ORIGINAL ARTICLE

Adoption of New Scoring System (PConPUP) for the Timing of Epidural Bolus Dose during the Second Stage of Labour

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Abstract

Background: Labour epidural analgesia is considered the gold standard technique for relieving labour pain. The impact of epidural analgesia on the second stage of labour considering the progress and outcome is a great concern. The timing of the epidural bolus during the second stage is controversial. This study aimed to evaluate the effectiveness of a new three-point scoring system (PConPUP) to determine the timing of epidural bolus at the second stage of labour.

Methods: This observational study was carried out at the Department of Obstetrics and Gynaecology of Bangladesh Medical University (BMU) and Mohammadpur Fertility Services and Training Centre (MFSTC), Dhaka. Parturients aging 19-35 years, full term (> 37weeks), and cervical dilatation ≥4 cm were included. They were received an epidural bolus dose of 12 ml levobupivacaine-fentanyl (0.1%) when at least two major criteria reached score 2 along with rest criteria score 1 or a total score ≥8. The quality of analgesia, mode of delivery, maternal haemodynamics, and APGAR score were documented.

Result: A total of 44 patients were selected for this study. The average age was 24.69 ± 6.39 years, BMI was 24.42 ± 3.61 Kg/m^2, and Gestational age was 38.44±0.23 weeks. Before epidural bolus, cervical dilation was 4.68±0.51 cm, pulse 90.0±1.34 beats/min, SBP 121.90±7.83 mmHg, DBP 74.45±6.09 mmHg, fetal heart rate 137.51±3.61 beats/min, and VAS score was 6.97±1.14. After epidural bolus, VAS score was reduced to 2.15±0.25 and no change of haemodynamics was observed. All parturients gave birth through vaginal delivery, only 6 (14%) needed instrumental delivery. APGAR score of the baby at the 1st and 5th minute were good.

Conclusion: This new scoring system (PConPUP) can be used as a tool to determine the timing of epidural bolus during the second stage of labour.

Keywords: Labour analgesia, Epidural bolus, Second stage, New scoring system (PConPUP)

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Introduction

Neuraxial techniques are considered the gold standard, despite the different modalities of labour analgesia[1]. The most commonly practiced technique is epidural analgesia among the different neuraxial labour analgesia[2]. It came into light in early 1946[3]. Since then it is frequently practiced in developed countries. In United Kingdom 20% women preferred it while in the United States of America 58% of women use it for labour analgesia[3,4].

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The local anaesthetic concentration that is sufficient to produce effective analgesia in the first stage of labour may not be able to produce satisfactory analgesia in the second stage of labour. As because the second stage of labour is characterized by the descent of the foetus and more frequent contractions of the uterus, which cause more pain. Therefore, the volume and concentration of local anesthetics need to be increased to achieve adequate analgesia[1]. But any intervention that affects the progress and outcome of labour would be a great concern for obstetricians, anaesthesiologists, and pregnant mothers[5]. Considering the negative impact on the second stage of labour, some obstetric care providers discontinue epidural pain medication during this time. So, the timing of the first bolus epidural dose for relief of labour pain in the second stage is critical.

To optimize the timing of the first epidural bolus during the commencement of the second stage of labour, a new scoring system (PConPUP) was developed. By integrating three major and three minor criteria the scoring system ensures timely and effective pain relief while maintaining smooth labour progression, along with avoiding the need for any intervention such as assisted vaginal delivery or caesarian section and maximum maternal satisfaction. To precisely identify the initiation of the second stage of labour, this scoring system combines objective physiological markers (contraction frequency and duration, involuntary urge to push, mean arterial pressure and pulse rate) with subjective measures (Visual Analogue Scale for pain intensity).

The scoring system is a three-point scoring system that includes three major and three minor criteria. Each major criteria scores the lowest 1 and highest 3, and each minor criteria scores the lowest 0 and highest 2. The intensity of pain, increased duration of each contraction, and an involuntary urge to push down are important signs of initiating the second stage, so these criteria are selected as major criteria.

The intensity of pain is assessed by the Visual Analogue Scale (VAS). In the scoring system, VAS 1 to 3 defines score 1, VAS > 3 defines score 2, and VAS > 5 defines score 3. Another two important signs of initiating the second stage are an increase in the duration of uterine contraction and an involuntary urge to push down[6]. The duration of uterine contraction in between 20 to 30 seconds defines score 1, 31 to 40 seconds defines score 2, and 41 to 60 seconds defines score 3. The involuntary urge to push refers to the automatic bearing-down reflex experienced by parturients. No urge refers to score 1, bearable urge refers to score 2, and intractable urge refers to score 3.

