

A COMPARISON OF DEXMEDETOMIDINE AND FENTANYL AS AN ADJUVANT TO 0.25% BUPIVACAINE FOR EPIDURAL ANALGESIA IN PERCUTANEOUS NEPHROLITHOTOMY (PCNL)

Trishala Jain¹, Maya Damor², Anupama Gupta³, Pinki Meena⁴

³Senior Professor, ^{2,4}Resident Doctor, ³Assistant Professor

Department of Anesthesia, SMS Medical College, Jaipur

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Address for Correspondence: Maya Damor, Resident Doctor, Department of Anesthesia, SMS Medical College, Jaipur

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Abstract

Background: PCNL can be performed under general anesthesia or regional anesthesia. PCNL is usually performed under general anesthesia due to better control of breathing and more comfort for the patients.

Methods: The study was conducted on 75 patients divided in 3 groups (n=25 in each group) undergoing PCNL. After obtaining permission from Research review board and institutional ethics committee. Informed and written consent was obtained from all patients for performance of epidural anaesthesia after complete explanation about the study protocol, side effects related to the drugs and procedure to the patient.

Results: The onset of sensory block was comparable in group B (7.28 ± 0.93 min) and group C (6.88 ± 0.97 min), faster when compared to group A (8.16 ± 0.85 min) group. The mean time of onset of motor block was comparable in group C (18.08 ± 1.41 min) and group B (20.56 ± 1.61 min) but slightly faster when compared to group A (26.08 ± 1.19 min) group. The mean VAS score was lower in Group C followed by Group B and was highest in Group A from 2 hours to 5 hours after surgery. Sedation score was significant higher in Group C ($p < 0.001$) as compared to Group A and B and there was no significant difference between Group A and B.

Conclusion: We conclude that PCNL can be performed using 0.25% bupivacaine in epidural anaesthesia without compromising on patient's comfort and surgeon's satisfaction.

Keywords: Percutaneous nephrolithotomy (PCNL), Dexmedetomidine, Fentanyl, Bupivacaine

INTRODUCTION:

PCNL can be performed under general anesthesia or regional anesthesia. PCNL is usually

performed under general anesthesia due to better control of breathing and more comfort for the patients. However, there are some occasional side effects from general anesthesia

such as lung atelectasia, drug allergy and postoperative nausea and vomiting.^{1,2}

Recently, PCNL under regional anaesthesia was reported as having some advantage over general anaesthesia, such as lesser post operative pain, lower dose requirement for analgesic drugs, and avoidance of the side effects from multiple medications during general anaesthesia.³ An regional block to the level of T6 is required. Regional techniques may be better tolerated in elderly, avoiding the cardiovascular and respiratory depressant effects of general anaesthesia. The advantages of regional anaesthesia includes the reduced blood loss and possibly less thrombo-embolic events with regards to PCNL

Spinal anaesthesia is the preferred regional anaesthetic technique because of technical ease, early onset and sure success of technique, but duration of anaesthesia and analgesia is limited.

Epidural anaesthesia, though demanding technically, has many advantages of providing anaesthesia for prolonged duration with repeated top-ups and also it is the preferred technique of choice for providing excellent post-operative analgesia.

Various studies have stated that the duration of anaesthesia and analgesia with the dose of dexmedetomidine is 1.5 – 2 times higher than fentanyl when used in epidural route⁴⁻⁶. These adjuvants, because of their analgesic properties and augmentation of local anaesthetic effects reduces the requirement of anaesthetic agents. Stable hemodynamics and decreased oxygen demand due to enhanced sympathoadrenal stability make them very useful pharmacologic agents⁷.

With this background information, after the approval of ethical committee we have done a prospective clinical study at our institute with the aim to compare the efficacy and clinical profile of α -2 adrenergic agonists dexmedetomidine and opioid fentanyl, when used as adjuvants in epidural anaesthesia in patients undergoing PCNL with special emphasis on their

sedative properties and ability to provide smooth intra-operative and post-operative analgesia.

