Research Paper

Efficacy of Sacral Plexus Block Combined with Dexmedetomidine for Prevention of Catheter-Related Bladder Discomfort in Patients with TURP

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This work focused on investigating therapeutic efficacy of sacral plexus block combined with dexmedetomidine in preventing catheter-related bladder discomfort in patients receiving transurethral resection of the prostate. Sixty patients undergoing elective prostatectomy were randomized as group D or group M (n=30 each). Both groups were given dexmedetomidine 0.5 µg/kg 10 min before induction of general anesthesia. The severity score of catheter-related bladder discomfort, Richmond agitation sedation scale, visual analog scale score and adverse events at 30 min (T1), 2 h (T2) and 6 h (T3) postoperatively were recorded. 1 d preoperatively, as well as 1 and 3 d postoperatively, the neuropsychiatric function of patients was tested by mini-mental state examination and the incidence of postoperative cognitive dysfunction was observed. Compared with group D, group M had significantly decreased catheter-related bladder discomfort incidence at T1 and T2 ($p<0.05$), but with the passage of time, difference in the incidence of catheter-related bladder discomfort of both groups at T3 was of no statistical significance ($p>0.05$). Compared with group D, the visual analog scale scores of group M at T1, T2 and T3 remarkably decreased ($p<0.05$). Relative to group D, group M had remarkably reduced agitation scores at T1, T2 and T3 ($p<0.05$). Differences in the side effects rate and postoperative cognitive dysfunction incidence were not significantly different between both groups ($p>0.05$). Sacral plexus block combined with dexmedetomidine decreases postoperative catheter-related bladder discomfort rate among transurethral resection of the prostate patients and has good comfort and safety.

Key words: Dexmedetomidine, sacral plexus block, transurethral resection of prostate, catheter related bladder discomfort

Prostate enlargement is a common cause of poor quality of life among the old people and Transurethral Resection of the Prostate (TURP) is an effective method for treating prostate enlargement. It has the following advantages like mild pain, minimal injury, rapid recovery and is widely used in elderly patients with prostate enlargement. All patients with TURP require indwelling catheters for bladder irrigation after surgery, so the probability of Catheter-Related Bladder Discomfort (CRBD) is significantly higher among patients receiving this surgery, which often causes intense discomfort and leads to hemodynamic instability and even postoperative agitation and delirium, which seriously affects the rapid recovery of patients[1,2]. Dexmedetomidine, the alpha-2 (α_2) adrenergic receptor agonist with high selectivity, acts on central blue spot nucleus and is widely used clinically for a variety of effects such as sedation, analgesia and anxiolysis without affecting the patient's respiratory function. Sacral plexus block is one of the more common types of epidural block and is widely used in anal surgery, adult rectal surgery and perineal related surgery. This work focused on investigating therapeutic efficacy of sacral plexus block combined with dexmedetomidine in preventing postoperative CRBD among patients with TURP and provides a clinical reference.

MATERIALS AND METHODS

General data:

The study protocols were approved by our ethics committee. Every participant provided informed consent before the trial. There were 60 male patients with the age of 50-65 y of American Society of Anaesthesiologists (ASA) class II~III receiving

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elective TURP procedure during January-December 2021 under general anesthesia. Exclusion criteria includes patients with puncture site infection; patients allergic to drugs in this test; coagulation disorders; Body Mass Index (BMI) greater than 30 and less than 18; those with coronary artery disease, severe hypertension, renal disease or diabetes mellitus history; use of pacemakers; drug and alcohol abuse; drug addicts; previous concomitant central nervous system disease. All enrolled patients were randomized as 2 groups, namely, experimental and control groups (groups M and D, respectively).

Anesthesia method:

Intravenous access was routinely opened after all patients entered the operating room and vital signs were routinely monitored. Patients in both groups were administered with 0.5 μg/kg dexmedetomidine prior to general anesthesia induction and the pumping was completed within 10 min, then a concentration of 0.2 μg/(kg/h) was pumped for maintenance till discontinuation 30 min prior to the end of this procedure. For anesthesia induction, 1.5-2.5 mg/kg propofol, 0.3-0.4 μg/kg sufentanil and 0.15 mg/kg cis-atracurium were administered and one suitable type of laryngeal mask was placed and mechanical ventilation was connected to the anesthesia machine to maintain partial End-Expiratory Carbon dioxide Partial Pressure ($PETCO_2$) between 235 and 45 mmHg. Patients in group M were given a single sacral plexus block under ultrasound guidance before induction of anesthesia and 0.3 % ropivacaine 8 ml was administered and induction was started after observing the patient for 20 min without adverse reactions. Intraoperative anesthesia maintenance was carried out by continuous pumping of propofol for sedation, remifentanil for analgesia and cis-atracurium for inotropic maintenance, intraoperative Bispectral Index (BIS) values were maintained between 40 and 60, and intraoperative heart rate and blood pressure of patients were maintained at about 20 % of the preoperative basal values. After surgery, a catheter coated with lidocaine cream was placed into the bladder in both groups.

