, 2.5%) from conversion group.

Table 2: Technical – phenomenological aspect for successful and failure group of epidural – Chi Square Test

Technical Predictors	Successful epidural (n=154,96.2%)	Epidural Conversion to GA (n= 6, 3.8%)	*P*-value
Bony Obstruction			
a. Yes	3 (1.9%)	0 (0.0%)	0.73
b. N0	151 (94.3%)	6 (3.8%)	
Total	154 (96.2%)	6 (3.8%)	
Difficulty in Threading Needle Catheter			
a. Yes	18 (11.2%)	2 (1.3%)	0.12
b. N0	136 (85.0%)	4 (2.5%)	
Total	154 (96.2%)	6 (3.8%)	

From physiological category data, it was found that 50 (31.3%) parturient were induced for labour. They consisted of (n = 48, 30.0%) from successful epidural and (n = 2, 1.3%) from conversion of epidural to general anaesthesia. The number of parturient undergone epidural anaesthesia without induction of labour was 110 (68.7%) whereby 106 cases (66.2%) was observed from successful epidural group epidural and four (4) cases (2.5%) from epidural conversion to general anaesthesia group were not induced for labour.

The total number of bloody tap occurred (n = 8, 5.0%) in successful group of epidural anaesthesia as compared to nil (n = 0, 0.0%) from epidural anaesthesia failure group. Therefore, the total number of non bloody tap incident was 152 (95.0%) and it was only occurred in successful group of epidural anaesthesia.

Table 3: Physiological elements for successful and failure group of epidural - Chi Square Test

Contextual Predictors	Numbers of Successful Epidural Anaesthesia (n, %)	Conversion of Epidural Anesthesia to General Aanaesthesia (n, %)	Asymptotic Significance (2-sided)
Induction of Labour			
a. Yes	48 (30.0%)	2 (1.3%)	0.91
b. No	106 (66.2%)	4 (2.5%)	
Total	154 (96.2%)	6 (3.8%)	
Bloody Tap			
a. Yes	8 (5.0%)	0 (0.0%)	0.57
b. No	146 (91.2%)	6 (3.8%)	
Total	154 (96.2%)	6 (3.8%)	

Independent T–Test was used to analyse the continuous physiologic data. It was quite obvious that, maternal mean duration of labour(measured in minutes) was much shorter 688.88 ± 256.32 (mean ± SD) in successful group of epidural anaesthesia as compared to epidural failure group 885.0 ± 97.11 (mean ± SD) with P value less than 0.05 (P = 0.01). Mean maternal Perfusion Index PI proven to be

higher in successful epidural group 4.65 ± 0.10 (mean ± SD). Maternal mean Perfusion Index PI proven to be lower in unsuccessful epidural group that needed conversion to general anaesthesia 3.99 ± 0.44 (mean ± SD) with P value less than 0.05 (P = 0.00).

Mean maternal blood lost was slightly higher volume measured in milliliter 520.09 ± 55.46 (mean ± SD) in successful epidural group as compared to epidural failure group 500.00 ± 53.19 (mean ± SD) with P value more than 0.05 as P = 0.39. Mean maternal Oxygen saturation SpO_2 was almost equivalent in successful epidural group with 98.30 ± 0.25 (mean ± SD) when compared to epidural failure with value of 98.28 ± 0.29 (mean ± SD).

The mean maternal initial Blood Pressure Systolic (S)) / Diastolic (D) at the level of 131.53 (S) / 80.25 (D) ± 16.55 (S) / 9.95 (D) for the successful epidural group. While the mean maternal initial Blood Pressure Systolic (S)) / Diastolic (D) for the failed epidural anaesthesia group that needed conversion to general anaesthesia was recorded as 134.17 (S) / 84.83 (D) ± 10.48 (S) / 9.96 (D) ± 10.48 (S) / 9.96 (D) with P value = 0.70 (Systolic) / P = 0.27 (Diastolic). Mean maternal initial base pulse rate as recorded per minute 84.77 ± 10.50 for successful epidural anaesthesia group and for epidural anaesthesia group 87.33 ± 11.36 with P = 0.56. Regarding to mean maternal haemoglobinHbgm %, it was recorded at the level of 12.13 ± 0.65 for successful epiduralanaesthesia group and 11.88 ± 1.00 for epidural failure anaesthesia group with P value 0.37. Pertaining to maternal mean arterial pressure, it was found that 97.35 ± 10.92 which slightly lower for successful epidural anaesthesia group when compared to epidural failure anaesthesia group as recorded at the level of 101.28 ± 8.18 with P value of 0.39. On the aspect of mean parturient temperature at the level 36.52 ± 0.98 for successful epidural anaesthesia group and at the level of 36.07 ± 1.44 for the epidural anaesthesia failure group with P value of 0.27.

