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ORIGINAL ARTICLE

Outcome of Deliveries Following Labour Epidural Analgesia in a Malaysian Teaching Hospital

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ABSTRAK

Kesan "analgesia epidural" ketika bersalin (LEA) masih tidak jelas samada ianya akan menjejaskan kaedah bersalin. Oleh itu, tujuan kajian adalah untuk menentukan sama ada LEA dikaitkan dengan peningkatan kadar kelahiran secara caesarean (CD) atau memerlukan bantuan alat bersalin melalui faraj (VAD). Ini ialah satu kajian kohort retrospektif yang menganalisis rekod kelahiran dan LEA secara berturut-turut dari Januari hingga April 2021. Caesarean elektif dikecualikan. Pesakit dibahagikan kepada kumpulan LEA dan "non-labour epidural analgesia" (NLEA). Hasil yang diukur ialah cara bersalin yang dinyatakan sebagai CD, VAD atau bersalin secara spontan melalui faraj (SVD). Sejumlah 262 kelahiran memenuhi kriteria kemasukan. Bersalin faraj spontan lebih ketara diperhatikan di dalam kumpulan NLEA (LEA 2(1.5%) vs NLEA 79(60.3%), p<0.001) berbanding ibu mengandung yang memilih LEA mempunyai lebih banyak VAD dan CD (LEA VAD 60(45.8%) vs NLEA VAD 4(3.1%), p<0.001; LEA CD 69(52.7%) vs NLEA CD 48(36.6%), p=0.013 masing-masing). Faktor risiko yang dikaitkan dengan CD dianalisis menggunakan model regresi logistik (LR). Analisa univariat menunjukkan bahawa LEA dan pariditi 0 dikaitkan dengan peningkatan risiko untuk CD manakala analisis multivariat menunjukkan LEA adalah faktor risiko bebas untuk CD. Ibu bersalin dalam kumpulan LEA mempunyai hampir dua kali ganda risiko untuk bersalin secara CD [nisbah odds terlaras 1.973(1.116-3.486), p=0.047]. Kesimpulannya, LEA dikaitkan dengan peningkatan kadar CD dan VAD.

Kata kunci: Analgesia epidural; bersalin dengan bantuan melalui faraj; kelahiran; pembedahan caesarean

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ABSTRACT

Effects of labour epidural analgesia (LEA) on mode of delivery is unclear. We aimed to establish if LEA was associated with increased rate of caesarean delivery (CD) or vaginal assisted delivery (VAD). This retrospective cohort study analysed the birth and LEA records consecutively from January until April 2021. Elective CDs were excluded. Paturients were divided into LEA and non-labour epidural analgesia (NLEA) groups. Outcomes measured were mode of deliveries stated as CD, VAD or spontaneous vaginal delivery (SVD). A total of 262 deliveries met the inclusion criteria. Spontaneous vaginal deliveries were significantly observed more in NLEA group (LEA 2(1.5%) vs NLEA 79(60.3%), p<0.001) whereas LEA group had significantly more VADs and CDs (LEA VAD 60(45.8%) vs NLEA VAD 4(3.1%), p<0.001; LEA CD 69(52.7%) vs NLEA CD 48(36.6%), p=0.013 respectively). The risk factors associated with CD were analysed using logistic regression (LR) models. Univariate showed that LEA and parity 0 was associated with increased risk for CD while multivariate analysis showed LEA was an independent risk factor for CD. Parturient in LEA group had almost twice the risk to have CDs [adjusted odds ratio 1.973(1.116-3.486), p=0.019]. In conclusion, LEA is associated with increased rate of CDs and VADs.

Keywords: Caesarean section; epidural analgesia; labour; vaginal assisted delivery

INTRODUCTION

Pain relief during labour is effectively provided via labour epidural analgesia (LEA) and is widely used in reducing labour pain (Bannister-Tyrrell et al. 2014; Naito et al. 2019; Zhang et al. 2001). To date, it is controversial as to whether LEA increases the risk of caesarean delivery (CD) (Bannister-Tyrrell et al. 2014; Halliday et al. 2022; Zhang et al. 2001). Most of the previous studies concluded that LEA was associated with a longer second stage thus increased the likelihood of CD (Gaiser 2005; Nguyen et al. 2021). Some studies have shown that women with LEA administration were more likely to have a CD for dystocia and foetal distress (Anim-Somuah et al. 2018; Decca et al. 2004; Eriksen et al. 2011; O'hana et al. 2008; Yamamoto et al. 2023), whereas other studies reported that LEA did not affect the CD rate (Gaiser 2005; Kearns & Lucas 2023). Many randomised controlled trials (RCTs) have been conducted to address this question. A meta-analysis reported that LEA does not increase the rate of CD. However, this Cochrane review showed inconsistent results due to high rates on non-compliance that included studies that crossed over from non-epidural arm to epidural arm (Anim-Somuah et al. 2018).

