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Comparative Study Of Ketamine Versus Dexmedetomidine As An Adjunct For Transversus Abdominis Plane (TAP) Block For Cesarean Sections

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Abstract

Objective: To compare the efficacy of adding dexmedetomine versus ketamine to bupivacaine for TAP block in terms of postoperative pain score, rescue analgesia requirements and postoperative nausea and vomiting.

Method: The study was a Quasi-experimental study conducted in the Anesthesia Department, Tertiary Care Hospital, from July to December 2023. We selected 120 patients scheduled for cesarean section and randomly divided them into two groups. At the end of surgery, group BD patients received a total volume of 40 ml, 20 ml on each side. This volume consisted of bupivacaine 0.125% with 0.5mcg/kg dexmedetomine. On the other hand, group BK patients received the same amount of volume on each side, but instead of bupivacaine and dexmedetomidine, we used bupivacaine 0.125% and ketamine 1 mg/kg. All patients were observed for post-op pain for 16 hours using a visual analogue scale. The need to give rescue analgesia was also recorded. Post-op vomiting was also noted.

Results: Both groups were comparable in terms of visual analogue scale scores at 4, 8, 12 and 16 hours post-operatively with a p-value of 0.462, 0.295, 0.848 and 0.154 respectively. In group BD, out of 60 patients, only 12 (20%) patients required rescue analgesia, whereas in group BK, 16 (26.67%) patients were given rescue analgesia (p-value 0.388). In group BD, out of 60, only 3 (5%) patients had vomiting, whereas in group BK, it was seen in 7 (11.67%) patients (p-value 0.186).

Conclusion: It is concluded in our study that the addition of dexmedetomidine or ketamine to bupivacaine for transversus abdominis plane block is equally effective and may provide effective analgesia for at least 16 hours.

Keywords: Adjuncts, Bupivacaine, Dexmedetomidine, ERAS, Ketamine, Nerve block, Cesarean section

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Introduction

Cesarean section is one of the most common surgeries performed in Pakistan. The rate of cesarean sections has dramatically increased in the last few decades.[1] According to the World Health Organization, 21% of all childbirths globally are through cesarean section, and this rate is expected to increase up to 29% by the year 2030.[2] Recent data shows similar trends in the rise of cesarean sections in Pakistan. According to recent surveys conducted in Pakistan, the rate has increased from 3.2% (1990) to 22% (2018).[3,4] This rising trend of cesarean deliveries and increasing population has put a lot of stress on the healthcare systems not only in the developed world but more in the poor and developing countries like Pakistan.

Many strategies can be employed to reduce this huge burden on our healthcare system. One of them is reducing the hospital stay after a cesarean section. Enhanced recovery after cesarean section does not only reduce the post-operative complications but can also reduce hospital stay and total cost of treatment.[5,6]

Effective pain relief after surgery is one of the key features of enhanced recovery after surgery (ERAS). Cesarean section is associated with moderate to severe post-operative pain if untreated or not properly treated. Multimodal analgesia with the regional nerve blocks seems to be the best strategy for controlling post-operative pain after surgery.

The Transversus abdominis plane block is the most commonly used block for the pain management of surgeries performed below the level of the umbilicus, including cesarean section. The abdominal wall below the umbilicus is mainly supplied by a pair of three nerves, including the T12, iliohypogastric and ilioinguinal nerves on each side.[7] These nerves travel between the trasversus abdominis and the internal oblique muscle. The plane between these two muscles is called the transversus abdominis plane. In this plane, these nerves can easily be blocked with USG-guided TAP block by visualizing the spread of local anaesthetic between the two layers.

The most commonly used local anaesthetics for nerve blocks include bupivacaine, lidocaine, ropivacaine and levobupivacaine.[8] Recently, many researchers have tried various combinations of local anesthetics and adjuncts to enhance the quality of analgesia and to prolong the duration of effective analgesia.[9,10] However, the best combination is yet to be discovered. We used two different combinations, i.e. bupivacaine and dexmedetomidine versus bupivacaine and ketamine, in the quest for the best combination for TAP block. The results of our study will help determine a better analgesic plan for post-op management in cases of cesarean section.

Materials And Methods

This quasi-experimental study was done from July to December 2023 after getting approval from the Ethical Review Board of the Tertiary Care Hospital. One hundred and twenty patients scheduled for elective cesarean section under spinal anaesthesia were selected. The sample size was calculated with G*Power version 3.1.9.3 for Windows. The expected Effect Size was 0.3, the alpha error probability was taken as 0.05, and the Power 0.95. The sample size was calculated to be 111, but it was rounded off to 120.

