

DISCUSSION

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The choice of anaesthesia for caesarean section depends on many factors including indication for the operation, degree of urgency, the desire of the parturient and also the experience of the anaesthesiologist.⁽¹⁾ Regional analgesia has become the preferred technique because general anaesthesia has been associated with higher maternal mortality.⁽³⁾

Spinal analgesia for elective caesarean delivery has many advantages including being a single injection, it is faster, easier, uses lower doses of local anaesthetics yet produces a denser blocking effect, less neonatal exposure to potentially depressant drugs, decreased risk of maternal pulmonary aspiration, awake mother to witness the birth of her child and better early postoperative analgesia.⁽⁸⁰⁾ Spinal analgesia has advantages over epidural analgesia that it can be used in urgent cases as rapid analgesia and adequate muscle relaxation can be obtained.⁽⁸¹⁾

Unexpected early regression of spinal block or prolonged operation can cause intraoperative pain. Increasing the local anaesthetics dose, addition of opioids or clonidine to local anaesthetics for spinal analgesia would be helpful for prolonging the spinal blockade but may cause haemodynamic instability, nausea, hypotension, respiratory depression⁽⁸²⁾ and delayed recovery from motor block.⁽⁸³⁾ Also, postoperative pain relief is an unresolved issue. One of the methods of providing postoperative analgesia is by prolonging the duration of intrathecal bupivacaine by additives such as opioids⁽⁸⁴⁾, clonidine,⁽⁸⁵⁾ ketamine⁽⁸⁶⁾ etc.

Wang⁽⁸⁷⁾ reported the first intrathecal administration of opioids in parturient in 1979, and achieved a prolonged analgesia. However, opioid-induced side effects, such as respiratory depression, nausea, vomiting, urinary retention, and pruritis, limit their use⁽⁸⁸⁾.

Hyperbaric bupivacaine is an amide local anaesthetic commonly used for spinal analgesia. It causes somatic and autonomic blockade producing a phenomenon of differential blockade which typically results in sympathetic blockade (judged by temperature sensitivity) that may be two segments higher than sensory blockade (pain, light touch), which in turn is two segments higher than motor blockade.⁽⁸⁹⁾

The aim of this study was to compare the efficacy of adding intrathecal dexmedetomidine versus fentanyl to hyperbaric bupivacaine for caesarean section as regards sensory and motor blockade, haemodynamic changes, Apgar score, side effects, parturient and surgeons' satisfaction.

Regarding demographic data:

In the present study there was no significant difference between both groups as regard the parturient age, their weight and the duration of operation.

Regarding haemodynamic changes:

Haemodynamic changes were assessed by continuous monitoring and recording the pulse rate, mean arterial blood pressure and oxygen saturation. Considering the physiological changes during pregnancy and effect of subarachnoid blockade on the

cardiovascular system, hypotension and bradycardia are most commonly as at full term the uterus contains about one-sixth of the mother's blood volume⁽⁹⁰⁾, a usual consequence of sympathetic blockade is a decrease in venous return and hypotension.⁽⁹¹⁾

In the current study, there were no significant differences in the heart rate between the two groups throughout all times of measurement. Bradycardia which is a potentially-serious complication of spinal analgesia⁽⁹¹⁾ did not occur except in 2 parturient in group II where heart rate reached 54 and 56 beat/min and needed no interference.

Sousaan Rasooli and Moslemi⁽⁹²⁾ reported that there was also no evidence of bradycardia in their study on 56 parturient receiving intrathecal bupivacaine alone or combined with mini-dose of fentanyl of 25 µg.

However, Mandell⁽⁹³⁾ and Cascio⁽⁹⁴⁾ stated that maternal heart rate decreased significantly compared to baseline values with no significant change in stroke index in their studies on the effects of intrathecal fentanyl on the hemodynamics in labouring parturient.

