International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2019): 7.583

# Low Dose Combined Spinal-Epidural Anesthesia Versus Conventional Epidural Anesthesia for Elective Cesarean Section in Severe Preeclampsia

**Mamdouh E. Lotffy[1], Ayman A. Radi[2], Dr. Nevine M. Soliman[3], Dr. Khaled M. Gaballah[4], Amir R. Youssef[5]**

[1, 2]Professor, Anesthesia Department, Faculty of Medicine –Menoufiya University

[3, 4, 5]Anesthesia Department, Faculty of Medicine –Menoufiya University

**Abstract:** ***Background: Severe preeclampsia is a critical situation which endangers the life of the mother &/or the fetus through decreasing the blood flow to the placenta leading to slow growth , growth retardation, Low birth weight, preterm birth & breathing difficulties to the new born; placental abruption & heavy bleeding ,HELLP syndrome(Hemolysis , Elevated Liver Enzymes & Low Platelet count), Eclampsia (preeclampsia plus seizures), cerebrovascular stroke or hemorrhage, pulmonary oedema, renal failure, liver failure, disseminated intravascular coagulopathy & it may end by death.The aim of this study was to compare low dose Combined spinal epidural & conventional epidural anesthesia for elective cesarean section in patients with severe pre-eclampsia as regards safety, efficacy & the best outcome. Methods: Our study included sixty patients with severe preeclampsia undergoing elective cesarean section and they were divided into two groups with thirty patients in each group; GroupI received low dose combined spinal epidural anesthesia under aseptic precautions using 7mg 0.5%heavy bupivacaine with 25micograms fentanyl intrathecal and incremental doses of 3-5 ml plain bupivacaine in the epidural catheter after10-15 minutes of the intrathecal injection while patients in group II received conventional epidural anesthesia under aseptic precautions using 16ml 0.5% plain bupivacaine (after 4ml of lidocaine2% as a test dose) the 16ml of plain bupivacine 0.5% were given over 3minutes. Results: In our study, there was no statistical significant difference between the two studied groups regarding the mean arterial pressure, the heart rate & the oxygen saturation ($SaO_2$) of the mother & the umbilical card measurements and APGAR score of the fetus at different time points. Conclusion: The use of low dose combined spinal epidural anesthesia for elective cesarean section in patients with severe pre-eclampsia is as safe, efficient with the same good outcome to the mother & the fetus as conventional epidural anesthesia.***

**Keywords:** Epidural spinal combined cesarean section preeclampsia

## 1. Introduction

The anesthetic plan for cesarean section must take into consideration the well being of the mother & the fetus; Both regional & general anesthesia are acceptable for cesarean delivery but the use of general anesthesia has dramatically fallen in the past few years & is now used in less than five percent of cesarean deliveries.(1,2)

To provide optimal safe anesthesia for cesarean section one must understand the maternal physiological changes during pregnancy as pregnancy affects virtually every organ ,moreover anesthetic care for the pregnant patient is unique in that two patients are cared for simultaneously; the parturient and the fetus. Failure to take these facts into consideration can produce disastrous consequences. (3)

Preeclampsia is a disorder of widespread vascular endothelial malfunction & vasospasm that occurs after 20 weeks gestation & can present as late as 4-6 weeks postpartum. It is clinically defined by hypertension & proteinuria with or without pathologic edema.(4)

The application of regional anesthesia is preferred in cases of severe preeclampsia if the initial criteria such as normal neurologic status & blood coagulation are fulfilled.(5,6,7)