Malaysia has a population of 32.7 million in the year of 2021 (Salameh et al. 2020). The yearly number of

deliveries in peninsula Malaysia is about 380,000 and the remaining numbers in East Malaysia (Sabah and Sarawak) makes the estimation of 500,000 in total (Chan & Ng 2000). At the start of the last decade, the rate of rise for CD in Malaysia had increased 3% over the first 5 years (2011-2015) from 21.8% to 25.3% (Karalasingam et al. 2020), which the rate continued to gradually rise towards the end of the decade (2018-2020) to 28.4% to 29.6% (Jeganathan et al. 2021). This is of concern as it carries inherent risks of mortality and morbidity for both the mother and baby (Eriksen et al. 2011; Penuela et al. 2019). If LEA is a risk for progression of labour, withholding epidural analgesia unnecessarily denies the parturient of pain relief (Halpern et al. 1998; Kearns & Lucas 2023). On the other hand, if LEA increases the risk of CD, the parturient should be informed of the risk (Halpern et al. 1998; Shatil & Smiley 2020).

There seem to be conflicting results about the outcome of deliveries which concerns anaesthetists, obstetricians and parturient. Studies designed to address this conflict is yet to be found in Malaysia. Therefore, the aim of this study was to investigate the association between LEA and CD in parturient who delivered in a tertiary teaching hospital.

MATERIALS AND METHODS

This was a 4-month (January to April 2021) retrospective comparative observational study on parturient who had delivered at Hospital Canselor Tuanku Muhriz (HCTM) with gestational age of ≥ 37 weeks. Ethics approval for this study was obtained from the Medical Research & Ethics Committee, HCTM (FF-2022-037, UKM PPI/111/8/JEP-2022-021). Parturient who were planned for elective CD were excluded.

Methodology

The Birth Registry and Epidural Labour Analgesia Registry were accessed consecutively over the study duration. The medical records of the deliveries and anaesthetic records were consecutively selected over the study duration and reviewed. Data collected were entered into a computerised database, cross tabulated, using an individualised identification number per patient. Data collected were maternal variables, such as gestational weeks, gravidity, parity, concomitant disease, age, weight, height, body mass index (BMI) at the onset of labour. Data related to the deliveries were also collected like mode of delivery which were spontaneous vaginal delivery (SVD), vaginal assisted delivery (VAD) or CD. The data were grouped into parturient who received LEA and those did not (NLEA). Dropout criteria were registries with incomplete data and these data were excluded from data analysis.

In our institution, LEA services have always been available and provided by anaesthesiologists. LEA would have been offered to parturient when they are in active labour and performed under aseptic technique following the anaesthesiologist and obstetrician examination. The test dose of 3 ml

of local anaesthetic was administered following insertion of epidural catheter and aspiration test. Once the test dose is negative, further 5-6 mls of 0.25% levo-bupivacaine or 0.2% ropivacaine will be given. Epidural analgesia was maintained with infusion local anaesthetic and patient controlled epidural analgesia (PCEA, 0.1% levobupivacaine with 2 g/ml fentanyl at 6-10 ml/hour) as decided by the attending anaesthetist.

Post epidural, for close monitoring, the anaesthesiologists are assisted by a dedicated anaesthetic team that consists of the anaesthetic trainee and an epidural nurse. An anaesthetic team will also monitor the conduct of labour along with the midwives and obstetrician. Labour progresses were monitored by monitoring the uterine contraction, foetal heart rate with cardiotocography and pelvis examination. After delivery, epidural catheter was removed by the anaesthetic team after evaluation. Flow chart of the study was shown in Figure 1.