Although, Hannas⁽⁹⁵⁾ reported that unlike tetracaine used in subarachnoid injection, hyperbaric bupivacaine caused a higher rise in catecholamines level and this is probably the reason for lower incidence of bradycardia. They also reported that changes in heart rate variability parameters in the course of spinal analgesia may reflect a decrease in sympathetic activity and a relative increase in parasympathetic activity as a result of the block and in the course of spinal analgesia, the more pronounced the changes in heart rate variability were the more distinct the hypotension.

Dexmedetomidine causes bradycardia but the effect is more prominent when administered intravenously and with a higher dose⁽⁹⁶⁾.

Regarding the mean arterial blood pressure changes in the present study, comparing the two studied groups showed non significant differences throughout the times of measurement.

After increasing the rate of fluid administration, blood pressure increased gradually by the end of the surgery. Hypotension that occurred in this study despite an increase in fluid administered was treated with incremental intravenous ephedrine in a dose of 10 mg each time. In this study there was no significant difference in mean blood pressure between both groups. Similar results were reported by Mabzad⁽⁹⁷⁾, Coombs⁽⁹⁸⁾ and Dobrydnjov⁽⁸⁵⁾.

Hypotension resulting from sympathetic blockade is the most common frequent complication that occurs with central neuroaxial blockade. Therefore, maternal blood pressure was continuously monitored. Hypotension is defined as a decrease in systolic blood pressure to < 90 mmHg or 20% less than base line value of the mean arterial blood pressure.⁽⁷³⁾ In this study evident hypotension occurred in seven parturients, three of them in group I (fentanyl group) and four in group II (dexmedetomidine group). Hypotension can be explained by the physiological changes that occurred during pregnancy and the effect of subarachnoid block on the cardiovascular stability which lead to peripheral vasodilatation, decrease in total peripheral resistance and hence a decrease in arterial blood pressure.⁽⁴²⁾

The most common side effect with α_2 adrenoreceptor agonist is bradycardia and hypotension. The sympatholytic effect through activation of pre-synaptic α_2 adrenoreceptor

is responsible for hypotension⁽⁹⁹⁾. In the present study, dexmedetomidine produced manageable and not significant systolic hypotension. The probable reason is, intrathecal administration of drug produces less systemic side effects than parenteral administration. Studies done by Hall JE et al., and Ananta RE et al., have shown dexmedetomidine also has anaesthetic sparing and anaesthesia potentiating effect^(100,101).

Post anaesthetic hypotension is a common problem during spinal analgesia in parturient undergoing elective caesarean section. Spinal analgesia leads to sympathetic blockade resulting in vasodilatation and a decrease in the venous return that in turn decreases the cardiac output and worsens the hypotension.⁽¹⁰²⁾

Several studies were done to analyze the different preventive and curative strategies for the management of hypotension during spinal analgesia for elective caesarean section⁽¹⁰³⁻¹⁰⁵⁾. Mercier et al compared crystalloid preload, colloid preload and vasopressors (such as ephedrine and phenylephrine) to prevent hypotension associated with spinal analgesia for caesarean section. They found that crystalloid preload alone was ineffective, colloid preload was effective but might be better used as second line of treatment. They also reported that the association of vasopressors with a rapid crystalloid preloading at the time of spinal injection was the most effective⁽¹⁰³⁾.

Cardoso⁽¹⁰⁶⁾ reported that on comparing the incidence of hypotension and the need for vasopressors in parturient submitted to caesarean section under spinal analgesia following preload with either crystalloid or colloid (modified fluid gelatin), the incidence of hypotension in their study was about 10% and colloid was equivalent to crystalloid in preventing or decreasing the incidence of hypotension. On the other hand, Dahlgren⁽¹⁰⁷⁾ found lower incidence of hypotension on using colloid when they compared colloid versus crystalloid preloading to prevent maternal hypotension during spinal analgesia for elective caesarean section.