MATERIAL AND METHODS

The study was conducted in the Department of Anaesthesiology, Sawai Man Singh Medical College and Attached Group of Hospitals, Jaipur after the approval of local institutional ethical committee and obtaining written informed consent from all patients before participation.

Study Design -Hospital based, comparative, Randomized, Double blind, interventional study in three groups of patients.

STUDY PERIOD 1st April 2017 to 26th March 2018

Method

The study was conducted on 75 patients divided in 3 groups (n=25 in each group) undergoing PCNL in Department of urology, S.M.S. Medical College and Attached Group of Hospitals, Jaipur. After obtaining permission from Research review board and institutional ethics committee. Informed and written consent was obtained from all patients for performance of epidural anaesthesia after complete explanation about the study protocol, side effects related to the drugs and procedure to the patient.

Group A (n=25): patient received only 20 ml epidural 0.25% bupivacaine.

Group B (n=25): patient received 20 ml epidural 0.25% bupivacaine along with fentanyl (1mcg/kg).

Group C (n=25): patient received 20 ml epidural 0.25% bupivacaine along with dexmedetomidine (1mcg/kg).

Inclusion Criteria

- ASA grade I, II
- Age 20 - 60 years
- Patient Height >145cm

- Patients undergoing PCNL
- Weight 40-80kg

The ASA classification was created in 1940 for the purposes of statistical and hospital records. It is useful both for outcome comparisons and as a convenient means of communicating the physical status of patients among anaesthesiologists. The higher the class, the higher is the anaesthetic risk.

Class 1- Healthy patient, no medical problems

Class 2-Mild systemic disease

Class 3-Severe systemic disease but not incapacitating

Class 4-Severe systemic disease that is a constant threat to life

Class 5-Moribund, not expected to live twenty four hours irrespective of operation.

Exclusion Criteria

- Patient refusal
- Patient having contraindications for epidural anesthesia (infection at the site of injection, spine deformity, patient receiving antiplatelet

drugs such as aspirin, clopidogrel, patient receiving heparin, pre-existing neurological defects).

- Any contraindication to Bupivacaine, lignocaine, dexmedetomidine and fentanyl use.
- Known hepatic, renal, cardiac, neurological, psychiatric, metabolic or respiratory disease.
- Evidence of gross radiological and anatomical abnormality in lumbar region.

Data analysis

All data were entered in excel sheet. Quantitative data was summarized in form of mean and SD. The difference in mean of two groups analysed using unpaired T-test. Qualitative data summarized in form of proportions. The difference in proportion analysed using Chi square test. The level of significance was kept 95% for all statistical analysis. p value < 0.05 was taken as statistically significant.

RESULTS

Table 1: Socio-demographic variable

Socio-demographic variable	Group A	Group B	Group C	P Value
Mean age (Yrs)	36.1±9.5	35.2±2.5	35.1±2.2	0.937
Male: Female	18:7	19:6	17:8	0.587
Weight	60.6±10.4	58.3±10.7	61.8+	0.501
ASA grade I:II	15:10	14:11	14:11	0.947

Difference of age, weight, sex and ASA grading difference between these groups was statistically not significant (p>0.05). Hence the groups were comparable with respect to socio-demographic variable.