Table 4: Monitored physiological elements for successful and Failure group of epidural Independent T - Test

Contextual Predictors - Mean	Successful epidural (n = 154, 96.2%) Mean ± SD	Epidural Conversion to GA (n = 6, 3.8%) Mean ± SD	Mean Difference and 95% confidence interval	*P*-value
Maternal Mean Duration Of Labour In Mins	688.88 ± 256.32	885.0 ± 97.11	196.14(-11. 65 to 403.93)	0. 01
Maternal Mean Perfusion Index PI	4.65 ± 0.10	3.99 ± 0.44	- 0.66(-0.76 to -0.55).	0.00
Maternal Mean Blood Lost	520.09 ± 55.46	500.00 ± 53.19	-20.09(-65.62 to 25.43)	0.39
Maternal Mean Spo2	98.30 ± 0.25	98.28 ± 0.29	-.02(-0.22 to – 0.19)	0.62
Mean Maternal Initial Blood Pressure Systolic (S) / Diastolic (D)	131.53 / 80.25 ± 16.55 / 9.95	134.17 / 84.83 ± 10.48 / 9.96	2.63(-10.84 to 16.11) / 4.57(-3.56 to 12.71)	0.70 (S) / 0.27 (D)
Maternal Initial Base Pulse Rate	84.77 ± 10.50	87.33 ± 11.36	2.57(-6.09 to 11.22)	0.56
Maternal Hbgm %	12.13 ± 0.65	11.88 ± 1.00	-0.25(-0.79 to 0.30)	0.37
Maternal Mean Arterial Pressure	97.35 ± 10.92	101.28 ± 8.18	3.92(-4.99 to 12.84)	0.39
Mean Parturient Temperature	36.52 ± 0.98	36.07 ± 1.44	-0.45(-1.27 to 0.37)	0.27

The method of bilateral somatosensory block evaluation two minutes interval applied to check for the assessment of effectiveness of epidural anaesthesia. Pin prick was the common technique applied as such for the successful epidural anaesthesia n = 77 (48.1%) and for the epidural anaesthesia failure n = 6 (3.8%). At this particular issue, seventy five parturient (n = 75, 46.9%) was not applied with any technique to assess the effectiveness of epidural anaesthesia. Ethyl Chloride Spray n = 1 (0.6%) and fine touch with cottonn = 1 (0.6%) were applied for the successful group of epidural anaesthesia. Ethyl Chloride Spray and fine touch with cotton were not applied for the epidural anaesthesia failure group. There was no correlation of using pin prick, Ethyl Chloride Spray and fine touch with cotton or without any testing for the bilateral somatosensory block evaluation as P value more than 0.05 (P = 0.12) in determination of successful or failure of epidural anaesthesia. Pain was evaluated by using a 0-10 cm Visual Analogue Scale VAS. Majority of parturient n = 136 (85.0%) in successful group epidural anaesthesia attained Scale 1 for VAS. It was followed by attaining Scale 2 of VAS (n = 18, 11.2%) for successful group epidural anaesthesia and nil of parturient attained Scale 3 for this successful epidural anaesthesia group. For epidural anaesthesia failure group, one parturient (0.6%) attained Scale 1, one parturient (0.6%) attained Scale 2 and four parturient (2.6%) attained Scale 3. It was revealed that quite significant Visual Analogue Scale as P = 0.00 that might influence the successful or failure of epidural anaesthesia,

Bromage score based on four grade criteria degree of block were analysed for right and left lower limb in this study. For the right lower limb, number of parturient in successful group of epidural anaesthesia(n = 94, 58.7%) achieved free movement of leg and foot and n = 2 (1.3%) for the failed epidural anaesthesia group. Second criteria that was just able to flex knee with free movement of right foot n = 10 (6.2%) achieved this criteria for the successful group of epidural anaesthesia and n = 2 (1.3%) achieved this criteria for the group of failure epidural anaesthesia. The third criteria of Bromage scale for the right lower limb, it was found n = 4 (2.5%) achieved the level of unable to flex knee but with free movement of foot for the successful group of epidural anaesthesia and n = 1 (0.6%) for the epidural anaesthesia failure group. The fourth criteria of Bromage scale for the right lower limb, the number of parturient in successful group of epidural anaesthesia n = 46 (28.8%) achieved unable to move leg or foot and n = 1 (0.6%) in epidural anaesthesia failure group achieved unable to move leg or foot.