Desalu and Kushimo⁽¹⁰⁵⁾ compared traditional crystalloid preloading (1 L normal saline 0.9%) and ephedrine infusion (30 mg ephedrine in 1 L normal saline 0.9%). They stated that prophylactic ephedrine infusion was more effective than crystalloid preloading in the prevention of hypotension during spinal analgesia for elective caesarean section.

In the present study, there were no significant differences between the two groups regarding oxygen saturation all through the measuring intervals which may be attributed to the non involvement of the intercostal muscles and/or diaphragm during motor blockade as a result of the small doses of the local anaesthetics,⁽¹⁰⁸⁾ and the supplemental oxygen administration through a face-mask throughout the whole procedure.⁽¹⁰⁹⁾

Regarding sensory and motor block:

Sensory block level which is usually recommended for caesarean section is T₄⁽¹¹⁰⁾, despite this, many parturient had several complaints which may need for supplementary analgesia.^(111,112) In this study, achieving T₄ block was significantly evident in group II (dexmedetomidine group) than group I (fentanyl group) with a faster onset of analgesia.

During caesarean section pressure and tractions, applied to the upper part of the abdomen for fetal extraction and on the other hand, shedding of blood and amniotic fluid from the abdominal cavity, traction on fallopian tube mesentery at the time of the uterine

extraction or cleaning of abdominal cavity from blood, all can excite the upper abdominal regions so it is necessary to achieve a high sensory block level which can be done using higher doses of hyperbaric bupivacaine, but the quality of block will be varied with different doses.^(111,112) A variety of ways have been tried to improve the quality of spinal analgesia during caesarean section either by injecting larger doses of local anaesthetics^(112,113) or the addition of opioids and other additives⁽⁸⁴⁾ to the hyperbaric bupivacaine solution.

In the present study parturient received dexmedetomidine had earlier onset, higher level of sensory block, and increased interval for first analgesic request leading to less requirement of postoperative analgesia than parturient received fentanyl.

In the current study comparing the two groups about 60% of parturient had sensory level T4 in group II comparing with 24% in group I. All parturient in both groups had sensory level above T8 during surgery which was satisfactory for both parturient and surgeons so no need for supplemental anaesthesia intraoperatively.

Also parturients in group II had a slower regression of sensory block as it took a longer duration from 180 to 315 minutes to regress to segmental level T12 compared to group I which took from 165 to 240 minutes.

Regarding the changes in pain intensity measured by VAS it was noticed that pain intensity in group II is statistically less significant than group I 15 min and 30 min after spinal and up to 6 hours post operative with earlier request for analgesics in group I. About 18 parturient in group I received diclofenac sodium, 10 of them recieved it twice and one recieved pethidine while 12 parturient in group II recieved diclofenac sodium, only 8 of them recieved it twice and no one recieved pethidine.

These results might be explained by increasing the analgesic action of α -2 adrenergic e.g dexmedetomidine receptor agonists in pregnant versus non-pregnant⁽¹¹⁴⁾ or by supressing phosphorylation of the N-methyl-D-aspartate receptor in spinal dorsal horn neurons.⁽¹¹⁵⁾

However, Ben David⁽¹¹⁶⁾ and Alimian⁽¹¹⁷⁾ noticed that addition of intrathecal fentanyl to hypebaric bupivacaine in spinal analgesia yield a higher sensory and motor block level with faster regression time of motor block than using just hyperbaric bupivacaine,they explained their results by selective block of A and C fibers by intrathecal fentanyl.

Kanazi et al⁽¹¹⁸⁾, reported that the addition of dexmedetomidine (3 μ g) or clonidine (30 μ g) to bupivacaine in spinal block shortens the time to onset of motor block and extends the sensory and motor block durations.Al-Mustafa et al⁽¹¹⁹⁾, added 5 μ g and 10 μ g dexmedetomidine to spinal bupivacaine and noted shorter times to onset of sensory and motor blocks along with longer block durations.Gupta et al⁽¹²⁰⁾, added 5 μ g dexmedetomidine or 25 μ g fentanyl to 12.5 mg bupivacaine in spinal blocks and noted a longer duration of both sensory and motor blockade, and good patient satisfaction in both groups compared to hyperbaric bupivacaine without additives.