Parturient who did not opt for LEA, other options of labour analgesia were offered and provided. The options were opioid based pharmacological

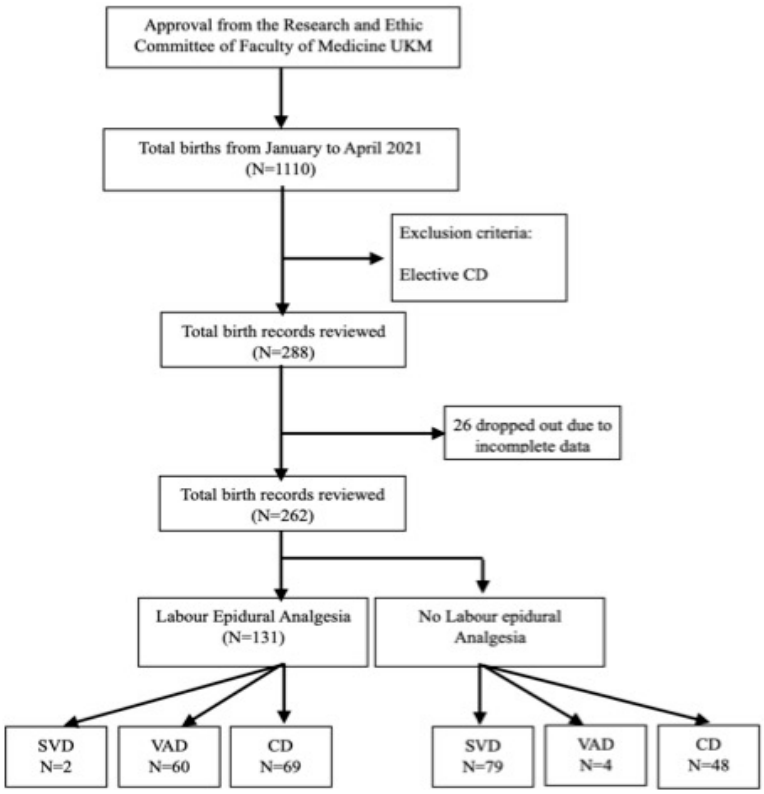

FIGURE 1: Overview of data collection process (CD: Caesarian delivery; VAD: Vaginal assisted delivery; SVD: Spontaneous vaginal delivery)

analgesia that were administered as either intramuscular pethidine prescribed by the obstetricians or patient controlled analgesia remifentanil prescribed by anaesthesiologists with specific indications. Inhaled analgesic Entonox was also an option.

Sample Size Calculation

This was a study of independent cases (LEA) and controls (NLEA) with 1 control(s) per case(s). We calculated that we had to study 131 parturient that received LEA and 131 who did not with assumption of exposure probability of 0.08 among those who did not receive LEA and 0.20 among those who did to be able to reject the null hypothesis with power of 0.80. The Type I error probability associated with this test of this null hypothesis was 0.05. This null hypothesis was evaluated using the uncorrected chi-squared statistic. Estimated dropout rate of 10% = (131+131) x 10% = 26. Therefore, we needed to review 288 medical records of parturient.

Calculation (Fleiss et al. 1981):

$$m' = \frac{\left[c_{\alpha/2}\sqrt{(r+1)\bar{P}\bar{Q}} - c_{1-\beta}\sqrt{rP_1Q_1 + P_2Q_2} \right]^2}{r(P_2 - P_1)^2}$$

$$m = \frac{m'}{4}\left[1 + \sqrt{1 + \frac{2(r+1)}{m'r|P_2 - P_1|}} \right]^2$$

m = n1 = size of sample from parturient who received LEA = 130
n2 = size of sample from parturient who did not receive LEA = 130
P1 = proportion of LEA = 0.077
P2 = proportion of NLEA = 0.195
α = "Significance" = 0.05
β = chance of not detecting a difference = 0.2 r = n2/n1 = ratio of LEA to NLEA = 1
1-β = Power = 0.8
P = (P1+rP2)/(r+1)
Q = 1-P

Data Analysis

For continuous variables (maternal age, body weight, height and maternal BMI), data were expressed as mean ± standard deviation. Categorical data such as pregnancy characteristics (parity and gravidity, comorbidities and various of mode of deliveries) were summarised as number counts and percentages. For comparison between LEA and NLEA groups, continuous data were analysed using the student's t-test and the Chi-square test was used to analyse the categorical data. To avoid type 1 error, Bonferroni correction was used in where $p<0.013$ was considered significant in parity variable while $p<0.016$ was considered significant in gravidity variable.

The risk factors associated with CD were analysed using logistic regression models. Univariate analysis by using simple logistic regression to identify the factors associated with CD was used. The forward logistic regression approach was used to incorporate results from the univariate analysis into the multivariate model's variable selection. Hosmer and Lemeshow goodness of fit test was used to assess the fit of the model.

