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Original Article

Effectiveness of Dexmedetomidine Versus Meperidine in the treatment of shivering after general anesthesia

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Abstract

Introduction: Postoperative shivering is one of the undesirable complications from general and regional anesthesia, which leads to complications such as increased oxygen consumption, hypoxemia, induced lactic acidosis, and catecholamine release. Various drugs have been used to treat shivering, but the mechanism is complex and still unknown, and the gold standard for treatment and prevention does not exist. so, This study aimed to investigate the effectiveness of dexmedetomidine and meperidine in treating shivering after general anesthesia.

Materials and Methods: In this randomized double-blind clinical trial study one hundred the American Society of Anesthesiologists (ASA) physical status I-II patients scheduled for elective abdominal surgery were enrolled. The patients who had postoperative shivering were randomly allocated into 2 groups of 50 patients each to receive dexmedetomidine 1 µg/kg (Dex group) and meperidine 0.4mg/kg (meperidine group). Demographic characteristics, the severity of shivering in patients, the rate of response to treatment within 15 minutes of treatment initiation, the duration of shivering, and hemodynamic variables were recorded. The data were analyzed using SPSS software (Version 20) using chi-square and t-test.

Results: As regards the response rate between Dexmedetomidine and Meperidine drugs used in this study, the Dex group had high response rate than the Meperidine group ($p = 0.04$). There was no statistically significant difference between the two groups in the onset of shivering (10.7±3 vs 12.1±2) ($p = 0.21$) and the time interval from treatment to cessation of shivering(3.7±2.4vs 4.1±2.7) ($p = 0.45$). Mean arterial pressure (MAP) and heart rate (HR) were significantly lower in the Dex group than Meperidine group.

Conclusion: Based on our findings, Dexmedetomidine 1 µg/kg is a better treatment than meperidine in relieving shivering after general anesthesia, also dexmedetomidine has an early onset effect, lesser recurrence, and higher incidences of hypotension and bradycardia.

Keywords: Dexmedetomidine, Meperidine, Shivering, Anesthesia, General

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Introduction

The shivering is a common perioperative complication that occurs in more than 60% of patients undergoing surgery under general anesthesia and 30% undergoing regional anesthesia (1).
also may lead to complications such as increased oxygen consumption, hypoxemia, lactic acidosis, and catecholamine release (2). This can impair normal recovery and be quite harmful in certain groups of patients, for example, patients with high intraocular pressure, high intracranial tension, and limited cardiorespiratory patients (3). Studies have shown that various factors are involved in the occurrence of shivering after surgery, including age, gender, duration of surgery and anesthesia, body temperature on entry to recovery, drugs used to induce and maintain anesthesia, non-depolarizing muscle relaxants, Vasopressor , type of surgery, insufficient pain control and others (4). Various drugs have been used to treat shivering, but the ideal drug and the gold standard for treatment have still not been found (5).
So this study aimed to investigate the effectiveness of dexmedetomidine and meperidine in treating shivering after general anesthesia.

Materials and Methods

This randomized, double-blind clinical interventional study was approved by the local ethics committee with code IR.TBZMED.REC.1398.400 and registered at the Iranian Registry of Clinical Trials (IRCT IRCT20150125020795N4). A total of 100 patients with physical status I or II of the American Society of Anesthesiologists (ASA), between the ages of 18 and 65 years, who underwent abdominal surgery and patients with shivering degrees of 1,2, 3, or 4 were included in this study. Informed consent was obtained from participating patients. Patients with failure to extubate at the end of the operation, systemic infections, and cardiopulmonary disease were excluded from the study. In both groups, general anesthesia was induced with propofol 2 mg/kg and fentanyl 1 µg/kg, followed by atracurium (0.5 mg/kg) to facilitate endotracheal intubation. General anesthesia was maintained with sevoflurane and O2/N2O. Participants were randomized into 1 of 2 study groups, using a computer-generated random number table, as Group Dex or Group Meperidine. In recovery, Group Dex received a dose of 1 µg/kg intravenous dexmedetomidine for 10 min. Group Meperidine received meperidine 0.4 mg/kg. All patients received oxygen via a face mask in the recovery room and were monitored. The severity of shivering in patients, the rate of response to treatment within 15 minutes of treatment initiation, the duration of shivering, and hemodynamic variables were recorded.
The intensity of shivering was graded as grade 0: absence of shivering, grade I: slight shivering (no visible shivering), grade II: medium level shivering (muscular activity in one muscle group only), grade III: severe shivering (muscular activity in more than one muscle group without generalized shivering), grade IV: generalized shivering (6,7).
The data obtained from the study were evaluated using descriptive statistical methods (mean± standard deviation, frequency, and percentage) plus Paired Samples T-test, Independent Samples T-test, and chi-square. To ensure the normality of the data distribution, the Kolmogorov-Smirnov test was utilized. The data were analyzed using SPSS software (Version 20).
In this study, $p < 0.05$ was considered statistically significant.