There is an increase in circulating catecholamines in the late second stage of labour, which increases blood pressure and pulse rate[7]. The frequency of uterine contractions usually increases from the late first stage[6]. So, mean arterial pressure (MAP), pulse rate, and frequency of contractions are selected as minor criteria. MAP at baseline defines the score 0, > 10% deviation refers to score 1, and > 20% deviation refers to score 2. Pulse rate at baseline defines the score 0; > 10% deviation refers to score 1, and > 20% deviation refers to score 2. When the frequency of contractions per 10 minutes is <3 defines the score of 0; between 3 to 4 defines the score of 1, and between 4 to 5 but not >5 defines the score of 2.

Currently, there is no established protocol in place to direct when to administer the initial epidural bolus, particularly in the late stages of labour. Usually, subjective pain reports or clinical judgment are used to determine whether to administer epidural analgesia, which can result in inconsistent practices[8]. This study aims to evaluate the effectiveness of new scoring system during the second stage of labour to administer epidural bolus dose of drugs without interfering with normal delivery.

Methods

This observational study was conducted at the Department of Obstetrics and Gynaecology of Bangladesh Medical University (BMU) and Mohammadpur Fertility Services and Training Centre (MFSTC), Dhaka. Patients aging 19-35 years, uncomplicated pregnancy, full term (> 37weeks), and cervical dilatation ≥4 cm were included in this study. The exclusion criteria includes patients receiving parenteral opioids within 2 hours, hypersensitivity to drugs, neurological or psychiatric disease and any irregularity in the fetal heart rate. The adopted three-point scoring system (P=pain, Con= frequency & duration of contraction, P= pulse, U= urge of defecation, and P= mean blood pressure) was used to determine the time when the epidural bolus of drugs would be administered in the second stage of labour (table I). When at least two major criteria reached score 2 along with rest criteria score 1 or a total score ≥8, an epidural bolus dose of 12 mL levobupivacaine-fentanyl (0.1%) was administered.

Table I: Adopted three-point scoring system (PConPUP)

		Score→ Variables ↓	1	2	3
Major Criteria	1	Intensity of Pain(VAS) ‘	1-3	>3	>5
	2	Duration of contraction	20-30 sec	31-40 sec	41-60 sec
	3	Defecation urge	No	Bearable	Intractable
			0	1	2
Minor Criteria	1	Mean Blood Pressure (MBP)	Baseline	>10% deviation from baseline	20% deviation from >baseline
	2	Pulse Rate	Baseline	>10% delation from baseline	>20% deviation from baseline
	3	Number of Contraction 10 inin	<3	3M	Not more than *5*

Development and implementation of the Scoring System (table I):

The scoring system was developed upon consultation with professors experienced in labour analgesia. Major and minor criteria were identified based on clinical observations and physiological markers relevant to the second stage of labour. A pilot study was conducted on eight patients (18% of the study population) to evaluate the feasibility, reliability, and effectiveness of the scoring system. The result of the pilot study was encouraging, and necessary adjustments were made to refine the scoring criteria. The final version was reviewed by departmental experts and approved by the Institutional Review Board (IRB) of BMU after incorporating suggested modifications. The approved scoring system was then implemented during the study to guide epidural bolus administration during the second stage and its outcomes were systematically assessed.

Monitoring based on different scores during the second stage:

The scoring variables were reassessed at 5 minutes, 10 minutes, and during delivery. Pain relief was considered adequate when VAS <3, and the quality of analgesia was assessed using a 4-point scale previously used by Sheeba et al. (2018)[9]. The neonatal assessment was done using the APGAR score at 1st and 5th minutes after delivery.

Statistical analysis:

Statistical analysis was carried out by using the Statistical Package for Social Sciences version 23.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The mean values were calculated for continuous variables. The qualitative observations were indicated by frequencies and percentages. Data were presented in tables and figures.

Results

A total 44 parturients were enrolled in this study. Two parturients had undergone caesarian section due to foetal distress before initiation of the second stage and had not received epidural bolus during the second stage of labour. The demographic and clinical characteristics were shown in table II. The demographic characteristics showed that the average age was 24.69 ± 6.39 years, BMI was 24.42 ± 3.61 Kg/m^2, and Gestational age was 38.44±0.23 weeks. Clinical examination at baseline revealed that cervical dilation was 4.68±0.51 cm, pulse 90.0±1.34 beats/min, SBP 121.90±7.83 mmHg, DBP 74.45±6.09 mmHg, fetal heart rate 137.51±3.61 beats/min, and VAS score was 6.97±1.14.

Table II: Demographic and baseline clinical characteristics of the parturients (n = 44)

Characteristics	Value
Age (years)	24.69 ± 6.39
BMI (Kg/m^2)	24.42 ± 3.61
Gestational age (weeks)	38.44±0.23
Cervical dilatation (cm)	4.68±0.51
Fetal heart rate (beats/min)	137.51±3.61
VAS score before the epidural	6.97±1.14
Pulse rate (beats/min)	90.0±1.34
SBP (mmHg)	121.90±7.83
DBP (mmHg)	74.45±6.09

Data were presented as Mean ± SD.