We selected all the patients scheduled for elective cesarean section under spinal anaesthesia with American Society of Anesthesiologists (ASA) class II who were willing to participate in the study and signed the consent form for the same. We excluded patients with a history of allergy to study drugs. Patients with infection at the site of injection, obesity with a body mass index greater than 35 kg/m^2, history of chronic pain, mental disorder and coagulopathy were also excluded. Patients with a history of motion sickness and hyperemesis were also excluded.

Selected patients were randomly divided into two equal groups with the help of the lottery method. All patients were given 2.5 ml of 0.5% hyperbaric bupivacaine for spinal anesthesia with a 27 G Quincke spinal needle. At the end of the cesarean section, one of the researchers performed the TAP block following the ultrasound technique and had at least a post-fellowship experience of 5 years and was well-versed with this technique. We used a linear ultrasound probe, which was placed in an axial plane in the mid-axillary line between the iliac crest and subcostal margin. When all three layers of muscles were visualized, we advanced the needle in the plane with the ultrasound probe. Local anaesthetic was injected when the target area was reached, and the clear splitting of two muscle layers was also observed. The same technique was followed on the other side as well. Group BD patients received a total volume of 40 ml, 20 ml on each side. This volume consisted of bupivacaine 0.125% with 0.5mcg/kg dexmedetomine. On the other hand, group BK patients received the same amount of volume on each side, but instead of bupivacaine and dexmedetomidine, we used bupivacaine 0.125% and ketamine 1 mg/kg. The study drugs were prepared by the anesthesiologist who was not part of this study. The person assigned to collect the data was unaware of what adjunct was used.

All patients were given intravenous paracetamol 1 gram 8 hourly post-operatively. The pain was assessed with the help of a Visual Analogue Scale (VAS). Any patient with a VAS score of 5 or more was given rescue analgesia. For rescue analgesia, we gave tramadol 100 mg intravenously. Demographic data, including age and BMI, was collected for all patients. The time taken for the surgery was recorded. VAS score was assessed at 4, 8, 12 and 16 hours post-operatively. The need to give rescue analgesia was also recorded. All patients were monitored for the adverse effects of dexmedetomidine and ketamine which included bradycardia, hypotension, hallucinations, tachycardia, and vomiting, was also noted.

We analyzed the collected data with the help of SPSS 24. Continuous variables are presented as mean and standard deviation, whereas categorical variables are presented as frequency and percentage. Two groups were compared with the help of an independent t-test, chi-square test and Mann-Whitney U test. A P-value of 0.05 or less was taken as significant.

Results

In our study, patients' ages ranged from 20 to 40 years. The mean age came out to be 28.68±4.05 and 27.38±3.61 for groups BD and BK, respectively. The difference was statistically insignificant. Similarly, the difference in BMI and duration of surgery between both groups was also statistically insignificant. Details are shown in Table 1 below.

In our study, we observed that VAS scores at the interval of 4, 8, 12 and 16 hours post-operatively were comparable, and no group had the superiority to the other in terms of analgesic effect of the TAP block. Detailed compassion is shown in Table 2 below.

Table 1: Comparison of Demographics and Duration of Surgery

	Group		P-value
	BD (n=60)	BK (n=60)	
Age (years)	28.68±4.05	27.38±3.61	0.066
BMI (kg/m^2)	27.82±2.49	28.64±2.73	0.093
Duration of Surgery (Minutes)	66.4±11.11	62.85±12.13	0.097

Table 2: Comparison of VAS Score

	Group RK	Median	Interquartile Range	p-value
VAS 4	BD	00	1.0	0.462
	BK	00	00	
VAS 8	BD	00	1.0	0.295
	BK	00	1.0	
VAS 12	BD	0.5	2.0	0.848
	BK	1	2.0	
VAS 16	BD	2.0	3.75	0.154
	BK	2.0	3.0	

We observed in our study that more patients in group BK required rescue analgesia. In group BD, out of 60 patients, only 12 (20%) patients required rescue analgesia, whereas in group BK, 16 (26.67%) patients were given rescue analgesia. However, this difference was not statistically significant as the p-value was 0.388. A comparison is shown in Figure 1.