Also, Robert et al⁽¹²¹⁾ noticed that spinal clonidine (as another α -2 adrenergic receptor agonist) produce no additional motor block.

Regarding Apgar score:

Apgar scores⁽⁷⁶⁾ were within the normal range in the both groups at one and five minutes. This could be explained by the quite short duration between the intrathecal injection and clamping the umbilical cord.

Kavak et al⁽¹²²⁾ compared general and spinal analgesia for elective caesarean section. They found that there was no significant difference between both types of anaesthesia. Also, Petropoulos et al⁽¹²³⁾ studied the effect of general, epidural and combined spinal-epidural analgesia with respect to short-term outcome of newborns delivered by elective Caesarean section of healthy parturient with normal pregnancies. They reported that neonatal outcomes were similar in the three studied groups and the type of anaesthesia did not influence short-term outcomes in infants born via elective caesarean section, although differences in acid-base status of the newborn recommend the use of spinal analgesia.

Regarding side effects:

There are multiple complications associated with spinal analgesia ranging from troublesome like nausea, vomiting, itching and sedation to the crippling and life threatening ones.

In this study nausea and vomiting were observed in 7 parturients out of 40 (6 in group I, 1 in group II). Nausea and vomiting were treated with metoclopramide in a dose of 10 mg. Hypotension which results in a decrease in cerebral blood flow was an important cause of vomiting after spinal blockade and in many cases restoring of the basal blood pressure was enough to treat the nausea and vomiting⁽¹²⁴⁾.

Alimian et al⁽¹²⁵⁾ reported higher incidence of nausea and vomiting in patients received intrathecal fentanyl than whom received intrathecal dexmedetomidine in their study in lower limb elective surgeries.

However, Manullang⁽¹²⁶⁾ noticed that intrathecal fentanyl is superior to intravenous ondansetron for the prevention of perioperative nausea during caesarean delivery with spinal analgesia.

In current study itching was observed in 5 parturients out of 40 (all in group I). This can be explained by histamine release of fentanyl.⁽¹²⁷⁾

Shivering was observed in 2 parturient in group II which had similar results as observed by Vettermann⁽¹²⁸⁾ who found that intrathecal fentanyl can have a protective effect against shivering.

No parturient complained of respiratory depression, urinary retention or post spinal headache during this study.

Regarding parturient and surgeon satisfaction:

The present study declared significant parturient satisfaction in group II than group I. However, there was a non significant surgeons' satisfaction difference between both groups.

Sindhavannda⁽¹²⁹⁾ reported that on comparing maternal satisfaction to spinal and epidural analgesia for caesarean section regarding the techniques and their outcomes they found that there was no significant difference between the two techniques. On the other hand, Halpern⁽¹³⁰⁾ reported higher maternal satisfaction with epidural than with spinal analgesia for elective caesarean section.

SUMMARY

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For most of the severely preeclamptic population, the risk–benefit profiles of spinal anesthesia and general anesthesia strongly favor the use of spinal anesthesia when feasible. Important factors to consider are the risks of clinically significant maternal hemodynamic derangements, difficult airway management, stroke, and adverse neonatal outcomes, in severely preeclamptic patients, spinal anesthesia–induced hypotension is typically easily treated, and there is no evidence that neonatal outcomes are compromised. In contrast, potential complications of general anesthesia, such as hypertensive crisis, stroke, and difficult airway management, are leading causes of morbidity and mortality in the preeclamptic population. Therefore, in the majority of severely preeclamptic patients, who are not coagulopathic or thrombocytopenic, the risk of difficult or failed airway management and delayed recognition of maternal stroke during a general anesthetic are felt to exceed the risk of adverse outcomes from spinal anesthesia–induced hypotension.