Results

The demographic information is shown in Table 1. The two groups were similar in terms of age, weight, duration of anesthesia, and duration of surgery. The onset of shivering was not a statistically significant difference between the two groups(10.7±3 vs 12.1±2) ($p = 0.21$). The difference in the time interval from treatment to stop shivering was shorter in the dexmedetomidine group compared to the meperidine group(3.7±2.4vs 4.1±2.7) ($p = 0.45$).

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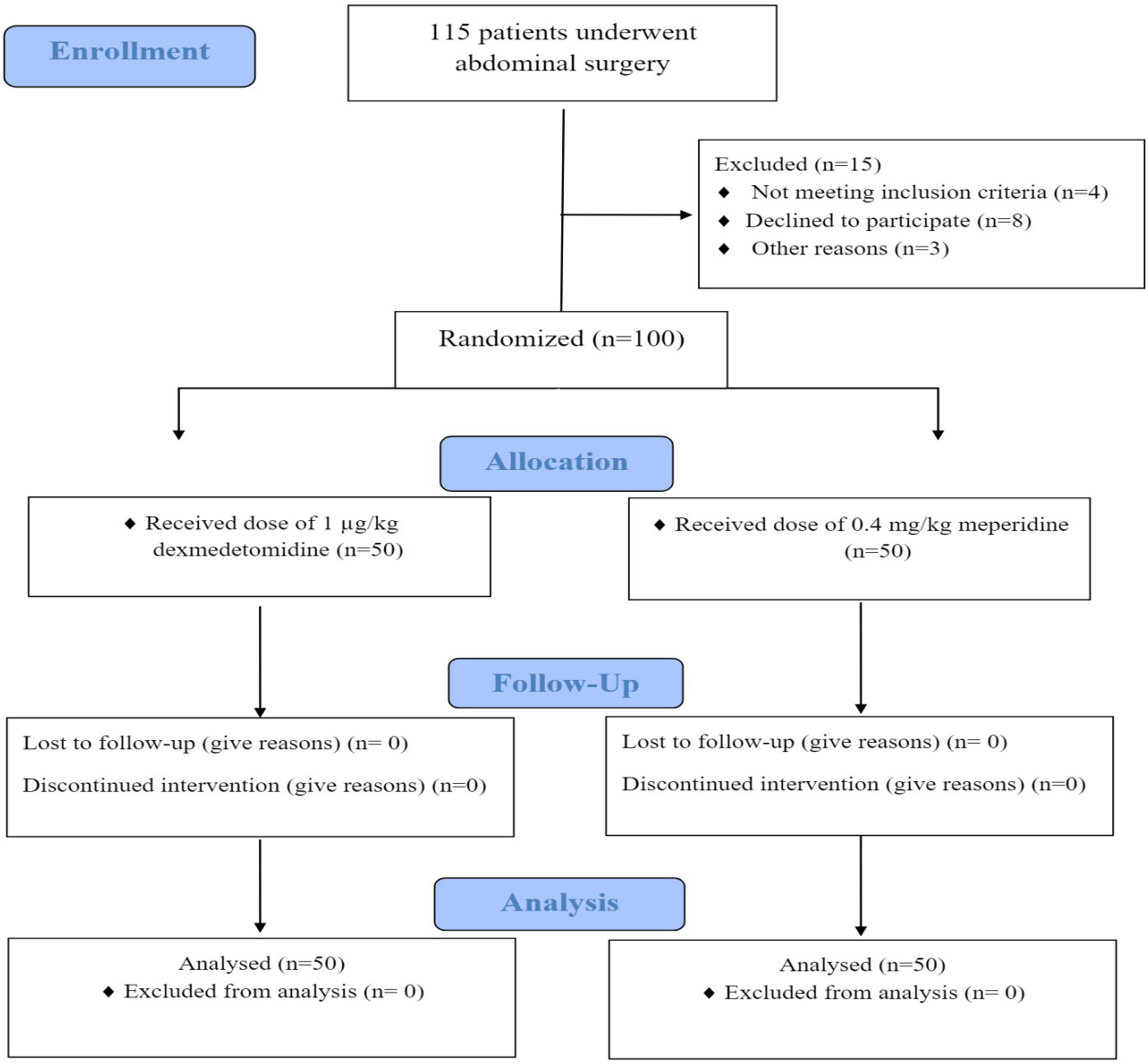
The intensity of shivering was significantly lower in the dexmedetomidine group after anti- anti-shivering drugs injection($p = 0.04$).

You can see the recurrence rate in 1 patient in the dexmedetomidine group and 2 patients in the meperidine group in Table 2. In the examination of hemodynamic parameters in recovery, the significant difference in MAP and HR values was observed between the two study groups, as shown in Table 3. Also, our findings showed that oxygen saturation (SpO2) decreased in patients when they entered the recovery period and during shivering. Figure 1 shows the flow chart of patient recruitment and data collection during the study.