Observation indicators:

Record the general condition of the patient, including age, weight and height; patients postoperative CRBD severity grading at 30 min (T1), 2 h (T2), 6 h (T3) [3] , agitation score[4] and Visual Analog Scale (VAS) score were recorded.

The severity of CRBD is graded as follows, 1 for patients with no discomfort; 2 for patients with mild discomfort when asked; 3 for patients with moderate discomfort with no behavioral reactions; 4 for patients with severe discomfort with no behavioral reactions. A score of 2 or more was considered as the occurrence of CRBD.

Agitation score is graded as follows, 0: No agitation; 1: Physical agitation when stimulated, relieved by verbal reassurance; 2: Agitation without stimulation and attempts to remove the catheter and drainage tube and 3: Intense struggle, requiring multiple brakes.

Then record the operation time, patient awakening time; the occurrence of adverse events including sinus bradycardia, nausea and vomiting, agitation, chills, etc.

Incidence of Postoperative Cognitive Dysfunction (POCD) patients was tested for neuropsychiatric function using the Mini-Mental State Examination (MMSE) 1 d before surgery, as well as 1 d and 3 d after surgery. The test included a total of seven items, including temporal orientation, place orientation, immediate memory, delayed memory, attention and calculation, language, and visuospatial aspects, and its score was 30 points at most. A reduction of 2 points compared to 1 d preoperatively was defined as a criterion for the occurrence of POCD[5] .

Statistical analysis:

Statistical Package for the Social Sciences (SPSS) 20.0 was applied to statistically analyze the data. Measurement variables were represented by mean±standard deviation ($\bar{x}\pm s$) and Analysis of Variance (ANOVA) was used to compare the repeated measures; count data were analyzed through Fisher's exact probability test or chi-square test, $p<0.05$ stood for statistical significance.

RESULTS AND DISCUSSION

General condition, operation time together with awakening time was shown in Table 1. Altogether 60 patients were recruited into this work and differences in general condition, operative time and time to awakening were of no statistical significance of both groups ($p>0.05$).

Postoperative CRBD rate at diverse time-points was shown in Table 2. Relative to group D, group M had the markedly decreased CRBD incidence at time points T1 and T2 ($p<0.05$), while that of both groups

at time point T3 showed no significant difference over time (p>0.05).

Postoperative VAS scores at different time points were shown in Table 3. Compared with group D, group M exhibited remarkably decreased VAS scores at T1, T2 and T3 time points (p<0.05), indicating an advantage of nerve block in postoperative analgesia.

Postoperative agitation scores at different time points were shown in Table 4. Compared with group D, group M had significantly lower agitation scores at T1, T2 and T3 time points than group D (p<0.05).

Occurrence of adverse reactions was shown in Table 5. For adverse reactions, compared with group D, the number of patients in group M decreased with no significant difference (p>0.05).

MMSE scores and occurrence of POCD were shown in Table 6. MMSE scores were not significantly different, 1 d preoperatively between two groups (p>0.05); besides, MMSE scores of two groups were not significantly different, 1 and 3 d postoperatively compared with those before surgery (p>0.05) and POCD incidence was not significantly different between both groups (p>0.05).

TABLE 1: COMPARISON OF GENERAL PATIENT DATA BETWEEN THE TWO GROUPS

Groups	Number of patients	Age (y)	BMI (kg/m^2)	Number of ASA II/III patients	Surgery time (min)	Time to remove the mask (min)
Group D	30	56.4±6.9	24.6±7.4	17/13	72.5±18.3	10.5±4.8
Group M	30	57.8±6.3	25.8±6.9	15/15	73.9±17.8	10.2±5.1

TABLE 2: COMPARISON OF CRBD INCIDENCE OF BOTH GROUPS OF PATIENTS

Groups	T1		T2		T3	
	Number of patients	Rate (%)	Number of patients	Rate (%)	Number of patients	Rate (%)
Group D	15	50	12	40	4	13.3
Group M	5	16.7	4	13.3	3	10
χ^2 value	7.5	5.4545	0	55.4°	55.4°	55.4°
p-value	0.0062	0.0304	1	55.4°	55.4°	55.4°

TABLE 3: COMPARISON OF VAS SCORES BETWEEN TWO GROUPS

Groups	T1	T2	T3
Group D	2.5±0.4	3.1±0.6	2.0±0.4
Group M	1.3±0.3	1.5±0.5	1.6±0.6
t-value	13.1453	11.2206	3.0382
p-value	0	0	0.0036