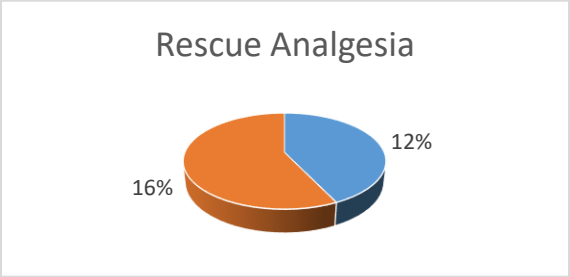

Figure 1: Percentage of Patients Requiring Analgesia Requirement in Both Groups

In this study, we observed that more patients in group BK experienced vomiting, but the difference was statistically insignificant with a p-value of 0.186. In group BD, out of 60, only 3 (5%) patients had vomiting, whereas in group BK, it was seen in 7 (11.67%) patients. A detailed comparison of adverse effects is shown in Table 3 below.

Table 3: Post-Op Adverse Effects of the Research Drugs

Adverse Effect	Group		p-value
	Group BD (n=60)	Group BK (n=60)	
Bradycardia	3 (5%)	1 (1.67%)	0.309
Hypotension	4 (6.67%)	2 (3.33%)	0.402
Tachycardia	2 (3.33%)	4 (6.67%)	0.418
Hallucinations	0 (0%)	0 (0%)	--
Vomiting	3 (5%)	7 (11.67%)	0.188

Discussion

Early recovery after surgery plays a vital role in reducing post-operative complications like thromboembolic events and reducing the overall treatment cost.[11,12] Effective pain relief is of utmost importance for early recovery.[13] It can be easily achieved with a combination of NSAIDs, opioids and peripheral nerve blocks. TAP block provides good post-op analgesia for cesarean section.[14] In our study, we found out that when either ketamine or dexmedetomidine is added with bupivacaine for TAP block, both combinations provide effective and prolonged post-operative analgesia that lasts for at least 16 hours in most cases. A similar study conducted by Karasu D et al. reached the conclusion that ketamine and dexmedetomidine can be added to bupivacaine for TAP block without any major side effects, and both combinations not only reduce the post-op VAS scores but also extend the time first to rescue analgesia.[15] Another study by Ozer D et al. showed similar results. They concluded that TAP block with ketamine rather than bupivacaine alone results in lower VAS scores, and the former combination provides a longer duration of analgesia post-operatively, but surprisingly, total consumption of rescue analgesia in both groups was comparable.[16]

In our study, 20% of patients in group BD and 26.67% of patients in group BK required rescue analgesia, and this difference was not statistically significant. In a similar study conducted by Ramya PA et al., it was observed that only 22.23% of patients who were given dexmedetomidine and bupivacaine for TAP block required rescue analgesia, whereas of those patients who only received bupivacaine for TAP block, 42.86% required rescue analgesia.[17] We can easily say that adding adjuncts to bupivacaine for TAP block provides superior analgesia as compared to when given alone.

Post-operative nausea and vomiting after cesarean delivery is very common and reported in international literature as high as 80%.[18] Reasons for this include hyperemesis gravidarum, use of various drugs including opioids and oxytocin, post-op hypotension, etcetera.[19] In our study, 5% of patients in group BD and 11.67% in group BK had post-op vomiting. A meta-analysis conducted by Johns N et al. showed similar results. They concluded that prolonged analgesia provided by TAP block reduces opioid consumption and markedly reduces the incidence of postoperative nausea and vomiting.[20]

The limitation of our study was that we only observed the patients for 16 hours post-operatively, and we did not calculate the total consumption of analgesics. It is, therefore, recommended that a similar study should be done, and patients should be observed till the time of discharge with total post-operative analgesia consumption and frequency of nausea and vomiting.

Conclusions

It is concluded in our study that the addition of dexmedetomidine or ketamine to bupivacaine for transversus abdominis plane block is equally effective and may provide effective analgesia for at least 16 hours.

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Contributions:
M.A, M.H, M.U.F, M.W - Conception of study
M.A, M.H. - Experimentation/Study Conduction
M.A, M.H, A.H, M.A - Analysis/Interpretation/Discussion
M.A, M.H, A.H, M.A - Manuscript Writing
M.A, M.H, M.U.F, M.W, M.A - Critical Review

All authors approved the final version to be published & agreed to be accountable for all aspects of the work.