RESULTS

There were 1110 births over the study period. A total of 288 birth records were included in this study. However, 26 birth records were dropped out because of incomplete data. Thus, 262 data from births and LEA records were analysed which consisted of 131 records of parturient who received LEA and 131 who did not.

Table 1 showed the maternal demographic and pregnancy characteristics of the parturient with or without the use of epidural analgesia during labour respectively. Parturient in LEA group were significantly younger and were in their first pregnancies when compared to those in the NLEA group who were significantly older parturient and were in their third pregnancies or more. Parturient diagnosed with

TABLE 1: Demographic, pregnancy characteristics and mode of deliveries for parturients. Values were expressed in mean ± standard deviation or numbers with percentages in parathesis

	LEA (N=131)	NLEA (N=131)	P value[a]	P value[b]
Age (years)	30.1 ± 4.4	33.9 ± 5.2	<0.001*	
Height (cm)	156.6 ± 4.9	156.7 ± 5.2	0.807	
Weight (kg)	70.8 ± 9.0	70.0 ± 10.2	0.546	
BMI (kg/cm)	28.8 ± 4.3	28.4 ± 4.4	0.44	
Parity			<0.001*	
0	81 (61.8)	49 (37.4)		<0.001*
1	30 (22.9)	35 (26.7)		0.476
2	11 (8.4)	23 (17.6)		0.027*
>3	9 (6.9)	24 (18.3)		0.005*
Gravidity			<0.001*	
1	65 (64.7)	41 (31.3)		<0.001*
2	32 (24.4)	36 (27.5)		0.575
>3	24 (18.3)	54 (41.2)		<0.001*
Previous caesareandelivery	9 (6.9)	24 (18.3)	0.277	
Comorbidities				
Advanced maternal age	6 (4.6)	41 (31.3)	<0.001*	
Maternal obesity	30 (22.9)	11 (8.4)	0.001*	
GDM on diet control	15 (11.5)	7 (5.3)	0.075	
Bronchial asthma	3 (2.3)	0(0.0)	0.082	
Short stature	2 (1.5)	1 (0.8)	0.563	
Pre-eclampsia	2(1.5)	0 (0.0)	0.157	
Mode of delivery			<0.001	
Caesarean delivery	69 (52.7)	48 (36.6)		0.013*
Vaginal assisted delivery	60 (45.8)	4 (3.1)		<0.001*
Spontaneous vaginal delivery	2 (1.5)	79 (60.3)		<0.001*

P value[a] = overall p value; P value[b] = P value post hoc; *indicated significant value
LEA: Labour epidural analgesia; NLEA: No labour epidural analgesia; BMI: Body mass index; GDM: Gestational diabetes mellitus. Advanced maternal age is considered when parturients are age more than 35 years. Maternal obesity is considered when the BMI of parturients is more than 30 kg/cm^2.For comparison between LEA and NLEA groups, the Student's t-test was used for continuous variables and the Chi-square test for categorical variables. To avoid type 1 error, Bonferroni correction was used in where p<0.013 was considered significant in parity variable while p<0.016 was considered significant in gravidity variable.

advanced maternal age (over 35 years) were significantly less likely to choose epidural analgesia during labour, while obese pregnant women (BMI over 35 kg/m) were significantly more likely to opt for it. Spontaneous vaginal deliveries were significantly observed more in parturient that did not receive epidural analgesia during labour in contrast to those who did that had significantly more VADs and CDs.

Multivariate logistic regression with adjustment for the cofounding effects of various maternal parity and gravidity was used to identify the factors associated with increased risks of CDs as shown in Table 2. Parturient who had epidural analgesia in labour had almost twice the risk to have CDs. The indications for CDs for both groups were comparable as shown in Table 3.