For the left lower limb, number of parturient in successful group of epidural anaesthesia (n = 93, 58.0%) achieved free movement of leg and foot and n = 2 (1.3%) for the failed epidural anaesthesia group. Second criteria that was just

able to flex knee with free movement of left foot n = 10 (6.3%) achieved this criteria for the successful group of epidural anaesthesia and n = 2 (1.3%) achieved this criteria for the group of failure epidural anaesthesia. The third criteria of Bromage scale for the right lower limb, it was found n = 5 (3.1%) achieved the level of unable to flex knee but with free movement of foot for the successful group of epidural anaesthesia and n = 1 (0.6%) for the epidural anaesthesia failure group. The fourth criteria of Bromage scale for the right lower limb, the number of parturient in successful group of epidural anaesthesia n = 46 (28.8%) achieved unable to move leg or foot and n = 1 (0.6%) in epidural anaesthesia failure group achieved unable to move leg or foot. The P value of 0.02 Bromage score based on four grade criteria degree of block right limb among parturient demonstrated significant difference. Similarly the P value of 0.03 Bromage score based on four grade criteria degree of block left limb among parturient demonstrated significant difference.

Table 5: Emotional Experiences Category in Relation to Epidural Anaesthesia that Needed Conversion to GA based on Chi Square Test. Data expressed as number and Percentage – Chi Square Test

Contextual Predictors	Numbers of Successful Epidural Anaesthesia (n, %)	Conversion of Epidural Anesthesia to General Aanaesthesia (n, %)	Asymptotic Significance (2-sided)
The Method of Bilateral Somatosensory Block Evaluation Two Minutes Interval			
Ethyl Chloride Spray	1 (0.6%)	0 (0.0%)	0.12
Fine Touch With Cotton	1 (0.6%)	0 (0.0%)	
Pin Prick	77 (48.1%)	6 (3.8%)	
Not applicable	75 (46.9%)	0 (0.0%)	
Total	154 (96.2%)	6 (3.8%)	
Visual Analogue Scale			
Scale 1	136 (85.0%)	1 (0.6%)	0.00
Scale 2	18 (11.2%)	1 (0.6%)	
Scale 3	0 (0.0%)	4 (2.6%)	
Total	154 (96.2%)	6 (3.8%)	
Bromage Score Based on Four Grade Criteria Degree of Block Right Limb			
Free Movement of Leg and Foot	94 (58.7%)	2 (1.3%)	0.02
Just Able To Flex Knee With Free Movement of Foot	10 (6.2%)	2 (1.3%)	
Unable To Flex Knee But With free Movement of Foot	4 (2.5%)	1 (0.6%)	
Unable To Move Leg or Foot	46 (28.8%)	1 (0.6%)	
Total	154 (96.2%)	6 (3.8%)	
Bromage Score Based on Four Grade Criteria Degree of Block Left Limb			
Free Movement of Leg and Foot	93 (58.0%)	2 (1.3%)	0.03
Just Able To Flex Knee With Free Movement of Foot	10 (6.3%)	2 (1.3%)	
Unable To Flex Knee But With free Movement of Foot	5 (3.1%)	1 (0.6%)	
Unable To Move Leg or Foot	46 (28.8%)	1 (0.6%)	
Total	154 (96.2%)	6 (3.8%)	

The controversies about the factors determining the epidural anaesthesia failure were not fully understood as might due to inappropriate methodology or sample size of previous studies. Based on Chia et al (2015), they carried out a retrospective cohort study on epidural anesthesia for hundred and eight parturient (n = 108) undergoing cesarean section with the illustration of n = 11 (11.1%) failure rate. These percentage of failure rate came from various variation as indicated by Samina Ismail et al (2015) from their observational study revealed that epidural anaesthesia failure to achieve surgical anesthesia in 6.8% (n = 12/176). Another study done by Hermanides et al (2012) claimed that epidural anaesthesia& analgesia failure reached up to 30.0% in clinical practice. However in our study, it was found that the failure rate only n = 6, (3.8%) from the total number of parturient (n = 160) undergone caesarean section. This finding was very contrary with suggestion by The Royal College of Anaesthetists (2012) that less than 3.0% of epidural anaesthesia cases should need conversion to general anaesthesia as only 0.8% exceeded.

