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Original Article

Haemodynamics during Percutaneous Nephrolithotomy in Spinal Anaesthesia with Two Doses of Hyperbaric Bupivacaine (0.75%)

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Abstract

Background: **To compare variation in haemodynamics during percutaneous nephrolithotomy in spinal anaesthesia with two doses of hyperbaric bupivacaine (0.75%).**

Methods: **In this randomized comparative study 60 patients, undergoing percutaneous nephrolithotomy, were included. It was done to compare the variation in haemodynamic parameters after spinal anaesthesia using two different doses of local anaesthetic before and after keeping patients in prone position. Patients were divided into two groups: Group A(n=30) (22.5 mg hyperbaric Bupivacaine 0.75%) and Group B (n=30)(30 mg hyperbaric Bupivacaine 0.75%). Spinal block was performed in sitting position. Hemodynamic measurements were carried out at different time points while patients were in supine and prone position.**

Results: **Decrease in heart rate was significant in Group B than in Group A after 10 minutes of spinal block while in supine position (p<0.001) and the drop in heart rate was significant statistically in Group B when patients were turned to prone position (p<0.001).Systolic and diastolic blood pressures decreased in Group B at 5 and 10 minutes in supine position which further decreased following prone positioning and the decrease was highly significant statistically(p=<0.001).**

Conclusion: **22.5 mg of injection hyperbaric Bupivacaine is haemodynamically safer as compared to 30 mg of the same drug during spinal anaesthesia in percutaneous nephrolithotomy.**

Key Words: **Haemodynamics, Spinal anaesthesia, Percutaneous nephrolithotomy**

Introduction

Monitoring haemodynamics during surgeries is one of the most important tasks that anaesthesiologists have to do in the operating theatres. Perioperative anaesthesia has made many different and difficult surgeries possible with significantly reduced morbidity and mortality. Among those, one of the procedures in the treatment of nephrolithiasis is percutaneous nephrolithotomy (PCNL). PCNL is the treatment of choice for large renal stones, staghorn calculi, and stones that are multiple or resistant to shock wave lithotripsy.[1,2] Anaesthesia for PCNL can be general or regional.[3] Regional anaesthesia has many advantages over general anaesthesia in the abdomen and extremities including avoidance of anaphylaxis that may be caused by the latter due to the use of multiple drugs.[4,5] Complications of general anaesthesia such as pulmonary (atelectasis), vascular, and neurologic disorders (brachial nerve injury or spinal cord injury), or airway related complications especially during change of the position are more likely than of spinal anesthesia.[6,7]Surgery performed in prone position poses anaesthetic challenges in two ways: prone positioning either following general or regional anaesthesia brings about hemodynamic alterations due to reduction in cardiac index and control of airway may not be easy in prone position as compared to supine position. Meticulous and careful delivery of anaesthesia and vigilant monitoring during intraoperative period avoids this difficulty. Surgeries are successfully carried out keeping patients prone following careful deliberation of spinal anaesthesia. This obviates the need of endotracheal intubation and avoids multiple drugs used in general anaesthesia. Patients are able to maintain their airway on their own as they remain awake and conversant during the procedure. The exact volume of local anaesthetic for spinal anaesthesia to patients going to be kept in prone position has not yet been clearly described.[8]

Shrestha BR, et al investigated to find out the level of sensory block in supine and prone position in two groups of patients undergoing PCNL in spinal anaesthesia with two different volumes of hyperbaric

bupivacaine. [8] They concluded that three ml of hyperbaric bupivacaine for spinal anaesthesia is good enough for the surgery in prone position with relatively more hemodynamic safety as compared to the four ml of the same drug.