TABLE 4: COMPARISON OF AGITATION SCORES BETWEEN TWO GROUPS

Groups	T1	T2	T3
Group D	1.6±0.3	2.1±0.4	0.8±0.3
Group M	0.8±0.3	1.1±0.2	0.6±0.3
t-value	10.328	12.2474	2.582
p-value	0	0	0.0124

TABLE 5: COMPARISON OF INCIDENCE OF ADVERSE REACTIONS BETWEEN THE TWO GROUPS

Groups	Number of patients	Sinus and bradycardia	Nausea and vomiting	Restlessness	Cold
Group D	30	9	6	6	7
Group M	30	8	7	5	5
χ^2 value		0.0821	0.0982	0.1113	0.4167
p-value		0.7745	0.754	0.7387	0.5186

TABLE 6: MMSE SCORES AND OCCURRENCE OF POCD

Groups	MMSE Score			Number of patients of POCD	
	1 d before surgery	1 d after surgery	3 d after surgery	1 d after surgery	3 d after surgery
Group D	25.4±2.5	24.8±2.1	25.1±2.4	4	0
Group M	26.0±2.3	24.9±2.5	25.6±2.2	3	0

TURP patients are placed with catheters in the early postoperative period because of the need for continuous bladder irrigation. However, due to surgical trauma, catheterization and other irritations, patients have a high incidence of CRBD, which resembles overactive bladder symptoms, such as urinary frequency and urgency, and difficult urination in addition to suprapubic pain[6] . This discomfort can cause agitation in post-surgical patients during recovery from anesthesia, which in turn increases the risk of postoperative bleeding, drainage tube slippage and adverse cardiovascular events[2], decreases hospital satisfaction, prolongs discharge time and is detrimental to patient prognosis. Therefore, how to suppress CRBD and reduce patient's pain and discomfort has become a major challenge for anesthesiologists in postoperative analgesia.

The main clinical methods to reduce CRBD are intravenous Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), tramadol, dexmedetomidine, opioids and anticholinergics, etc. These methods can effectively reduce the bladder spasm risk and its severity[7,8], but the systemic effects brought about by intravenous medication are difficult to avoid and at the same time, these methods are all therapeutic measures for patients after the occurrence of CRBD after surgery. These methods can only reduce the discomfort of patients to a certain extent and cannot reduce the incidence of CRBD.

In recent years, multimodal analgesia has been widely used in clinical anesthesia, which can maximize the analgesic effect through the analgesic mechanism of many different drugs or different analgesic modalities.

Dexmedetomidine, as an α2 adrenergic agonist with high selectivity, acts on central blue spot nucleus and is widely used clinically for its sedative, analgesic and anxiolytic effects without affecting the respiratory function of patients[9]. As discovered by Qu *et al.* 0.6 μg/kg dexmedetomidine decreased postoperative CRBD within 1 h following general anesthesia[10]. For patients receiving mid-upper abdominal procedure, dexmedetomidine (0.5 μg/kg intravenously) was administered in preparation for abdominal closure. CRBD risk and severity were significantly different between dexmedetomidine and control groups, with less severe postoperative pain and deeper sedation depth in the dexmedetomidine group[11]. Xiao *et al.* mate analysis showed that dexmedetomidine effectively prevented postoperative urethral CRBD without serious adverse effects[12]. This suggests that dexmedetomidine significantly reduces the incidence of CRBD.

In recent years, ultrasound has been widely used in perioperative nerve blocks. With the help of ultrasound system, it can precisely guide the localization of nerves, improve the success rate of operation, reduce the dosage of local anesthetics and decrease the incidence of related complications. Nerve block anesthesia not only reduces the dosage of intravenous anesthetic drugs and opioids and their adverse effects, but also shortens the awakening time and provides good postoperative analgesia. The urethra and bladder-originated afferent nerve impulses cross pelvic visceral nerves to enter spinal cord in its sacral segment, the level at which nerve conduction is blocked with caudal block anesthesia[13]. Therefore, effect of sacral plexus block on catheter-induced discomfort has been justified. Some studies have shown that preoperative sacral plexus block anesthesia decreases catheter-induced discomfort early after surgery[14]. Catheter-induced discomfort has been reported to peak in terms of its severity and incidence in the first 2 h postoperatively and gradually decrease over time, with more than half of the patients discomfort decreasing to mild or disappearing within 6 h[15], which closely correlates with our findings.

In this trial, group M had remarkably decreased incidence of CRBD, VAS score and agitation score compared with group D at T1, T2 and T3, indicating that sacral plexus block combined with dexmedetomidine can effectively decrease postoperative CRBD risk while alleviating ureteral discomfort among patients with TURP. Side effect rate was not significantly different between both groups, indicating that ultrasound-guided sacral

plexus block has a good safety profile. Because most patients undergoing TURP are elderly and postoperative POCD risk dramatically increases among the old people, probably between 12 % and 40 %[16], dexmedetomidine has been widely found to improve the occurrence of delirium and postoperative cerebral dysfunction[17,18] and MMSE scores and POCD occurrence were not significantly different between group M and group D, indicating that the combination of sacral plexus block and dexmedetomidine not only significantly reduces the incidence of CRBD, but also has a role in the prevention of POCD.