At the same times, the controversies about the factors determining the epidural anaesthesia failure covered very limited issues as what previous studies displayed. In fact, Chia et al (2015) could not prove demographic characteristics influenced the epidural anaesthesia failure. Our study also could not prove demographic characteristics influenced the epidural anaesthesia failure. As what found by Chia et al (2015) mean age (years) were 31.4 ± 4.12 with P value of 0.69. They did not analysed mean age for successful epidural and epidural anaesthesia failure as what done by us. In our data mean maternal age were 27.96 ± 5.47 for successful epidural and 29.83 ± 6.11 for epidural failure with P value of 0.41. From our descriptive statistic, it was found that mean age of our samples were 28.03 ± 5.48 slight younger than mean age group from Chia et al (2015) samples. Again, it was so difficult to make assumption that age influenced the epidural anaesthesia failure.

There was no concrete reference data in analyzing the effect of parity on the successful or epidural anaesthesia failure. Muppuri et al (2012) studied for factors of risk potential independent epidurals failure among 502 parturients for labour. In their study they indicated that n = 171 (34.1%) were nulliparous and n = 331 (65.9%) were primiparous. It was not so cleared whether parity affected the successful epidural anaesthesia. For this particular aspect, we found our respondents n = 89 (55.6) were nulliparous, n = 32

(20.0%) were primiparous and n = 39, (24.4%) were multiparous.

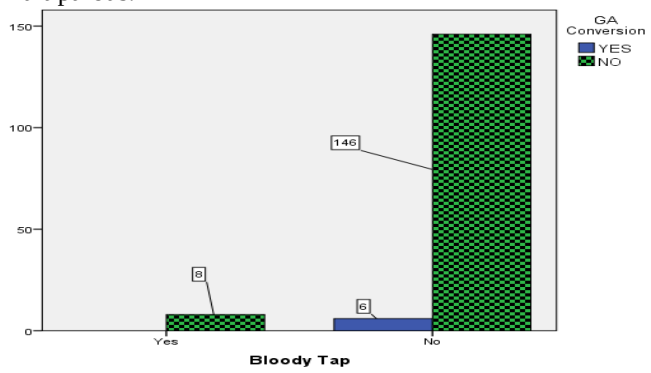

Figure 1: Incidence of bloody tap

At our setting, the mean duration for labour among successful group of epidural anaesthesia was 688.88 ± 256.32 and for epidural anaesthesia failure group was 885.0 ± 97.11. In other word, it could be said that the successful group of epidural anaesthesia slightly lomger as compared to epidural anaesthesia failure group. It really significant when P = 0.01 that showed duration of labour influenced the effectiveness of epidural anaesthesia. A study carrried out by Kathuria&Sapkal (2016) latent phase prolongation for nullipara was 21 hours and for multipara was about 12 hours. We calculated that those parturient with nullipara status took duration of 731.7 minutes (12.2 hours) and those with multipara 585.0 minutes (9.8 hours). It was very curious such big difference between our finding and Kathuria&Sapkal (2016) finding.

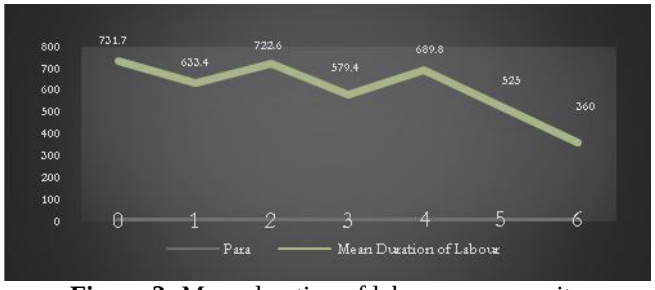

Figure 2: Mean duration of labour versus parity

Looking at the maternal mean perfusion index, Ho-Shiang et al (2014) made an assumption that the oximeter probe (Masimo Corp., Irvine, CA, USA) projects infrared light through the tissue bed of the finger tip and could assess peripheral perfusion. The pulse oximeter perfusion index (PI) had been used to indicate sympathectomy-induced vasodilatation. Ginosar et al (2009) hypothesized that pulse oximeter perfusion index PI provided an earlier and clearer indication of sympathectomy following epidural anesthesia than skin temperature and arterial pressure. Both of them studied on forty patients received lumbar epidural catheters. Patients were randomized to receive either 10 ml 0.5% bupivacaine or 10 ml 0.25% bupivacaine. PI in the toe, mean arterial pressure (MAP) and toe temperature were all assessed at baseline and at 5, 10 and 20 min following epidural anesthesia. The effect of epidural anesthesia over time was assessed by repeated measures analysis of variance. Additionally, they defined clinically evident sympathectomy criteria (a 100% increase in the PI, a 15% decrease in MAP and a 1 degrees C increase in toe temperature).