Patients and Methods

This prospective randomized comparative study was conducted by the Department of Anaesthesia at Benazir Bhutto Hospital, Rawalpindi, from August 2016 till January 2017.The inclusion criteria was all the adult patients undergoing percutaneous nephrolithotomy, ASA I and II, patients having body weight of 45-80 kg and with a minimum height of height of 150 cm. Patients with history of coagulopathy, ingestion of antiplatelet drugs and infection on their back at the site of lumbar puncture, patients with deformed spine, who refused for spinal anaesthesia or cases with ineffective or partial spinal block not reaching the desired sensory level of T5-6 and needing general anaesthesia afterwards, were excluded. Randomization was done through random number list already generated using SPSS software version 22 equally but randomly allocating 60 patients either group A for bupivacaine dose 22.5 mg or group B for Bupivacaine 30 mg. Thirty patients in group A received 22.5 mg of hyperbaric bupivacaine (0.75%) for spinal anaesthesia , while 30 patients of group B received 30 mg of the same drug. Spinal anaesthesia was given in sitting position with full aseptic precautions using 25 G Whitacre spinal needle at L3-4 intervertebral space. Patients were kept in supine position for some time. Haemodynamic parameters were recorded at different time intervals of 5 and 10 minute following spinal block while they were supine and first 10 minute of prone positioning. To facilitate venous drainage and have abdomen free, two bolster rolls were kept at two different sites- one at the xiphisternum and other one at iliac crest level. Heart rate less than 50/minute and mean arterial pressure (MAP) drop more than 30% of the baseline value were managed with anticholinergics and crystalloid/vasopressor (phenylephrine) respectively.

Results

There were 42 male patients in the study while 18 patients were female (Table 1). Mean age in group A was 37.93±5.27. In group B mean age was 40.46±6.22 (Table 2). The decrease in heart rate was significant in Group B than in Group A after 10 minutes of spinal block while in supine position (p<0.001) and the drop in heart rate was significant statistically in Group B when patients were turned to prone position (p<0.001). More of anticholinergics were used to increase the heart rate in Group B (Table 3). The systolic blood pressure decreased in Group B at 5 and 10 minutes in supine position which further decreased following prone positioning and the decrease was highly significant statistically(p=<0.001) (Table 4). The diastolic blood pressure in Group B followed a similar trend as that of systolic blood pressure with a decrease at 5 and 10 minutes supine and a further decrease following prone positioning and it was also highly significant statistically(p<0.001). More of vasopressors were used to increase the blood pressure in group B (Table 5).

Table I- Gender distribution in two groups

	Male	Female
Group A	21	9
Group B	21	9

Table 2- Age Distribution

	Mean±SD				
Parameter	Group A	Group B	Mean differ-r-ence	p-value	Signif-icance
Age(Years)	37.93± 5.27	40.46± 6.22	2.53	.095	Not Signif-icant

Table 3. Heart rate per minute in two groups

Group	Baseline value	At 5 min supine	At 10 min supine	At 10 min prone
A	87±5.69	79±9.22	76±9.53	73±9.40
B	85±5.73	75±5.44	67±4.37	62±9.41
p-value	0.236	0.051	<0.001	<0.001

Table 4.Systolic blood pressure in mmHg in two groups

Group	Baseline value	At 5 min supine	At 10 min supine	At 10 min prone
A	132±7.36	118±9.38	110±9.35	98±6.35
B	133±6.75	109±8.75	97±7.26	88±5.50
p-value	0.549	<0.001	<0.001	<0.001

Table 5. Diastolic blood pressure in mmHg in two groups

Group	Baseline value	At 5 min supine	At 10 min supine	At 10 min prone
A	85±4.10	77±6.13	70±5.88	63±4.68
B	85±4.06	71±4.28	64±3.97	56±4.31
p-value	0.777	<0.001	<0.001	<0.001

Discussion

This study reveals that more number of patients receiving 30 mg local anaesthetic in spinal block demonstrated a significant decrease in heart rate, systolic and diastolic pressures as compared to the group receiving 22.5 mg of the drug. Median age of patients in two groups was not different statistically. Age difference may contribute in local anaesthetic distribution according to Cameron AE et al [9] who stated that the greater the age the more cephalad the spread of the level of anaesthesia. [9]Gender distribution in two study groups was similar in this study, having male patients predominant in each group. Sex of a patient has no direct effect on distribution of local anaesthetic solution in cerebrospinal fluid if all other factors involved in determining the distribution are kept constant.[10]