The aim of this study was to evaluate the efficacy of adding intrathecal dexmedetomidine versus fentanyl to hyperbaric bupivacaine for cesarean section in preeclampsia as regards sensory and motor blockade, hemodynamic changes, Apgar score, parturient and surgeons' satisfaction.

This study was carried out in El-Shatby Maternity University Hospital, on fifty parturient scheduled for elective cesarean delivery under spinal analgesia.

Parturients were randomly categorized into 2 equal groups (25 parturient each).

Group I [Fentanyl group]:

25 parturients received spinal analgesia consisting of 2 ml of 0.5% hyperbaric bupivacaine and 0.5 ml fentanyl (25µg).

Group II[Dexmedetomidine group]:

25 parturients received spinal analgesia consisting of 2 ml of 0.5% hyperbaric bupivacaine and 0.5ml diluted dexmedetomidine (5µg).

All parturient were given intravenous lactated Ringer's solution 10 ml/kg as volume preload. Oxygen was administered through a face mask. Spinal analgesia was performed in the sitting position at the L 3-4 interspace with midline approach by using a 25 gauge needle. After intrathecal injection, parturients were placed supine with left uterine displacement with a wedge beneath the right hip to maintain a pelvic tilt.

Hemodynamic measurements (pulse rate, mean arterial blood pressure, oxygen saturation), sensory blockade (time to reach the highest sensory level, segmental level of highest sensory blockade , time to reach T12, pain intensity and time for first request for analgesia), motor blockade (onset, duration and regression using the modified Bromage score), perioperative side effects or complications (including sedation, hypotension, nausea, vomiting...etc.), fetal well-being using Apgar score , both parturient and surgeon satisfaction were all recorded and statistically analyzed.

There was no significant difference between the two groups regarding age, weights and duration of the operation.

There was no statistically significant difference also between the two groups regarding pulse rate, mean arterial blood pressure and oxygen saturation.

The results revealed that parturients who received intrathecal dexmedetomidine had a higher and faster level of sensory blockade and delayed regression of sensory level compared to those who received intrathecal fentanyl.

Regarding the changes in pain intensity measured by VAS. The dexmedetomidine group revealed low VAS compared to fentanyl group immediately after spinal and up to 3 hours post operative with earlier and multiple requests for analgesics in fentanyl group.

Comparing both groups regarding onset of motor block and its regression using modified bromage score we noticed no significant difference in duration and regression of motor block in fentanyl group compared to dexmedetomidine group.

Apgar scores were within the normal range in the both groups at one and five minutes.

Sedation was significant in dexmedetomidine group, although it did not occur in any parturient of fentanyl group.

There was no post spinal headache, urinary retention and respiratory depression in any parturient of both groups.

There was no significant difference in the incidence of hypotension and bradycardia between the two studied groups.

Nausea and vomiting were more evident in parturients who received intrathecal fentanyl than who received intrathecal dexmedetomidine, and itching was found only in fentanyl group.

Parturient were more satisfied in dexmedetomidine group than fentanyl group and there were no differences in surgeons' satisfaction in both groups.

From this study we conclude that dexmedetomidine has better sensory blockade and no significant difference in motor blockade with less incidence of nausea, vomiting and itching than fentanyl when used intrathecally in severe preeclamptic patients.

CONCLUSIONS

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From this study, we conclude that:

- Spinal analgesia has proved to be an effective and safe method for caesarean section with limited side effects.
- Satisfactory sensory and motor blockade were successfully achieved in both groups intraoperatively.
- Using intrathecal dexmedetomidine for cesarean section showed better sensory blockade as compared to intrathecal fentanyl.
- More time interval for the first request of supplementary analgesia in dexmedetomidine group in post operative period.
- Fewer requests for supplementary analgesia in dexmedetomidine group in post operative period.
- Using intrathecal dexmedetomidine for caesarean section showed no significant difference in motor blockade compared to fentanyl.
- Intra operative sedation was significant in dexmedetomidine group.
- Less incidence of nausea, vomiting and itching in dexmedetomidine group than fentanyl group.