The numbers of patients demonstrating these changes for each test were compared using the McNemar test for each time point. Both of them satisfied that PI was an earlier, clearer and more sensitive indicator of the development of epidural-induced sympathectomy than either skin temperature or MAP. At our setting we had a proof of similar trend with Zifeng at al (2013) Perfusion Index in pediatric caudal block under basal ketamine anesthesia. Their trend of PI in Group I increased by 363 ± 318% and 778 ± 578% at 5 min and 20 min after caudal block, while no significant changes in MAP and HR were found compared to the baseline before caudal block. Thus, PI provided an earlier, more objective, and more sensitive indicator to assess the early onset of epidural anaesthesia effectiveness for parturient undergoing caesarean section. As what we saw figure 3 perfusion index, became useful indicator in early detection for epidural block during caesarean section. From this perspective, no conversion group epidural anaesthesia increasing in trend of perfusion index PI as compared to conversion group of epidural anaesthesia to general anaesthesia.

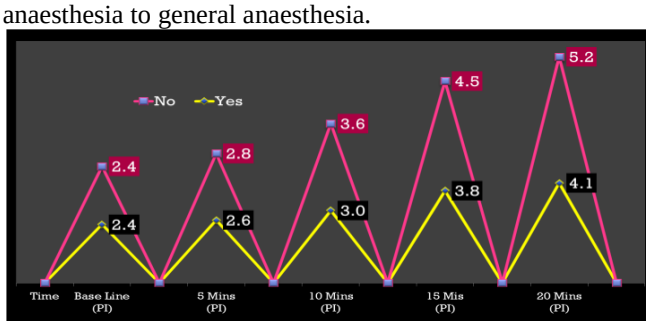

Figure 3: Perfusion index trend between successful epidural and epidural failure group

Overall perception from us, caesarean section an extremely safe operation. Most of the serious complications associated with cesarean sections were not due to the operation itself but from blood lost. In fact hypotension could occur due the blood lost during caesarean section which could affect peripheral vascular tone. A study done by Toyama et al (2013) about perfusion index derived from a pulse oximeter and the incidence of hypotension during spinal anaesthesia for caesarean section delivery. They revealed baseline perfusion index PI correlated with the degree of decreases in systolic and mean arterial pressure (r¼0.664, P,0.0001 and r¼0.491, P¼0.0029, respectively) due to sympathetic blockade and decreased cardiac output due to blood pooling in blocked areas of the body. Our study did not focused on the incidence of hypotension and we were focused on the incidence of blood lost. Basically in our study, the bleeding incidences were well controlled with mean blood lost for parturient undergoing caesarean section as illustrated in the table below (Table 7). Mean blood lost in the conversion group (n=6, 500.00 ± 53.20 ml) and no conversion group (n=154, 520.10 ± 55.46 ml).

Table 7: Comparison of Blood Lost Between Conversion and No Conversion Group

	GA Conversion	n	Mean	Std. Deviation
Total Blood Lost	Yes	6	500.00	53.20
	No	154	520.10	55.46