The technique, site and speed of injection, size and direction of bevel of spinal needle were kept constant for all patients in both groups in the study. These factors could have effect on the local anaesthetic spread in cerebrospinal fluid.[11]The local anaesthetic administered to intrathecal space gets fixed to its receptors ranging from 10 to 25 minutes after giving fixed maximum possible sensory height before regression of the block commences in due course of time.[12]

To perform PCNL the sensory height attained with 22.5 mg of hyperbaric bupivacaine was more than sufficient for the patients going to be positioned prone after 10 min of supine position with acceptable haemodynamic changes than with 30 mg of the same agent for spinal anaesthesia which could produce higher sensory and thereby autonomic blockade leading to clinically significant bradycardia and hypotension. The significant haemodynamic changes are further accentuated by the decreased cardiac index of prone position.[13] There has been a finding that the physiologic impact of prone position on cardiorespiratory function is minor so long as the abdomen is not compressed.[14]

In our study there was more consumption of crystalloids, anticholinergics and vasopressors in patients of group B to correct the resulting decreased heart rate and blood pressure. This is in accordance with the study done by Shrestha BR et al.[8]Spinal anaesthesia is relatively easy to perform, has many advantages over general anaesthesia and allows the surgery to take place in the best possible conditions.[15-17] There are certain possible risks of spinal anaesthesia for prone position surgery like potential for higher blocks, limited access to airway if patients are not fully awake, uncomfortable position for surgeries of long periods, need of repositioning if critical events occur and inconvenient if spinal anaesthesia does not work. Questions arise what in case of cardiac arrest. The patient can be turned supine on to the trolley. Literatures state that chest compressions in the prone position are possible and may generate higher systolic pressure and improve ventilation. [18,19] Furthermore it is possible to defibrillate patients in the prone position with lateral pad positions.[20]

In this study none of the patients required repositioning or faced complications or failure of spinal blocks. Nevertheless spinal anaesthesia allows early ambulation and enhanced recovery after surgery with adequate postoperative pain relief.[21,22,23] Studies are being conducted to explore other modalities of regional anaesthesia like combined spinal-epidural anaesthesia or epidural anaesthesia alone in PCNL.[24,25] Efficient and safe local anaesthetic doses in all these modalities need further studies.

Conclusion

22.5 mg of injection hyperbaric Bupivacaine is hemodynamically safer as compared to 30 mg of the same drug during spinal anaesthesia in percutaneous nephrolithotomy.

References

1. Mehrabi S, Shirazi K. Results and complications of spinal anesthesia in percutaneous nephrolithotomy. Urol J. 2010;7(1):22-25.
2. Keoghane SR, Cetti RJ, Rogers AE, Walmsley BH. Blood transfusion, embolisation and nephrectomy after percutaneous nephrolithotomy (PCNL). BJU international. 2013 Apr 1;111(4):628-32.
3. Gonen M, Basaran B. Tubeless percutaneous nephrolithotomy: spinal versus general anesthesia. Urol. J. 2014 ;11(1):1211- 15.
4. Movasseghi G, Hassani V, Mohaghegh MR, Safaeian R. Comparison between spinal and general anesthesia in percutaneous nephrolithotomy. Anesth Pain Med. 2014 ;4(1): 112-15
5. Cicek T, Gonulalan U, Dogan R, Kosan M, Istanbulluoglu O. Spinal anesthesia is an efficient and safe anesthetic method for percutaneous nephrolithotomy. Urology. 2014 ;83(1):50-55.
6. Kuzgunbay B, Turunc T, Akin S, Ergenoglu P. Percutaneous nephrolithotomy under general versus com¬bined spinal-epidural anesthesia. J Endourol. 2009;23(11):1835–38.
7. Karacalar S, Bilen CY, Sarihasan B. Spinal-epidural anesthesia versus general anesthesia in the management of percu¬taneous nephrolithotripsy. J Endourol. 2009;23(10):1591–97.
8. Shrestha BR, Khadgi S, Shrestha S. Two different volume of local anaesthetic in subarachnoid block for Minipercutaneous Nephrolithotomy in prone position. Journal of Kathmandu Medical College. 2012 Dec ;(1):10-15.