Table 2: Study variable

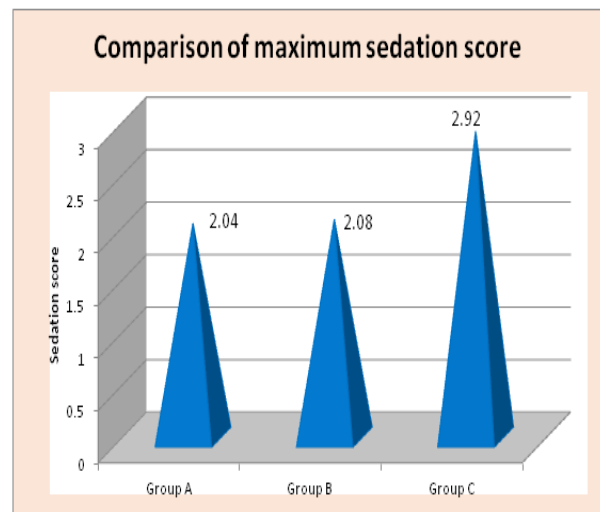
Group	Mean ± SD	ANOVA	Post hoc p value	
Mean time of onset of sensory block				
Group A	8.16 ± 0.85	F= 12.64 P< 0.001	A vs B	0.014
Group B	7.28 ± 0.93		A vs C	<0.001
Group C	6.88 ± 0.97		B vs C	0.118
Mean time to reach maximum sensory level (min)				
Group A	18.12 ± 2.44	F= 3.013 P= 0.055	A vs. B	0.973
Group B	17.96 ± 2.42		A vs. C	0.073
Group C	16.52 ± 2.74		B vs. C	0.118
Mean duration of sensory block (min)				
Group A	248.2 ± 10.65	F= 599.53 P< 0.001	A vs B	< 0.001
Group B	289.6 ± 6.65		A vs C	< 0.001
Group C	345.4 ± 11.85		B vs C	< 0.001
Mean time of onset of motor block(min)				
Group A	26.08 ± 1.19	F= 209.86 P< 0.001	A vs B	< 0.001
Group B	20.56 ± 1.61		A vs C	< 0.001
Group C	18.08 ± 1.41		B vs C	< 0.001
Mean time of duration analgesia requirement (min)				
Group A	207.4±29.	F=323.21 P<0.001(S)	A vs B	<0.001(S)
Group B	284.2±20.2		AvsC	<0.001(S)
Group C	373.1±17.		BvsC	<0.001(S)
VAS score				
Time point	Group A	Group B	Group C	P Value
0 hour	0	0	0	-
1 hour	0.1 ± 0.3	0.1 ± 0.3	0	0.132
2 hour	0.6 ± 0.9	0.1 ± 0.3	0	< 0.001 (S)
3 hour	1.3 ± 1.4	0.7 ± 1.1	0	< 0.001 (S)
4 hour	3.3 ± 1.3	2.4 ± 0.7	0.1 ± 0.3	< 0.001 (S)
5 hour	4.3 ± 1.8	3.9 ± 1.6	1.4 ± 0.5	< 0.001 (S)

Above table illustrates the comparison of mean time to onset of sensory blockade among study groups. The mean time to onset of sensory blockade was highest in Group A (8.16 min) followed by Group B (7.28 min) and lowest in Group C (6.88 min). This difference in time to onset of sensory blockade among the study groups was statistically significant (P<0.001). Post hoc analysis revealed that the time to onset of sensory blockade was significant higher in Group A as compared to Group B (p=0.014) and C (p<0.001). Present table illustrates that most of the subjects in all Group A (96%) had achieved T6 sensory level and only 1 (4%) had T4 level while

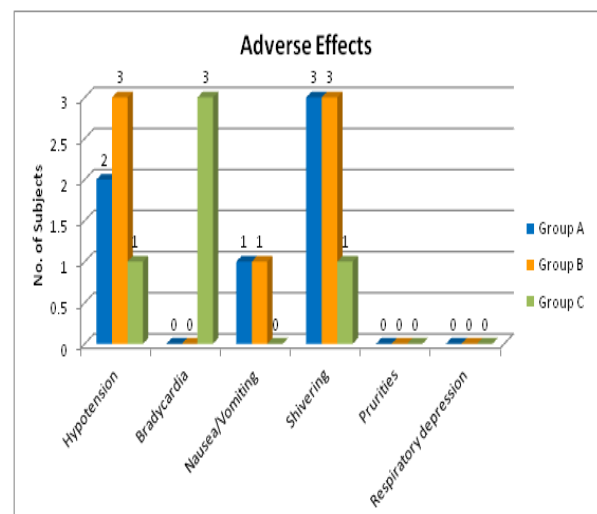
in group B 19 (76%) had T6 level and 6 (24%) had T4 level. None the patients in both Group A and Group B had T5 level. In Group C, most of the subjects had T6 level (84%) and 12% had T4 level and 1 (4%) had T5 sensory level. This difference in maximum sensory level achieved was however not found to be statistically significant (p=0.172). Present table illustrates that most of the subjects in all Group A (96%) had achieved T6 sensory level and only 1 (4%) had T4 level while in group B 19 (76%) had T6 level and 6 (24%) had T4 level. None the patients in both Group A and Group B had T5 level. In Group C, most of the subjects had T6 level (84%) and 12% had T4 level and 1