## 2. Materials and Methods

The study was carried out in EL Menoufyia University Hospital ;Sixty patients with severe preeclampsia were included in this prospective, randomized ,Controlled study with approval of the ethical committee of department of Anesthesia and after taking a written consent .Inclusion criteria; severe hypertension (a systolic blood pressure over 160 mmHg) with at least + proteinuria ,moderate hypertension (a systolic blood pressure over 140 mmHg &/or diastolic blood pressure over 90 mmHg) with significant proteinuria 2+& severe headache with visual disturbance, epigastric pain, signs of clonus, liver tenderness, platelet count falling to below 100 x $10^9$/L, Alanine amino transferase rising to above 50 IU/L, Creatinine > 100 mmol/L .Exclusion criteria ;Obese patients (Body mass index>30Kg/$m^2$), patients with any neurological or neuromuscular disorder or history of seizures, patients with cardiovascular disease, failed or inadequate block, local infection at the site of the block, history of allergy to local anesthetic ,patients with coagulopathy or under anticoagulation therapy ,emergency cesarean section in which there is high risk to the mother &/or the fetus & immediate surgical interference is needed and newly born infants with congenital anomalies that affects his general well being. Patients were prepared for regional anesthesia by history taking, clinical examination, laboratory investigations, antihypertensive measures & premedications. After sitting Inserted an I.V. cannula (18G), to all patients which I premedicated them by intravenous ranitidine 50 mg & metoclopramide 10 mg & an infusion of

Ringer's lactate solution 10-15 ml /kg body weight over 20-30 minutes prior to initiation of the regional blocks .Baseline records of Blood pressure, pulse rate, respiratory rate and oxygen saturation were recorded. An indwelling catheter was inserted and urine output measured hourly. Oxygen saturation was measured continuously and charted with the blood pressure. Fluid balance and detailed input and output recordings were charted. Neurological assessment was performed using GCS. Fetal well-being was assessed in the initial stages before delivery by using abdominal ultrasound while after delivery by measuring umbilical cord blood gases and by using Apgar score at 1 minute and 5 minutes.

**The patients were randomly divided into two groups: Combined spinal epidural group (Group 1=30 patients)(CSE group)**The patients received 7mg 0.5% heavy bupivacaine with 25 micrograms fentanyl intrathecal and incremental doses of 3-5ml plain bupivacaine in the epidural catheter after 10-15minutes of the intrathecal injection which was repeated in some cases after 15-20 minutes with a total volume of 20-25ml through the whole procedure.

**Conventional Epidural group (Group 2=30 patients): *(C.EP group)*** The patients received 16ml 0.5% plain bupivacaine (After 3ml of lidocoin 2% as a test dose). Heart rate, respiratory rate and arterial blood pressure were measured and recorded preoperatively as a base line, Immediately after performance of the block, Before & after skin incision and Every 5 minutes till the end of the surgery then every 30 minutes for the first hour and every one hour for the next 6 hours.

***Onset of the block*** (the time from injection of the local anesthetic to the time of complete loss of sensation at the operative site).

***Quality of the block:*** Which was judged according to the patient satisfaction (completely pain free).

**Analytic statistics:**

F-test (ANOVA =analysis of variance), is a test of significance used for comparison between more than two groups having qualitative variables.

Friedman matched pairs test for comparison between the two quantitative variables in the same group.

Chi square test (X2), used to study the association between the two qualitative variables or more.

A value of $P < 0.05$ was considered statistically significant.

## 3. Results

Table (1) There was statistical significant difference between the two studied groups regarding the onset of block (sensory – motor) ($P < 0.05$),the need for vasopressor and intraoperative addative analgesics ($P < 0.05$) and the first request for analgesia ($P < 0.05$).

Table (2) There was statistical significant difference between the two studied groups regarding mean arterial blood pressure at onset of block, after 3 min., after skin incision and after 45 min ($P < 0.05$).

Table (3) There was no statistical significant difference between the two studied groups regarding umblicial cord measurements ($P > 0.05$). There was no statistical significant difference regarding umblicial cord measurements in group I and group II ($P > 0.05$).

Table (4) shows that nausea in group I (CSE) was 4(13.33%) and in group II (CEP) was 5(16.67%), vomiting was 3(10%), 3(10%) respectively and bradycardia was 1(3.33%) and 6(20%) respectively. There was no statistical significant difference between the two studied groups regarding the incidence of adverse events complication ($P > 0.05$).

Table (5) shows that, time of block performance in group I (CSE) has mean value 7.4±1.75 and in group II has mean value 7.8±2.36. Time of onset of adequate block for surgery has mean value 7.2 ±2.98 and 27.5±4.42 respectively. Duration of surgery has mean value 37.3 ±5.98 and 37.3±5.04 respectively, Duration of postoperative analgesia has mean value 116.2 ±9.44 and 118±8.96 respectively, post operative recovery of sensory block has mean value 1.63±0.45 and 1.70±0.25 respectively. There was statistical significant difference between the two studied groups regarding the time of onset of adequate block ($P < 0.05$).