DISCUSSION

Parturient who received LEA in our study had almost double the risk for

TABLE 2: Risk factors associated with increased caesarean deliveries

	OR	P value (for univariate)	Adjusted OR	P value(for multivariate)
LEA	1.924 (1.174-3.154)	0.009*	1.973 (1.116-3.486)	0.019*
Parity				
0	2.787 (1.239-6.269)	0.013*	4.094 (0.756-22.186)	0.102
1	1.842 (0.763-4.445)	0.174	2.293 (0.510-10.317)	0.279
2	REF			
>3	1.310 (0.465-3.684)	0.609	1.432 (0.479-4.280)	0.520
Gravidity				
1	1.640 (0.895-3.004)	0.109	1.251 (0.400-3.918)	0.700
2	REF			
>3	0.756 (0.86-1.480)	0.415	1.393 (0.359-5.403)	0.632
Advanced maternal age	1.00 (0.53-1.88)	0.997	1.915 (0.888-4.130)	0.098
Maternal obesity	1.22 (0.63-2.37)	0.563	0.993 (0.487-2.025)	0.985

Variable(s) entered: NLEA group or LEA group, Parity, Gravidity, Previous CD.
OR: odds ratio; LEA: Labour epidural analgesia; NLEA: No labour epidural analgesia; CD: Caesarean delivery

TABLE 3: Indications for caesarean deliveries. Values were expressed as numbers with percentages in paratheses

	LEA (N=69)	NLEA (N=48)	P value
Fetal distress	39 (41.1)	26 (54.2)	0.801
Poor progress	20 (21.1)	11 (22.9)	0.37
Failed IOL	5 (5.4)	1 (2.1)	0.213
Maternal request	0 (0)	5 (10.4)	0.092
Severe Pre-eclampsia	1 (1.1)	4 (8.3)	0.07
Twin Pregnancy	1 (1.1)	1 (2.1)	0.795

LEA: Labour epidural analgesia; NLEA: No labour epidural analgesia; IOL: induction of labour

CDs compared to those that did not. Our findings are consistent with some previous studies where parturient had epidural as labour analgesia increased their risk for CDs (Bannister-Tyrrell et al. 2014; Wang et al. 2019). The Cochrane Systematic Review in 2014 detected almost similar risk for CDs as our study, however, unlike our study where indications for CDs were comparable, in their review failure to progress was associated with higher CDs than CDs associated with foetal distress among parturient who had LEA (Bannister-Tyrrell et al. 2014).

Wang et al. (2019) investigated 100 parturient that received LEA whom delivered either via CDs or SVDs. They detected parturient with gestational age closer to 40 weeks and had longer interval time between epidural analgesia and the CDs ranging from 8 to 18 hours increased the risk for CDs compared to parturient who had SVDs. Neither of these risk factors were investigated in our study. We investigated whether parity or gravidity would be risk factors affecting the use of LEA on delivery outcomes. Though in our study nulliparous parturient significantly increased the risk for CDs in the univariate analysis, yet in the multivariate analysis, it is not an independent risk factor for increasing CDs risk.

Parturient in the present study who had LEA also significantly increased incidence of VADs. This finding is consistent with studies by Penuela et al. (2019), Ismail et al. (2015) and Sharma et al. (2002). A recent narrative review on epidural analgesia in labour summarised 3 metanalyses, that were performed in year 2013, 2017 and 2018 which included 61 randomised control trials collectively of variable methodological quality, concluding that duration of labour and VAD rates were affected by LEA specifically pertaining to the concentrations of local anaesthesia (LA) used but the LA concentration did not affect the CD rates (Halliday et al. 2022). We did not measure the duration of labour in our study. However, based on the comparison of indications for CDs in our study, labour progress did not significantly affect the indication for CDs. Therefore, we are deducing that the durations of labour were not affected by LEA in our study.

In relation to the concentrations of LA used in the LEA, following the landmark study that showed SVD rates increased when lower concentrations in comparison to high concentrations of LAs were used in the epidural infusions, our institution practices using low concentrations of LAs which were 0.1% levobupivacaine (COMET 2001). However, our parturient that received LEA were provided with PCEA, where a bolus of 5mL epidural admixtures were delivered through the epidural catheter, that were infusing the admixture in a fixed rate, with a 15-minute lockout interval using the analgesia pump. A study using uterine electromyography (EMG) had shown that the uterine EMG activities were suppressed with the use of PCEA which in their study prolonged the first stage of labour by almost 1.5 hours (Ye et al. 2015).The motor block caused by LEA and its effect on oxytocin secretion from the pituitary gland are

believed to contribute to reduced uterine muscle activity. During normal SVDs, stretching of the muscles of the birth canal stimulates neurohormonal reflex leading to rapid release of oxytocin by pituitary. However, LEA may interfere with the excretion of oxytocin and might require artificial labour augmentation with oxytocin (Gaiser 2005). We did not collect any information concerning labour augmentation in either group of our study. Furthermore, we also did not measure the total duration of epidural infusion and cumulative boluses of PCEA used which will reflect the total dose of LAs used. We suggest future studies to collect these pertinent data so that we have a better understanding of the effects of LEA on delivery outcomes.