However, there are still some limitations in this study, such as the sample size is still small, the concentration and dose of local anesthetics during nerve block was not studied in a group control study and the dose of dexmedetomidine was not studied in a group control study, which is the direction for further research in the future. In conclusion, sacral plexus block combined with dexmedetomidine is an effective regimen to be promoted in preventing postoperative CRBD among patients receiving TURP.

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Conflict of interests:

The authors declared no conflict of interest.

REFERENCES

1. Teo JS, Lee YM, Ho HS. An update on transurethral surgery for benign prostatic obstruction. Asian J Urol 2017;4(3):195-8.
2. Bai Y, Wang X, Li X, Pu C, Yuan H, Tang Y, *et al.* Management of catheter-related bladder discomfort in patients who underwent elective surgery. J Endourol 2015;29(6):640-9.
3. Schaeffer EM. Re: The efficacy of pregabalin for prevention of catheter-related bladder discomfort: A prospective, randomized, placebo-controlled double-blind study. J Urol 2016;195(2):370-1.
4. Jacobi J, Fraser GL, Coursin DB, Riker RR, Fontaine D, Wittbrodt ET, *et al.* Clinical practice guidelines for the sustained use of sedatives and analgesics in the critically ill adult. Crit Care Med 2002;30(1):119-41.
5. Bekker AY, Weeks EJ. Cognitive function after anaesthesia in the elderly. Best Pract Res Clin Anaesthesiol 2003;17(2):259-72.
6. Moataz A, Chadli A, Wichou E, Gallouo M, Jandou I, Saber S, *et al.* Predictors of catheter-related bladder discomfort. Prog Urol 2020;30(16):1045-50.
7. Li S, Song L, Ma Y, Lin X. Tramadol for the treatment of catheter-related bladder discomfort: A randomized controlled trial. BMC Anesthesiol 2018;18(1):1-5.
8. Zhang GF, Guo J, Qiu LL, Li SM, Zheng M, Xia JY, *et al.* Effects of dezocine for the prevention of postoperative catheter-related bladder discomfort: A prospective randomized trial. Drug Des Devel Ther 2019;13:1281-8.
9. Hu B, Zhou H, Zou X. Blind method regarding the effect of dexmedetomidine on CRBD. J Anesth 2018;32(3):461.
10. Qu QC, Tao JP, Si YY, Sun Z, Jiao SL. Effect of dexmedetomidine in the treatment of catheter-induced bladder discomfort after general anesthesia. Guangdong Med J 2017;38(13):2075-7.
11. Yun YZ, Mei XJ, Rong Z, Lei L. Dexmedetomidine reduces catheter-related bladder discomfort: A prospective, randomized, placebo-controlled, double-blind study. PR Health Sci J 2016;35(4):191-6.
12. Xiao M, Tang GQ, Liu J, Wei Y, He SY, Wang K, *et al.* Efficacy of dexmedetomidine administration on postoperative catheter-related bladder discomfort: A meta-analysis. Int J Urol Nephrol 2018;38(3):418-22.
13. Snell RS. The pelvis: Part II, The pelvic cavity. In: Snell RS, editor. Clinical anatomy for medical students. 1st ed. Boston: Little, Brown and Company; 1973. p. 291-327.
14. Tsuchiya M, Kyoh Y, Mizutani K, Yamashita J, Hamada T. Ultrasound-guided single shot caudal block anesthesia reduces postoperative urinary catheter-induced discomfort. Minerva Anestesiol 2013;79(12):1381-8.
15. Agarwal A, Dhiraaj S, Pawar S, Kapoor R, Gupta D, Singh PK. An evaluation of the efficacy of gabapentin for prevention of catheter-related bladder discomfort: A prospective, randomized, placebo-controlled, double-blind study. Anesth Analg 2007;105(5):1454-7.
16. Needham MJ, Webb CE, Bryden DC. Postoperative cognitive dysfunction and dementia: What we need to know and do. Br J Anaesth 2017;119(1):i115-25.
17. Carr ZJ, Cios TJ, Potter KF, Swick JT. Does dexmedetomidine ameliorate postoperative cognitive dysfunction? A brief review of the recent literature. Curr Neurol Neurosci Rep 2018;18(10):1-7.
18. Krogseth M, Watne LO, Juliebø V, Skovlund E, Engedal K, Frihagen F, *et al.* Delirium is a risk factor for further cognitive decline in cognitively impaired hip fracture patients. Arch Gerontol Geriatr 2016;64:38-44.

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