Table (6) shows that, in group I (CSE) 24(80%) were satisfied and in group II (CEP) were 22(73.3%) satisfied. There was no statistical significant difference between the two studied groups regarding patient's satisfaction ($P > 0.05$).

**Table 1:** Comparison between the two studied groups regarding assessment of block, operative data and times

| | Group I CSE "n=30" | Group II C EP "n=30" | t-test | P value |
|---|---|---|---|---|
| **Assessment of block** | | | | |
| Onset of block*Sensory* | 285.2±41.2 | 380.5±41.3 | 4.12 | 0.001* |
| *Motor* | 256.3±36.2 | 168.2±23.6 | 3.65 | 0.003* |
| No. of segments blocked | 16.2±3.21 | 15.85±2.96 | 1.23 | 0.214 |
| **Operative data** | | | | |
| Need for vasopressor (ephedrine mg) | 1.36±0.69 | 0.51±0.36 | 2.45 | 0.018* |
| Intaoperative fluid required | 650.0±254.0 | 520.0±168.2 | 1.24 | 0.211 |
| Intaoperative blood loss | 58.2±42.0 | 40.8±31.0 | 1.54 | 0.149 |
| Duration of surgery | 55.3±6.2 | 52.3±5.25 | 0.84 | 0.414 |
| Intaoperative addative analgesics | 22.1±24.3 | 15.2±10.6 | 6.58 | 0.021* |

| | | | | |
|---|---|---|---|---|
| Intraoperative sedation score | 1.00±0.65 | 1.52±0.68 | 0.95 | 0.42 |
| Atropine | 3.0±2.1 | 2.00±1.65 | 1.06 | 0.432 |
| **Time** | | | | |
| Time of recovery of motor block | 6.0±2.12 | 6.1±2.10 | 0.51 | 0.417 |
| Segmental regression time | 4.0±1.21 | 5.06±1.32 | 1.54 | 0.365 |
| Time to first request of analgesia (min.) | 210.0±65.0 | 341.2±42.6 | 12.3 | 0.001* |

**Table 2:** Comparison between the two studied groups regarding mean arterial blood pressure at different time points

| **Group I** | **onset of block n=30** | **After 3 min n=30** | **Before skin incision n=30** | **After skin incision n=30** | **5 min n=30** | **10 min n=30** | **15 min n=30** | **20 min n=26** | **25 min n=20** | **30 min n=10** | **35 min n=10** | **40 min n=6** | **45 min n=2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 119.60 | 106.90 | 100.73 | 93.83 | 89.27 | 92.50 | 91.97 | 94.87 | 92.30 | 95.57 | 98.22 | 96.38 | 91.00 |
| S.D. | 12.89 | 12.12 | 10.54 | 10.02 | 16.57 | 9.07 | 8.92 | 7.78 | 15.43 | 6.64 | 6.99 | 8.99 | 7.62 |
| P1 | | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0004* |
| **Group II** | **onset of block n=30** | **After 3 min n=30** | **Before skin incision n=30** | **After skin incision n=30** | **5 min n=30** | **10 min n=30** | **15 min n=30** | **20 min n=26** | **25 min n=22** | **30 min n=12** | **35 min n=10** | **40 min n=8** | **45 min n=2** |
| Mean | 126.83 | 112.77 | 104.57 | 99.73 | 93.20 | 91.57 | 93.47 | 96.03 | 98.93 | 100.53 | 102.52 | 101.45 | 107.67 |
| S.D. | 17.09 | 9.31 | 9.22 | 10.23 | 6.60 | 7.09 | 7.74 | 11.04 | 8.04 | 8.45 | 9.06 | 7.54 | 1.53 |
| P1 | | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0001* | 0.0026* |
| P2 | 0.034* | 0.0199* | 0.0696 | 0.013* | 0.11604 | 0.32932 | 0.24464 | 0.31889 | 0.02056 | 0.00821 | 0.03901 | 0.07650 | 0.007* |