(4%) had T5 sensory level. This difference in maximum sensory level achieved was however not found to be statistically significant ($p=0.172$). Above table illustrates the comparison of mean time to onset of motor blockade among study groups. The mean time to onset of motor blockade was highest in Group A (26.08 min) followed by Group B (20.56 min) and lowest in Group C (18.08 min). This difference in time to onset of motor blockade among the study groups was statistically significant ($P<0.001$). Post hoc analysis revealed that the time to onset of motor blockade was significant higher in Group A ($p<0.001$) as compared to Group B and C and it was significantly higher in group B as compared to Group A ($p<0.001$). Above table illustrates the comparison of mean duration of motor block among study groups. The mean duration of motor block highest in group C (161.1 ± 9 min) followed by group B (158.8 ± 9.6 min) and lowest in groupA (142.2 ± 6.6). This difference in mean duration of motor block among study groups was statistically significant ($p<0.001$) post hoc analysis revealed that the mean duration of motor block among study groups was significant higher in groupc ($p<0.001$) as compared to group A and B and it was significantly higher in group B as compared to group A ($p<0.001$). Above table illustrates the comparison of mean time of analgesia among study groups. The mean time to 1st rescue analgesia was highest in Group C (373.1 min) followed by GroupB (284.2min) and lowest in GroupA (207.4min).This difference in mean time to1st rescue analgesia among the study groups was statistically significant ($P<0.001$). Post hoc analysis revealed that the mean time to 1st rescue analgesia was significant higher in Group C ($p<0.001$) as compared to Group A and B and it was significantly higher in group B as compared to Group A ($p<0.001$).The comparison of VAS score among study groups.The mean VAS score was lower in GroupC followed by GroupB and was highest in GroupA from 2hours to 5hours after surgery. This difference in VAS score from 2to5 hour after surgery was found to be statistically significant

($p<0.001$) i.e.pain was significantly lower in Group C as compared to GroupA and B.



The mean maximum sedation score was highest in GroupC (2.92) followed by Group B (2.08) and lowest in GroupA (2.04).This difference in maximum sedation score among the study groups was statistically significant ($P<0.001$).Post hoc analysis revealed that the sedation score was significant higher in Group C ($p<0.001$) as compared to Group A and B and there was no significant difference between GroupA and B.



No statistical significance in the incidence of adverse effects among the three groups. Prurities and respiratory depression was nil among 3 groups.

DISCUSSION

The present study was conducted in the department of anesthesiology, S.M.S. medical

college and attached group of hospitals, Jaipur. The present study was done to compare dexmedetomidine and fentanyl as an adjuvant to 0.25% Bupivacaine for epidural analgesia in percutaneous nephrolithotomy (PCNL) in terms of hemodynamic stability, sensory and motor block characteristics and postoperative analgesia, 75 patients of ASA Grade 1 and 2 were randomly allotted in three study groups of 25 each using computer generated random number table. The demographic variables were comparable in all three groups.

The mean time to onset of sensory blockade in study was earliest in Group A (8.16 min) followed by Group B (7.28 min) and lowest in Group C (6.88 min). This difference in time to onset of sensory blockade among the study groups was statistically significant ($P < 0.001$). Study by **(Edward B et al)⁸** was having similar results.