Consort flow diagram 1. The consort flow diagram of the study

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Table 1. Patient characteristics information

Variables	Group Dex (n = 50)	Group Meperidine (n=50)	P-Value
Age (years)*	41.83±6.21	40.02±6.36	0.229
Sex **			
Female (N (%))	30(60%)	28(56%)	0.314
Male (N (%))	20(40)	22(44%)	
Weight (kg)*	85.14±9.4	86.83±9.4	0.398
ASAI/II**	39(78%)/11(22%)	37(74%)/13(26%)	0.501
Duration of Anesthesia (Min)*	129.83±10.5	126.18±10.4	0.218
Duration of Surgery (Min)*	109.14±9.03	108.79±9.4	0.301

*t- test **Chi-Square Test

Table 2. Evaluation of response, treatment time and outcome to shivering in two groups

Variables	Group Dex (n=50)	Group Meperidine (n=50)	P-Value
Onset of shivering (min)* Mean±SD	10.7±3	12.1±2	0.215
Shivering grade (0/1/2/3/4) ** upon arrival in the recovery room	0/8/12/12/18	0/5/15/13/17	0.79
1	8(16%)	5(10%)	0.75
2	12(24%)	15(30%)	0.54
3	12(24%)	13(26%)	0.62
4	18(36%)	17(34%)	0.5.2
Shivering grade (0/1/2/3/4) after drugs injection (after15 min)	40/8/2/0/0	28/15/6/1/0	
0	40(80%)	28(56%)	0.000
1	8(16%)	15(30%)	0.011
2	2(4%)	6(12%)	0.034
3	0	1(2%)	-
4	0	0	-
Time interval from treatment to stop of shivering(min)* Mean±SD	3.7±2.4	4.1±2.7	0.45
Success Rate**	50(100%)	50(100)	-
Recurrence Rate**	1/50(2%)	2/50(4%)	0.59

*Independent samples t-test ** Chi-Square test

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Table 3. Comparison of hemodynamics, SpO2, in two groups

Parameters	Group	After arrival to recovery	10 min After arrival to recovery	P-value	20 min After arrival to recovery	P-value	30 min After arrival to recovery	P-Value
HR(beat/min)	Dex	88±12	72±14	0.026#	75±13	0.031#	72±10	0.021#
	Meperidine	89±13	87±15	0.329	89±12	0.965	92±13	0.330
	P-Value	0.076	0.04*	P-Value	0.05*	P-Value	0.006*	-
MAP(mmHg), mean± SD	Dex	100±11	82.3±6	0.018#	87±8	0.031#	82.3±10	0.021#
	Meperidine	105±9	99±9	0.097	97.3±8	0.68	100±10	0.134
	p-value	0.045*	0.031*	P-Value	0.022*	P-Value	0.031*	-
SpO2 (mmHg), mean ± SD	Dex	94.5±0.2	95.5±0.8	0.381	98.4±0.8	0.804	98.5±1	0.189
	Meperidine	94.2±2	94±0.3	0.347	98±1	0.806	98±0.3	0.087
	P-Value	0.452	0.316	-	0.287	-	0.111	-

Independent samples -test. Mean±SD, P-Value of <0.05 was considered as statistically. *P<0.05 Varsus Meperidine #P<0.05 varsus After arrival to recovery

Patients was differ significantly in terms. HR: Heart Rate; MAP: Mean Arterial Pressure

Discussion

Postoperative shivering is an unpleasant experience for patients. Many attempts have been made to prevent shivering, but a standard procedure has not yet been established (8). Previous studies have shown that dexmedetomidine is a highly selective α2-adrenergic receptor agonist that can increase hemodynamic stability during surgery and reduce the occurrence of shivering after spinal and general anesthesia (9). Meperidine is a combination of μ and κ receptor agonists and can prevent hypothermia by constricting peripheral vessels and dilating central vessels (10, 11).

So, finding the effective therapeutic agent to prevent postoperative shivering in patients undergoing surgery is essential. In this study, the clinical effectiveness of meperidine (0.4 mg/kg) and dexmedetomidine (1 mg/kg) for treating general anesthesia shivering in patients after abdominal surgery has been investigated. The results showed that dexmedetomidine injection is a more effective way to help treat post-anesthetic shivering than meperidine injection after general anesthesia. The study's results aligned with similar general and spinal anesthesia studies. Cao et al. compared dexmedetomidine (1 μg/kg) and meperidine (0.5 mg/kg) to reduce the incidence and severity of shivering in patients undergoing CABG, and they found that the incidence of shivering was significantly lower in both groups, but in the dexmedetomidine group were observed in patients bradycardia and hypotension (12). The complete disappearance of shivering was significantly different in the two groups, so the group receiving dexmedetomidine experienced shivering in a much shorter time than the group receiving meperidine. Over the years, several studies have shown that post-operative shivering is not directly related to the drop in core body temperature during surgery, and other factors are also involved in the occurrence of shivering after surgery patients (13).