**Table 3:** Comparison between the two studied groups regarding umblicial cord measurements

| | pH | paco2 | paO2 | base excon | HCO3 | Oxygen saturation | APGAR At 1 min | APGAR At 5 min |
|---|---|---|---|---|---|---|---|---|
| Group I | | | | | | | | |
| Mean | 7.27 | 54.28 | 22.78 | 3.13 | 24.61 | 64.88 | 9.13 | 9.88 |
| S.D. | 0.06 | 9.95 | 8.28 | 2.61 | 2.89 | 10.11 | 0.74 | 0.34 |
| | | | | | | | | |
| Group II | | | | | | | | |
| Mean | 7.27 | 54.28 | 22.78 | 3.13 | 24.61 | 64.88 | 9.13 | 9.88 |
| S.D. | 0.06 | 9.95 | 8.28 | 2.61 | 2.89 | 10.11 | 0.74 | 0.34 |
| | | | | | | | | |
| p | 0.11517 | 0.09336 | 0.45916 | 0.41863 | 0.46204 | 0.39276 | 0.05010 | 0.47696 |

**Table 4:** Comparison between the two studied groups regarding the incidence of nausea, vomiting, and bradycardia intraoperatively

| | Group I CSE n=30 | | Group II C.EP n=30 | | P |
|---|---|---|---|---|---|
| | No. | % | No. | % | |
| Nausea | 4 | 13.33 | 5 | 16.67 | 0.625 |
| Vomiting | 3 | 10.00 | 3 | 10.00 | 0.26 |
| Bradycardia | 1 | 3.33 | 6 | 20.00 | 0.33 |

Data expressed as mean and standard deviation (mean±SD).
P > 0.05 denotes insignificance.

**Table 5:** Comparison between the two studied groups regarding the different times

| | Group I CSE | Group II C.EP | t | p |
|---|---|---|---|---|
| Time of block performance | 7.4±1.75 | 7.8±2.36 | | 0.258 |
| Time of onset of adequate block for surgery | 7.2±2.98 | 27.5±4.42 | 12.66 | 0.0001 |
| Duration of surgery | 37.3±5.98 | 37.3±5.04 | | 0.500 |
| Duration of postoperative analgesia | 116.2±9.44 | 118.0±8.96 | | 0.205 |
| Post operative recovery of sensory block | 1.63±0.45 | 1.70±0.25 | | 0.241 |

**Table 6:** Comparison between the two studied groups regarding patients satisfaction.

| | Group ICSE | | Group IIC.EP | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Satisfied | 24 | 80 | 22 | 73.3 |
| Unsatisfied | 6 | 20 | 8 | 26.7 |
| p | 0.655 | | | |

Data expressed as mean and standard deviation (mean±SD)
P > 0.05 denotes insignificance

## 4. Discussion

The demographic data of our study include age, weight and height show insignificant difference between the two studied groups with agreement with ***Sivevski et al., (2005)*** [8]

In our study, there was no statistical significant difference between the two studied groups regarding the mean arterial pressure, the heart rate & the oxygen saturation (Sao2) of the mother at periods of follow up.

In agreement with our results ***Chaudhary S, and Salhotra.,***[9]carried out prospective randomized multicenter study comparing the hemodynamic effects of SAB and EA for CS in preeclampsia and found that spinal anesthesia produced blood pressure& heart rate decreases similar to epidural anesthesia in severely preeclamptic patients with similar maternal and fetal outcomes.

Also ***İçel et al.,***[10] carried out a study for comparison between maternal and fetal outcomes among patients undergoing cesarean section under general and spinal anesthesia: A prospective randomized clinical trial in a tertiary-level public hospital on 100 patients randomly divided into general anesthesia (n = 50) and spinal anesthesia (n = 50) groups.They found that although the

incidence of hypotension was more frequent in cases of spinal anesthesia than in cases with epidural anesthesia ; the duration of significant hypotension was short in both groups & the neonatal outcomes assessed by Apgar score & umbilical blood gas analysis were similar in both groups.