The onset time of epidurally administered local anesthetic bupivacaine 0.5% was found to be 8-9 minutes in previous studies **(Edward B et al)⁸**. Decreasing the concentration in our study to 0.25% did not prolong the time of onset of block (6-8 minutes).

The mean time to reach maximum sensory level was earliest in Group A (18.12 ± 2.44 minutes) followed by Group B (17.96 ± 2.42 minutes) and Group C (16.52 ± 2.74 minutes). Although it was shortest in Group C but it does not differ statistically (P value 0.055). Similar findings were noted by **Babu MSS et al⁹** when they compared epidural Bupivacaine with dexmedetomidine and Bupivacaine with clonidine for post-operative analgesia which is quite in favour of our study results. Another prospective study done by **Gupta.K et al¹⁰** had similar findings.

The mean time to onset of motor blockade in our study was maximum in Group A (26.08 min) followed by Group B (20.56 min) and lowest in Group C (18.08 min). This difference in time to onset of motor blockade among the study groups was statistically significant ($P < 0.001$).

This observation was similar to **Bajwa.S et al¹¹ (2011)** who studied dexmedetomidine and

fentanyl for epidural analgesia in lower limb orthopaedic surgery, time taken to reach highest bromage was early in dexmedetomidine group than fentanyl

Another study done by **Gupta.K ET al¹⁰** reported that time taken to achieve complete motor block in dexmedetomidine group was shorter (19.27 ± 4.7 min) than fentanyl group (22.78 ± 5.5 min).

The mean duration of motor blockade, in our study was max. (161.1 ± 9 min) in group C and (158.8 ± 9.6 min) in group B and (142.2 ± 6.6) in group A, which were statistically significant between the groups A vs B and A vs C, while it was not significant between group B and C. Same results were obtained by **Bajwa.S ET al¹¹** there report has shown that mean duration of motor block was prolonged in dexmedetomidine in comparison to fentanyl which were statistically significant.

Similar results were obtained in a prospective study by **Gupta.K ET al¹⁰, Kaur J et al¹², Rastogi B et al¹³** they all concluded that mean duration of motor block was prolonged in dexmedetomidine then fentanyl P value was highly significant

In our study the mean time to 1st rescue analgesia was highest in Group C (373.1 ± 17.4 min) followed by Group B (284.2 ± 20.2 min) and lowest in Group A (207.4 ± 29.8 min). This difference in mean time to 1st rescue analgesia among the study groups was statistically significant ($P < 0.001$). Dexmedetomidine was more effective in this respect. The mean VAS score was lower in Group C followed by Group B and was highest in Group A from 2 hours to 5 hours after surgery. This difference in VAS score from 2 to 5 hour after surgery was found to be statistically significant ($p < 0.001$) i.e. pain was significantly lower in Group C as compared to Group A and B. It was consistent with the findings of various studies such as **Bajwa.S ET al¹¹, Babu MSS et al⁹, Gupta K et al¹⁰, Rastogi B et al¹³** found out that time for first rescue analgesia was increased in dexmedetomidine group compared to fentanyl

group The results were statistically significant in all studies.

The mean maximum sedation score was highest in Group C (2.92) followed by Group B (2.08) and lowest in Group A (2.04). The results of our study correlates with the study by **Bajwa et al¹¹**, **Gupta K et al¹⁰**, **Thimmappa ET al¹⁴** they evaluated that dexmedetomidine has the superior sedation and analgesic effect when compared to fentanyl as an adjuvant to Bupivacaine

CONCLUSION

We conclude that PCNL can be performed using 0.25% bupivacaine in epidural anaesthesia without compromising on patient's comfort and surgeon's satisfaction. Use of low concentration epidural anaesthesia helps in early ambulation of patients and thus reduces the hospital stay and overall cost of the surgery. Addition of fentanyl and dexmedetomidine improves the quality of analgesia and prolongs the duration of anaesthesia with latter being better in this regard. Dexmedetomidine has higher efficacy than fentanyl with epidural bupivacaine therefore it is a better adjuvant to 0.25% bupivacaine for PCNL than fentanyl.

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