We found that significantly younger parturient received LEA. As also indicated by another study, this could be related to parturient's knowledge of epidural analgesia in labour (Gari et al. 2017). The difference in the level of awareness could possibly be explained by the acceptance of the older age group parturient perceiving childbirth that does not as a physiological require much intervention (Ali Alahmari et al. 2020). Furthermore, our findings could possibly be explained by the anticipated increased pain that will be experienced during labour by nulliparous parturient (Sheiner et al. 2000) or poorer understanding of the anticipated delivery process which aggravates their labour pain experienced (Ye et al. 2011), leading to encouragement by the medical staff to the younger parturient to request for the LEA.

Parturient who were gravidity 3 and above were less likely to receive epidural in our study. This could be since multiparous women had shorter duration of labour as compared to nulliparous women which epidural analgesia might not be in time to commence (Tilden et al. 2019). In addition, our study found that the number of pregnancies was significantly correlated with maternal age. Specifically, women in their third pregnancy or beyond were significantly more likely to be diagnosed with advanced maternal age, as shown in Table 3. As this was a retrospective study, we did not have the opportunity to interview the attending obstetricians. We assumed, similarly as a study by Sheiner et al. (2000), the obstetricians did not offer LEA thinking that older parturient who are multiparous would have shorter duration and smoother, thus, less painful deliveries. In contrast to a study by Nguyen et al. (2021) who found that parturient over 35 years old and multiparous were likely to use LEA. Interestingly, Ranta et al. (1996) found that the level of labour pain was negatively associated with parturient parity which the parturient in their study reported that they had received inadequate labour analgesia. In our study, it would have been interesting to investigate the feedback regarding the labour pain experienced in parturient who did not receive LEA.

We observed more parturient with maternal obesity were given epidural analgesia. This could be the result of the recommendations made by the Royal College of Obstetricians

and Gynaecologists (RCOG) and American College of Obstetrics and Gynaecologists (ACOG). Both colleges recommend that obese parturient are evaluated by the anaesthetic team which RCOG further specifies the consultation should occur in the third trimester for class 3 obese parturient (Denison et al. 2019). This evaluation allows the anaesthetic team to ascertain a thorough medical history and comorbidities as well as anticipate neuraxial placement and airway difficulties. Counselling can also be done. The parturient should be made aware that neuraxial placement may be difficult and advise them to request epidural analgesia in their labour as adequate time possibly needed for the procedure to be done and reducing the need for emergency caesarean delivery requiring general anaesthesia (Taylor et al. 2019). In our study, we did not investigate further whether the parturient had consultation with the anaesthetic team antenatally.

This present study demonstrated that parturient in NLEA group had increased chances of having SVDs compared to those in the LEA group. However, they were also among parturient who were in their third pregnancy or more. This finding is in line with a study by Kearns et al. (2021). It was found that parturient who had significantly higher odds of having SVDs if they had a pre-existing preference for SVDs (Kearns et al. 2021). When parturient perceive labour as a process that her body needs to do to deliver the baby, thus, less fear of the process, which leads to not wanting LEA during labour (Malm et al. 2016).

Like all studies, our study has its limitations. Although this study is performed in a rigorous manner, it only represented a single centre population. Therefore, the results of our study should be interpreted with caution. Furthermore, inherent to retrospective studies, information that would have been interesting to investigate to improve our understanding of the effects of LEA on delivery outcomes were not available. Example of these information are reasons for not opting for LEA, feedback regarding labour pain without LEA or any data that were mentioned in previous paragraphs that may affect delivery outcomes but were not collected.

CONCLUSION

Parturient who had epidural analgesia during labour had significantly higher VADs and CDs whereas those who did not had higher SVDs. LEA used during labour increased the risk for parturient for CDs by two-folds.

CONFLICT OF INTEREST

Authors declared no conflict of interest.

AUTHORS' CONTRIBUTION

Wan Mat WR: Principal author who contributed to conceptualisation, resources provision, the proposal writing, data collection, data analysis, reviewing and editing manuscript draft. Khor CW: Author who contributed to conceptualisation, resources provision, the proposal writing, data collection,

data analysis, reviewing and editing manuscript draft. Izaham A, Mahadi SN, Maaya M, Budiman M, Tan KW: Authors who contributed to reviewing and editing manuscript draft.

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