Most of the parturients had intense pain during the second stage of labour. After the bolus administration, VAS score decreased markedly. (table III) The mean duration of contraction before bolus was 36.14±9.24 seconds. (table IV) Most of the patients fell in score 2 for the involuntary urge to push before giving epidural bolus. (table V)

Table III: Pain intensity at the second stage of labour by visual analogue scale (n=42)

VAS	Value
VAS scoring points before the bolus	
Score 2 (>3)	7 (17%)
Score 3 (>5)	35 (83%)
VAS before bolus	6.58±1.11
VAS after bolus	2.15±0.25

Data were expressed as Mean ± SD and absolute number, within parenthesis percentage over column total.

Table IV: Scoring points of duration of contraction during the second stage of labour (n = 42)

Duration of contraction	Value
1 (20-30 sec)	6 (14%)
2 (31-40 sec)	28 (67%)
3 (41-60 sec)	8 (19%)
The mean duration of contraction before bolus	36.14±9.24

Data were expressed as Mean ± SD and absolute number, within parenthesis percentage over column total.

Table V: Scoring points of involuntary urge to push during the second stage of labour between two groups (n = 42)

Involuntary urge to push	Value
Bearable (score 2)	28 (67%)
Intractable (score 3)	14 (33%)

Data were expressed as absolute number, within parenthesis percentage over column total.

The mean arterial pressure (MAP) of maximum patients was within the baseline limit (scoring point 0) before giving epidural bolus. The mean MAP after bolus was 90.33±5.24 mmHg. (table VI) The pulse rate of the maximum patients was within the baseline limit (scoring point 0) before giving epidural bolus. The mean Pulse rate after bolus was 92.67±8.68 beats/min. (table VII)

Table VI: Scoring points of MAP during the second stage of labour (n = 42)

MAP (mmHg)	Value
0 (baseline)	35 (83%)
1 (>10% deviation from baseline)	5 (12%)
2 (>20% deviation from baseline)	2 (5%)
MAP after bolus	90.33±5.24

Data were expressed as Mean ± SD and absolute number, within parenthesis percentage over column total.

Table VII: Scoring points of pulse rate during the second stage of labour (n = 42)

Pulse (bpm)	Value
0 (baseline)	31 (74%)
1 (>10% deviation from baseline)	8 (19%)
2 (>20% deviation from baseline)	3 (7%)
Pulse rate after bolus	92.67±8.68

Data were expressed as Mean ± SD and absolute number, within parenthesis percentage over column total.

The number of contractions during the second stage of labour was at a score of 1 for maximum patients before giving epidural bolus. The mean frequency of contraction per 10 minutes was 3.62±0.49. (table VIII) The quality of pain relief after epidural bolus was assessed by a 4-point questionnaire. Most of the patients were aware of contraction but no pain 27 (64%), only 10 (24%) experienced pressure with tolerable discomfort. (table IX) The APGAR score in 1st and 5th minute were 7.65±0.87 and 8.80±0.41 respectively. (figure 1)

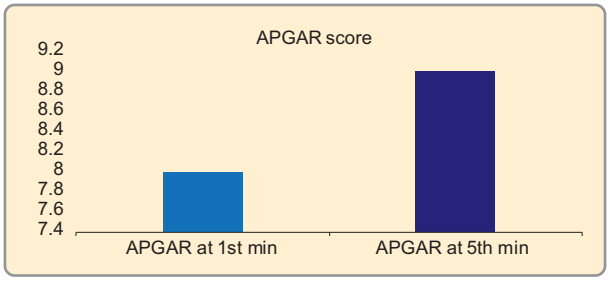

Figure 1: Distribution of the neonatal outcome based on APGAR score

Table VIII: Scoring points of frequency of contraction per 10 minutes during the second stage of labour (n = 42)

Number of contractions	Value
1 (3-4)	24 (57%)
2 (not more than 5)	18 (43%)
Frequency of contraction per 10 minutes	3.62±0.49

Data were expressed as Mean ± SD and absolute number, within parenthesis percentage over column total.

Table IX: Assessment of Quality of analgesia after epidural bolus at the time of delivery (n=42)

Quality of analgesia	Value	
1	No pain	4 (9%)
2	Awareness of contraction but no pain	27 (64%)
3	Awareness of pressure but tolerable discomfort	10 (24%)
4	Distressing pressure or pain	1 (2%)

Data were expressed as absolute number, within parenthesis percentage over column total.

The mean duration of the first stage and second stage were 198.18 ± 113.71 min and 22.75±9.97 min respectively. Most of the parturients 36 (86%) gave birth through normal vaginal delivery whereas only 6 (14%) required ventouse.