Also Jain Jet al.,[11] studied the mean arterial pressure changes associated with low and conventional doses of spinal anesthetic ;twenty four of severely preeclamptic patients scheduled for elective cesarean delivery randomly allocated to receive 7.5 mg [Group 1] or 10 mg [Group 2] of bupivacaine with 20mcg of fentanyl for spinal anesthesia. Phenylephrine boluses were used to maintain the MAP of >80% of baseline. The incidence of hypotension, neonatal outcome using Apgar scores, umbilical cord blood gases, and need for resuscitation were compared between the two groups. They found that the low intrathecal doses of bupivacaine& epidural supplementation (when needed) produced adequate anesthesia for cesarean section in severe preeclamptic patients with insignificant decreases in mean arterial pressure & heart rate & with good fetal outcome.

***Poredos and Novak-Jankovic.***,[12] did a randomized comparison of low doses of hyperbaric bupivacaine in combined spinal epidural anesthesia for cesarean delivery and they found that the lowest dose of hyperbaric bupivacaine 7mg provided equally rapid onset & effective anesthesia for cesarean delivery while reducing the incidence of hypotension compared with 8 & 9 mg. However because of its shorter duration of anesthesia, it may be feasible only when the block can be reinforced using a functional epidural catheter.

***Arzola and Wieczorek.***,[13] agreed that low doses spinal anesthesia as a part of combined spinal epidural technique is a valuable method in improving maternal & fetal outcome during anesthesia for cesarean delivery and it is as safe as conventional epidural anesthesia in severe preeclamptic women regarding the maternal and neonatal outcome.

***Elgharabawy and Mahrose.***,[14] carried out a study on sixty women scheduled for cesarean section divided into three groups (20 in each group) receiving spinal injections of 0.04mg heavy bupivacaine/cm height (group A), 0.05mg heavy bupivacaine/cm height (group B), and 0.06mg heavy bupivacaine/cm height (group C). They stated that despite the benefit of lower maternal side effects as hypotension, nausea & vomiting the low dose bupivacaine in spinal anesthesia compromises anesthetic efficacy& usually needs anesthetic supplementation as epidural bolus doses or even conversion to general anesthesia.

Recently the addition of opioids as fentanyl to local anesthetic for intrathecal injection in cases of spinal anesthesia during cesarean section provide more dense block and postoperative analgesia. [15]

The degree of neuronal blockade depends on the amount and concentration of local anesthetic and of opioids used and on the properties of the axon. Thin unmyelinated C fibers associated with pain are blocked first while thick myelinated A-alpha fibers are blocked moderately while myelinated small preganglionic sympathetic fibers are blocked first.[16]

Also ***Rollins and Lucero.,*** stated that in accordance with ASA guidelines there are no decisive reasons in order to choose either spinal or epidural block and actually literature is unable to give a definitive suggestion about complications and advantages so the choice between these two types of block would be up to maternal wish, the preference of the anesthesiologist and to fetal and maternal factors regarding their condition and whether this cesarean section is elective or emergency.[16,17]

Also ***Henke VG*** found that spinal anesthesia is widely regarded as a reasonable anesthetic option for cesarean delivery in severe preeclampsia. Compared with healthy parturients , those with severe preeclampsia experience less frequent, less severe spinal-induced hypotension.[18]

Comparison studies were done to judge the effect of using intrathecal local anesthetic alone or with added opioids in cesarean section as regards the neonatal outcome by using umbilical cord analysis, APGAR score and NACS score and from these data they found that there was no neonatal adverse effects related to the use of small doses of intrathecal opioids as 6.25-25 micrograms of fentanyl or 2-5 micograms of sufentanil.[19]

***Simmons et al.,***[20]found that single shot spinal, combined spinal epidural, and epidural anesthesia have all been used effectively and that there is no evidence that one technique has an advantage over the other and that hypotension requiring vasopressor medication during neuraxial anaesthesia is less common in women with pre-eclampsia than in healthy women.[20]

***Parthasarathy et al.,***[21] stated that neuraxial anaesthesia is now widely used in obstetric anaesthesia and that spinal and epidural anaesthesia are both safe in patients presenting with pre-eclampsia.