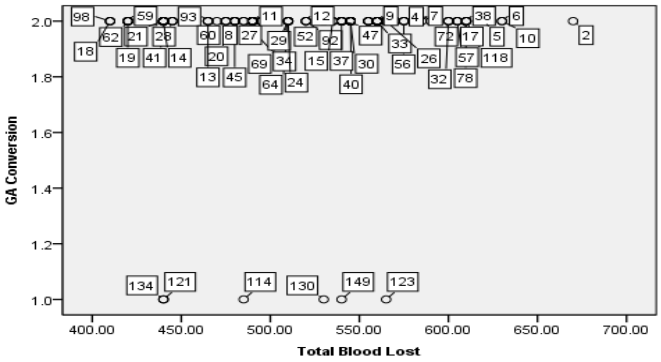

Figure 4: Distribution of Blood Lost Between Conversion And No Conversion Group

We also observed the amount of blood lost did not influence the mean perfusion index. As most probably, in our study the bleeding phenomena well controlled based on Anova test p > 0.05, p = 0.95. Khan et al (2006) conveyed the message that the calculated blood loss based on patient's blood volume and drop in Hct was 787 +/- 519 ml. Heesen et al. (2013) found a significant difference in the amount of blood loss associated with epidural anesthesia compared with that associated with general anaesthesia GA. In our study there was no significant difference in term of amound blood lost between conversion and no conversion group of parturients undergoing caesarean section when p = 0.39, p > 0.05 based on Anova test. Blood lost also did not influenced the perfusion index based on Spearman correlation when p > 0.05, p = 0.51.

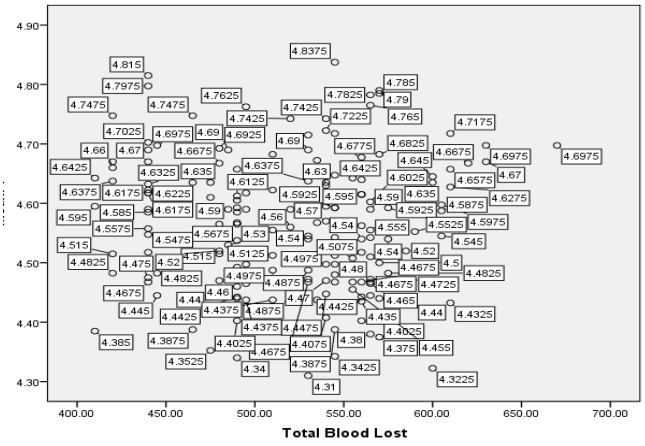

Figure 5: Total Blood Lost versus Perfusion Index

As described by Lima et al (2002) poor peripheral perfusion was defined as a capillary refill time >2 secs and central-to-toe temperature difference > or = 7 degrees C. Lima et al (2002) measured Peripheral perfusion index and arterial oxygen saturation by using the Philips Medical Systems Viridia/56S monitor. Lima et al (2002) discovered the distribution of the peripheral perfusion index was skewed and values ranged from 0.3 to 10.0, median 1.4 (inner quartile range, 0.7-3.0). They found a significant correlation between the peripheral perfusion index and the core-to-toe temperature difference was found (R2=.52; p <.001). At our result, increasing temperature did not increase mean Oxygen saturation as P = 0.36 was not correlated at all.

Table 8: Oxygen saturation SpO_2

Parturient	Pulse Oximeter Oxygen Saturation SpO2							
Temperature	97.2	97.8	98.0	98.2	98.3	98.6	98.9	Total
33.2	0	2	0	3	3	4	0	12
36.0	0	1	0	2	1	0	1	5
36.1	0	0	0	3	0	1	0	4
36.2	0	0	0	2	2	1	0	5
36.3	0	0	0	1	0	0	0	1
36.4	0	1	0	2	1	1	0	5
36.5	0	0	0	2	0	2	0	4
36.6	0	0	0	1	2	0	0	3
36.7	0	0	1	14	10	13	0	38
36.8	0	4	0	12	10	16	0	42
36.9	1	4	0	3	3	7	0	18
37.1	0	1	0	7	4	2	0	14
37.6	0	1	0	6	2	0	0	9
Total	1	14	1	58	38	47	1	160

Lima et al (2002) claimed that changes in peripheral perfusion index and changes in core-to-toe temperature difference correlated significantly (R =.52, p <.001). Speights (2017) in his clinical studies in adult and pediatric patients demonstrated that an increase in PI is an early indicator of general and epidural anaesthesia which occurred before the onset of the anaesthetic effect due to peripheral vasodilatation. Masimo Corporation (2016) stressed that detection of a spike in PI was a sign to the successful onset of anaesthesia. Thus according to Speights (2017), conversely, no increase in perfusion index PI in a patient given anaesthesia that might be an early warning of anaesthetic failure. Therefore, as an objective indicator of pain levels in patients, the PI had been used to determine proper management of pain, especially in patients unable to communicate their discomfort to the anaesthesiologist.