Discussion

Labour pain during the second stage is due to the descent of the foetus and more frequent contractions of the uterus. The minimum local analgesic concentration of local anesthetics has been successfully achieved to produce adequate analgesia in the first stage of labour. However, in the second stage of labour, A-δ fiber recruitment in the pain pathway increases the requirement for local anesthetics to produce satisfactory analgesia. The timing of the epidural bolus is also crucial for effective pain relief as well as the smooth progression of labour. But there is no consensus guideline regarding the time of the first epidural bolus during the second stage of labour. This study investigates the effectiveness of a new scoring system to determine the timing of the first epidural bolus at the second stage of labour. This new three-point scoring system (PConPUP) consists of six variables, including pain intensity (VAS), number of uterine contractions, duration of contraction, defecation urge, mean blood pressure, and pulse rate. The total number of scores will determine whether the first epidural bolus is given or not. Calabrese et al. (2025)[10] developed a new index (CONPAIN) integrating pain and uterine contraction duration during labour epidural analgesia to monitor neuraxial labour analgesia effectiveness. They have found that CONPAIN showed greater relative changes compared to the numerical rating scale (NRS) during the first 10 minutes following initiation of labour analgesia. But they did not observe the changes during the second stage.

In this study, patients who had at least two major criteria reached score 2, along with the rest criteria score 1 or a total score ≥8, received the first epidural bolus during the second stage of labour. It was observed that the intensity of pain was markedly reduced after the epidural bolus and there were no significant haemodynamic changes. The quality of analgesia after epidural bolus at the time of delivery was assessed, and found that most of the patients were aware of contraction but no pain 27 (64%), and aware of pressure with tolerable discomfort 10 (24%). Sharmin et al. (2022)[1] conducted a study to explore the effect of epidural bolus levobupivacaine and lignocaine in late second stage of parturition and found that 25 (68.5%) and 16 (43.2%) patients were aware of contraction but no pain in the levobupivacaine and lignocaine group, respectively. Kumar et al. (2017)[11] compared the quality of labour epidural analgesia between levobupivacaine and ropivacaine and stated that 69% patients in the levobupivacaine group were aware of contraction but no pain. The results of the above mentioned studies support that the new scoring system effectively determine the time to maintain quality of analgesia.

The mode of delivery is an important determinant of labour epidural analgesia. In our study, 42 (100%) gave birth through vaginal delivery. Out of 42, only 6 (14%) required ventouse. Two patients underwent

caesarean section due to foetal distress before initiation of second stage and did not receive epidural bolus. Sharmin et al. (2022)[1] and Kumar et al. (2017)[11] reported the incidence of vaginal delivery in levobupivacaine group were 100% and 83%, respectively. But Kumar et al. (2017)[11] stated the incidence of instrumental delivery was more in levobupivacaine (32%) group and the rate of cesarean section was 17%. Chestnut et al. (1990)[12] found that cesarean section rate was 10% and 13% in early and late groups of epidural bolus, respectively. Lee et al. (2008)[13] reported higher cesarean section rate in the early group than the late group (16.4% vs. 7.7%, p = 0.002). Another study reported that the incidence of instrumental delivery was 6.45% and the rate of cesarean section was 11.4% in levobupivacaine group[9]. Therefore it can concluded that the time determined by the new scoring system did not increase the rate of instrumental delivery as well as caesarean section.

In our study, we have found that the APGAR score in 1st and 5th minute were 7.65±0.87 and 8.80±0.41, respectively. Kumar et al. (2017)[11] documented the maximum APGAR score at 1 min and 5 min was 8 and 9, respectively. Sharmin et al. (2022)[1] found that only 3 (7.9%) had APGAR score less than 7 in 1st minute. Other studies also found good APGAR score[2,9].

Lee et al. (2008)[13] concluded that the timing of epidural analgesia should be determined on an individualized basis. But in this study, we have used a three-point new scoring system (PConPUP) to determine the timing and found that the results were in concordance with the aforementioned studies[1,2,9,11-13].

Conclusion

The timing of the epidural bolus determined by the new three-point scoring system is not associated with reduced quality of analgesia, the increased rate of instrumental delivery and caesarean section. This scoring system (PConPUP) can considered as a useful tool to determine the timing of epidural bolus at the second stage of labour.

Declaration:

Ethics approval: The study was approved by the Institutional Review Board of Bangladesh Medical University, Dhaka, Bangladesh (BMU/2023/9028).

Author Contributions:

Conception and development of the idea: AF, AKMA, MSI

Writing: AF, MMK, KMA

Data analysis: AF, MMK, MSI

Data collection: AF

Review and Editing: MMK, AKMA, MSI

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Conflict of interest: None

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