***Khan et al.***,[22]found that early onset management of severe preeclampsia with maintenance of adequate placental perfusion during anaesthesia lowers perinatal deaths and this can be achieved by giving regional anesthesia as general anesthesia was associated with an increased number of perinatal deaths.

***Başaran al.,***[23]recommended the use of regional anesthesia techniques whenever possible in preeclamptic patients for better maternal and fetal outcome.

***Aregawi NG et al.,***[24]stated that although general anaesthesia can be used safely in preeclamptic patients ;it is also associated with greater maternal morbidity and mortality than regional anaesthesia techniques and in addition to that the onset of sensory loss in case of combined spinal-epidural anaesthesia is faster than that in case of epidural anesthesia only and this gives more satisfaction and more compliance to both the patient and the surgeon.

***Gupte et al***.,[25] stated that Preeclampsia is a pregnancy associated illness affecting multiple organ systems, its symptoms typically occur after the 20th week of gestation and consist of hypertension (>140/90 mmHg) and proteinuria (>300 mg/day) and it is one of the leading causes

of premature birth worldwide and early diagnosis and treatment are essential for both fetal and maternal health.

In this study, there was no significant difference between the two groups regarding the postoperative recovery of sensory block. In agreement with our study, Demiraran and Toker.,(2005) [26] thirty non laboring women with severe preeclampsia (PET) were randomised into three groups: epidural anesthesia with prophylactic fluid loading (EA-F), combined spinal epidural anesthesia with prophylactic fluid loading (CSE-F), or combined spinal epidural anesthesia with prophylactic ephedrine (CSE-V). They showed that, there were no statistical significant differences between the studied groups regarding recovery of sensory block or received bupivacaine. The same results were found in Moshiri, et al., (2001) study.[27]

## 5. Conclusion

The use of low dose combined spinal epidural anesthesia for elective cesarean section in patients with severe pre-eclampsia is as safe, efficient & the same good outcome to the mother & the fetus as conventional epidural anesthesia and either of them can be used to offer adequate reliable anesthesia for performing the procedure without affecting the general condition of the mother or the fetus & moreover they provide early postoperative pain relief to the mother.

## 6. Conflict of Interest

The authors declare that there are no conflict of interests.