Touching on blood pressure as haemodynamic changes, it was found that there was no correlation at all as P = 0.07 influencing Oxygen saturation. We tested with Chi square on relation whether any significant difference between successful epidural and epidural failure group. It was recorded that systolic blood pressure/diastolic blood pressure 134.17/84.83 mmHg slightly higher as compared to successful epidural group 131.53/80.25 mmHg. The physiologic changes of pregnancy, including an initial gradual increase in cardiac output, followed by the development of increasing aortocaval compression in the third trimester, as well as comorbidities such as preeclampsia, have generated considerable research into maternal hemodynamics (Dyer and James, 2008). Both of them studied the effects of epidural analgesia (anaesthesia) in labor. They suggested that heart rate and noninvasive blood pressure measurement, as well as communication with the awakening parturient during regional (epidural) anesthesia, remain the most important monitors for the obstetric anesthesiologist.

Simuyu (2015) also confirmed the conversion rate among patients who lost more than 1 litre of blood was significantly (Z-test p-value <.001) higher than the conversion rates among patients who lost blood between 0.5 and 1 litre. This is probably due to complications like post-partum haemorrhage that resulted in longer surgeries hence the conversions in this group. Catarci et al (2016) study lacked of data on mean arterial pressure MAP whereas in

our setting we also focused on mean arterial pressure reading. Our mean arterial pressure slightly lowered for successful epidural group as compared to epidural group failure (97.35 ± 10.92 versus 101.28 ± 8.18). The higher reading of mean arterial pressure MAP might be due to pain sensation. Sen et al (2016) studied on epidural anesthesia specifically referred to safe option for cesarean section in parturient with severe pulmonary hypertension. They illustrated following caesarean section surgery with blood pressure BP 112/58 mmHg, MAP 73 mmHg, PR 110/min, SpO2 100%. This was considered good finding to substantiate with our research data.

The method of bilateral somatosensory block evaluation was done through pin prick, fine touch with cotton and Ethyl Chloride Spray. These were the common practice globally. Pain block in obstetric epidural anesthesia was usually accompanied by relatively persistent retention of motor power; however, the reason for this was not entirely clear. Pin prick were the most popular used to determine the height of sensory block. Conversion among parturients n = 6 in this study came from the group tested through pin prick. The reasons for conversion were due to restlessness and patchy block. With sensory height of T 10 - T 8 with pin prick testing became questionable as at this height still epidural failure occurred. It was among paturients with sensory height of between of between T 12 - T 11 and T 7 – T 6 required no conversion to general anaesthesia. The study done by Simiyu (2015) on regional anaesthesia covering the aspect of epidural anaesthesia addressed that conversion rates among patients with sensory height less than T5 was 11 (6.2%). Whereas among parturient with sensory height of between of between T5 and T10 it was 16 (4.4%). While those with sensory height of more than T10 was 4 (12.5%). This finding could not support our result as contrary with finding. There was no statistical significance (Chi-square test P - value = 0.126) in conversion rates among patient's sensory height. Conversion occurred in patients who had adequate block at first mainly as a result of prolonged surgery. In our setting we had similar opinion with Simiyu (2015) that no statistical significance (Chi-square test P-value = 0.19) in conversion rates among patient's sensory height

Regarding the Visual Analogue Scale VAS as displayed below. Pain was evaluated using a 0-10 cm visual analogue scale (VAS) before, 15 and 30 min after the loading dose followed by hourly assessment until delivery. VAS score assessment was based specifically on abdominal or back pain resulting from contractions. Failed epidural is defined as VAS score ≥5, 30 min after a loading dose, given after the last attempt. Women who had a repeated attempt due to VAS ≥5 at 30 min or dural puncture or required repositioning of the catheter, resulting in subsequent pain relief expressed as VAS score <5 were not considered to have a Failed epidural. VAS score is assessed by obstetrician and not the anesthesiologist who performed the block. Furthermore, intrapartum vaginal examinations to assess cervical dilatation and fetal head station were also performed by experienced obstetrician

The conversion rate according to Bromage Scale (Right Limb) was; Scale 1 (n = 2, 1.3%), Scale 2 (n – 2, 1.3%), Scale 3 (0.6%) and Scale 4 (n = 1, 0.6%). The conversion rates varied significantly (Chi-square test P-value < 0.05) with motor grading. The conversion rate according to Bromage Scale (Leftt Limb) was; Scale 1 (n = 2, 1.3%), Scale 2 (n – 2, 1.3%), Scale 3 (0.6%) and Scale 4 (n = 1, 0.6%). The conversion rates varied significantly (Chi-square test P-value < 0.05) with motor grading. Kimuyu (2015) conversion rate according to Bromage Scale was; grade 0 (0%), grade 1 (40%), scale 2 (7.7%) and scale 3 (3.8%). He persuaded the conversion rates varied significantly (Chi-square test p-value < .001) with motor grading. One thing that we missed to understand his finding was analysis not done for both limbs.