9. Cameron AE, Arnold RW, Ghoris MW, Lamieson V. Spinal analgesia using bupivacaine 0.5% plain: variation in the extent of the block with patient age. Anesthesia. 1981;36:318-22.
10. Brown DT, Wildsmith JAW, Covino BG, Scott DB. Effect of Baricity on spinal anesthesia with amethocaine. Br J Anesth. 1980;52:589-95.
11. Kitahara T, Kuri S, Yoshida J. The spread of drugs used for spinal anesthesia. Anesthesiology. 1956;17:205-08.
12. David CW. Spinal anesthesia. Anesthesiology. 2001;94:888–906.
13. Hatada T, Kusunoki M, Sakiyama T. Hemodynamics in the prone jack-knife position during surgery. Am J Surg. 1991;162:55-58
14. Archer DP and Ravussin P. Perioperative effects of the prone position: anesthesiologic aspects. Ann Fr Anesth Reanim. 1998;17:172-76.
15. C. Pu, J. Wang, Y. Tang. "The efficacy and safety of percutaneous nephrolithotomy under general versus regional anesthesia: a systematic review and meta-analysis," *Urolithiasis 2015;* 43(5): 455–66.
16. Kim SS, Lee JW, Yu JH, Sung LH.Percutaneous nephrolithotomy: comparison of theefficacies and feasibilities of regional and general anesthesia.Korean Journal of Urology 2013; 54(12):846–50.
17. Cicek T, Gonulalan U, Dogan R.Spinal anesthesia is an efficient and safe anesthetic method for percutaneous nephrolithotomy. Urology 2014; 83(1): 50–55.
18. Mazer SP, Weisfeldt M, Bai D, Cardinale C, Arora R, Ma C. Reverse CPR: a pilot study of CPR in the prone position. Resuscitation. 2003 ;57(3):279-85.
19. Wei J, Tung D, Sue SH, Wu SV. Cardiopulmonary resuscitation in prone position: a simplifi ed method for outpatients. J Chin Med Assoc. 2006 ;69(5):202-06.
20. Walsh SJ, Bedi A, Miranda C. Successful defibrillation in the prone position. Br J Anesth. 2009 ;21(6):408-13.
21. Tyson MD and Chang SS .Enhanced recovery pathway versus standard care after cystectomy: a meta-analysis of theeffect on perioperative outcomes. European Urology 2016; 70(6): 995–1003.
22. Persson B, Carringer M, Andr´en O,Andersson SO.Initial experiences with the enhance recovery after surgery (ERAS) protocol in open radical cystectomy.Scandinavian Journal of Urology 2015; 49(4):302-07.
23. Lojanapiwat B, Chureemas T, Kittirattarakarn P.Efficacy of peritubal analgesic infiltration in postoperativ pain following percutaneous nephrolithotomy - A prospective randomized controlled study. International Brazilian Journal of Urology 2015; 41(5): 945–52.
24. Rawal N, Zimdert AV,Holmstr¨om B.Combined spinal-epidural technique. Regional Anesthesia andPain Medicine 1997; 22(5):406–23.
25. Tangpaitoon T, Nisoog C,Lojanapiwat B.Efficacy and safety of percutaneous nephrolithotomy (PCNL): A prospective and randomized study comparing regional epidural anesthesia with general anesthesia. International Brazilian Journal ofUrology 2012; 38(4):504–11.