## References

[1] Afolabi BB, Lesi FE. Regional versus general anesthesia for cesarean section. Cochrane Database syst Rev. 2012;10: 43-50.
[2] Practice Guidelines for Obstetric Anesthesia: An Updated Report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia and the Society for Obstetric Anesthesia and Perinatology. Anesthesiology 2016; 124:270.
[3] Lim G, Facco FL, Nathan N, Waters JH, Wong CA, Eltzschig HK. A Review of the Impact of Obstetric Anesthesia on Maternal and Neonatal Outcomes. Anesthesiology. 2018;129(1):192–215.
[4] Singh J, Kaur M, Kulshrestha A, Bajwa SJS. Recent advances in pre-eclampsia management: an anesthesiologist's perspective! Anaesth Pain & Intensive Care 2014;18(2):209-214.
[5] Merry AF. and Mitchell SJ. Complications of anaesthesia. Anaesthesia 2018, 73 (Suppl. 1), 7–11
[6] Nikooseresht M, Ali M, Rabiei S, Hajian P, Dastaran R, Alipour N. Comparing the Hemodynamic Effects of Spinal Anesthesia in Preeclamptic and Healthy Parturients During Cesarean Section Anesth Pain Med 2016; 6(3): e11519.
[7] John JairoPáez L, Navarro JR. Regional versus general anesthesia for cesarean section delivery. Rev colombanestesiol 2012; 40(3):203–6.
[8] Sivevski A, Ivanov E, Karadjova D, Slaninka-Miceska M, Kikerkov I. Spinal-Induced Hypotension in Preeclamptic and Healthy Parturients Undergoing Cesarean Section. Open Access Maced J Med Sci. 2019;7(6):996–1000.
[9] Chaudhary S, and Salhotra R. Subarachnoid block for caesarean section in severe preeclampsia. Journal of Anaesthesiology Clinical Pharmacology. 2011; 27(2): 169-173.
[10] İçel SA, Özkan Ö, İsmet G, Hakan E, Ercüment M, Kemal AY. Comparison of maternal and fetal outcomes among patients undergoing cesarean section under general and spinal anesthesia: a randomized clinical trial. Sao Paulo Med. J. 2015; 133( 3 ): 227-234.
[11] Jain K, Makkar JK, Anbarasan I, Yadanappudi S, Gander S. A randomized double-blind comparison of low-dose and high-dose bupivacaine for caesarean section in severely preeclamptic women using invasive blood pressure monitoring. J ObstetAnaesthCrit Care 2013; 3:84-90
[12] Poredos P, Novak-Jankovic V. Comparison of haemodynamic parameters between the high and low spinal block in young healthy patients. SIGNA VITAE 2017; 13(1): 32-43
[13] Arzola C, Wieczorek PM. Efficacy of low-dose bupivacaine in spinal anaesthesia for Caesarean delivery: systematic review and meta-analysis, *BJA: British Journal of Anaesthesia*, 2011; 107(3): 308–318.
[14] Elgharabawy W, Mahrose R. Optimizing heavy marcaine dose for spinal anesthesia in short stature pregnant female individuals undergoing cesarean section. Res OpinAnesth Intensive Care 2018; 5:231-9.
[15] Das R, Ranjan A, and Mishra D. Assessment of different dexmedetomidine doses on the duration of spinal anaesthesia. International Journal of Medical and Health Research. 2018; 4(8): 205-207.
[16] Rollins M, Lucero J. Overview of anesthetic considerations for Cesarean delivery, *British Medical Bulletin*, 2012;101(1): 105–125,
[17] Madkour NM, Ibrahim SA, Ezz GF. General versus spinal anesthesia during elective cesarean section in term low-risk pregnancy as regards maternal and neonatal outcomes: a prospective, controlled clinical trial. Res OpinAnesth Intensive Care 2019;6:119-24
[18] Henke VG, Bateman BT, Leffert LR. Focused review: spinal anesthesia in severe preeclampsia. AnesthAnalg 2013;117(3): 686-93.
[19] Gandhi KA, Jain K. Management of anaesthesia for elective, low-risk (Category 4) caesarean section. Indian J Anaesth 2018;62:667-74
[20] Simmons SW, Dennis AT, Cyna AM, Richardson MG, Bright MR. Combined spinal-epidural versus spinal anaesthesia for caesarean section. Cochrane Database Syst Rev. 2019;10:CD008100.
[21] Parthasarathy S, Kumar VR, Sripriya R, Ravishankar M. Anesthetic management of a patient presenting with eclampsia. Anesth Essays Res. 2013;7(3):307–312.
[22] Khan ZH. Preeclampsia/Eclampsia: An Insight into the Dilemma of Treatment by the Anesthesiologist. Acta Med Iran. 2011; 49(9):564-574.
[23] Başaran B, Çelebioğlu B, Başaran A, Altınel S, Kutlucan L, Martin JN Jr. Anesthetic practices for patients with preeclampsia or HELLP syndrome: A survey. J Turk GerGynecol Assoc. 2016;17(3):128–133.

[24] Aregawi A, Terefe T, Admasu W, Akalu L. Comparing the Effect of Spinal and General Anaesthesia for Pre-Eclamptic Mothers Who Underwent Caesarean Delivery in A Tertiary, Addis Ababa, Ethiopia. Ethiop J Health Sci. 2018;28(4):443–450.
[25] Gupte S, Wagh G. Preeclampsia-eclampsia. J ObstetGynaecol India. 2014; 64(1):4–13.
[26] Demiraran Y, Toker MK. Management of Preeclampsia in Perioperative Conditions. Gen Med (Los Angel) 2015; S2: S2-004.
[27] Moshiri E, Malekianzadeh B, Modir H, Moghadam VD. Comparison of Spinal Anesthesia With Low and Conventional Doses of Bupivacaine on Hemodynamic Changes in Severe Preeclampsic Patients Candidate for Cesarean Section. Biomed Pharmacol J. 2017;10(2).