The final discussion in this study was the conceptual framework could be fitted as new heuristics in new Transition Policy Anaesthesia Analysis TAPA can be developed for bridging the gaps in in determination of failure for epidural anaesthesia especially for caesarean section. Only two elements of physiological factors mean duration of labour and maternal mean perfusion index PI at parameter of 3.99 ± 0.44 contributed to epidural failures. In terms of emotional experiences, we detected three elements contributed to epidural failure such as visual analogue pain score VAPS, Bromage scale, restlessness and patchy block contributed to epidural failure. It was good to say that we managed to calculate mean perfusion index PI at parameter of 3.99 ± 0.44 contributed to epidural failures among parturients undergoing caesarean section when international data still not published.

Only physiological and emotional components contributed to epidural failure in which technology components assimilated into perfusion index became factors that contributed to epidural failure for caesarean section. Therefore, Pulse Oximetry Modalities became predictor for failed epidural among parturient mothers undergoing Lower Segment Caesarean Section LSCS. Our first hypothesis that there was no significant difference in term of failed epidural anaesthesia between category of Body Mass Index among parturient mothers undergoing Lower Segment Caesarean Section LSCS accepted when Chi square value 4.73 with P value 0.38 with Monte Carlo Sig. (2-sided) with degree of freedom 5 as displayed below. Our second hypothesis was there any relation between failed and successful epidural pertaining to perfusion index PI value among parturient mothers undergoing lower segment caesarean section LSCS also accepted. As we can refer below Chi square value 160.00 with P value 0.03 with Monte Carlo Sig. (2-sided) with degree of freedom 116

6. Conclusion

There was still a gap in relation to epidural study on rate of failure. It was an expectation that low rates of conversion of labour epidural anaesthesia to general anaesthesia GA for caesarean section occured. Phenomenological data did not contribute to the epidural failure. Certain components of physiological data such as duration of labour contributing to epidural failure and perfusion index showed positive correlation contributing as predictor for epidural effectiveness. While conversion of epidural anaesthesia to general anaesthesia GA implied an inadequate labour

anaesthesia and reliable assessment of adequacy of surgical anaesthesia was necessary. It was hoped that perfusion index PI monitoring would warrant further exploration for other clinical anaesthesia applications where information on peripheral perfusion or circulatory status would be useful. The traditional predictor psychosocial/emotional experience of visual analogue scale VAS still existed as predictor for epidural failure together with assessment using Bromage scale. It was a valid reason to belief that duration of labour, restlessness and patchy block became heuristic of indicator as well as predictor for epidural anaesthesia failure.

Potential future applications and research utilization findings included of the success and epidural anaesthesia failure based on that perfusion index PI values at parameter of 3.99 ± 0.44 as a value for predictive model also as new heuristic model. Some technical factors also expected to increase the primary and secondary success rate. Perfusion Index was considered as a technical tool available and had sufficient accuracy and predictability with a growing evidence-base to justify evaluating sympathetic tone or responsiveness in clinical anaesthesia practice. There was still a gap there at 23.2% for epidural failure when Hermanides et al (2012) described 27.0% for lumbar epidural and our study came out with the small rate of 3.8% among parturients undergoing LSCS. Therefore, this could be used asnew heuristics in new a Transition Policy Anaesthesia Analysis TAPA for bridging the gaps in determination of failure for epidural anaesthesia especially for lower segment caesarean section LSCS.

7. Recommendation

Future direction Technologic advances should be used as way to predict epidural failure. Transcutaneous Electrical Nerve Stimulation (TENS) should be used rather than using pin prick and fine touch with cotton for epidural effectiveness testing. Ultrasound imaging of the spine had recently been proposed to facilitate identification of the epidural space and predict difficult spine score, especially in women with abnormal lumbosacral anatomy (scoliosis) and those who were obese. There for we would like to propose perfusion index PI values derived from pulse oximeter be used as a parameter in determination of epidural failure among LSCS parturient mothers.

8. Limitation of the study

We could not have nerve stimulator something like Transcutaneous Electrical Nerve Stimulation (TENS) and ultrasound guided regional anesthesia techniques in order to reduce migration epidural needle during caesarean section. It was supposed to reduce the risk of epidural failure and increase the benefits of this kind of anesthesia (epidural anaesthesia)

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