One of the most prominent hypotheses is the discontinuation of narcotic drugs, which is caused by tolerance to these drugs. Short-acting drugs such as remifentanil can induce acute tolerance and analgesia by stimulating NMDA receptors (14). In our study, the recurrence rate of shivering in the dexmedetomidine group and the meperidine group were 2% and 4%, respectively. The results correspond with Shukla's study,

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where the recurrence rate was 5% (15). In our study, the MAP and HR were significantly lower in the Dex group when compared with the Meperidie group,which to the results of studies such as Nasseri et al. in 2017, Ameta et al. in 2018 and Venkatraman et al. in 2018, Yu et al. in 2019 and Omar et al. in 2019 are aligned and have the same results (16-20). Another study showed that dexmedetomidine reduces systolic blood pressure and heart rate. This is associated with an approximate 30% decrease in plasma norepinephrine concentration and decreased sympathetic activity (20). Our findings showed that patients had low oxygen saturation upon entering recovery and during shivering. The authors believe this persistent drop in oxygen saturation due to shivering is an essential feature of the immediate postoperative phase (21).

The limitations of our study were the small sample size and different duration of surgery. Therefore, it would be better to perform a similar study with a larger sample size for a more definite conclusion. In addition, this study must be performed multi-centrally.

Conclusion

Based on our findings, Dexmedetomidine injection is a better treatment than meperidine in relieving shivering after general anesthesia. also, dexmedetomidine has an early onset effect, lesser recurrence, and higher incidences of hypotension and bradycardia.

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Conflicts of Interest

The author declare that they have no conflicts of interest.

References

1. Bhattacharya PK, Bhattacharya L, Jain RK, Agarwal RC. Post anaesthesia shivering (PAS): A review. Indian J Anaesth. 2003;47(2):88-93.

2. Khan ZU, Naz U, Durrani M, Zeb A. Treatment of Post Operative Shivering in Head Trauma, Comparison of Ketamine & Pethidine. Ophthalmology Update. 2020;18(2):71-78.

3.Weinreb RN, Aung T, Medeiros FA. The pathophysiology and treatment of glaucoma: a review. Jama. 2014;311(18):1901-11.

4. Panneer M, Murugaiyan P, Rao SV. A comparative study of intravenous dexmedetomidine and intravenous clonidine for postspinal shivering in patients undergoing lower limb orthopedic surgeries. Anesthesia, essays and researches. 2017;11(1):151-154.

5.Lopez MB. Postanaesthetic shivering–from pathophysiology to prevention. Rom J Anaesth Intensive Care. 2018;25(1):73.

6.Karaman S, Günüşen I, Ceylan MA, Karaman Y, Çetin EN, Derbent A, et al. Dexmedetomidine infusion prevents postoperative shivering in patients undergoing gynecologic laparoscopic surgery. Turk J Med Sci. 2013;43(2):232-327.

7. Horn E-P, Sessler DI, Standl T, Schroeder F, Bartz H-J, Beyer JC, et al. Non-thermoregulatory shivering in patients recovering from isoflurane or desflurane anesthesia. The Journal of the American Society of Anesthesiologists. 1998;89(4):878-886.

8. Eberhart LH, Döderlein F, Eisenhardt G, Kranke P, Sessler DI, Torossian A, et al.Independent risk factors for postoperative shivering. Anesthesia & Analgesia. 2005;101(6):1849-1857.

9.Suyasa IK, Ryalino C, Pradnyani NPN. Dexmedetomidine provides better hemodynamic stability compared to clonidine in spine surgery. Bali Journal of Anesthesiology. 2018;2(3):90-94.

10.Kiyatkin EA. Respiratory depression and brain hypoxia induced by opioid drugs: Morphine, oxycodone, heroin, and fentanyl. Neuropharmacology. 2019;151:219-226.

11. Brice-Tutt AC, Wilson LL, Eans SO, Stacy HM, Simons CA, Simpson GG, et al. Multifunctional opioid receptor agonism and antagonism by a novel macrocyclic tetrapeptide prevents reinstatement of morphine-seeking behaviour. Br J Pharmac ol.2020;177(18):4209-4222.

12. Cao C, Lv M, Wei C, Yan J, Wang Y, Gu C.

[DOI: 10.61186/jsurgtrauma.12.1.4]

Protocol: Comparison of dexmedetomidine and meperidine for the prevention of shivering following coronary artery bypass graft: study protocol of a randomised controlled trial. BMJ Open. 2022;12(2).

13.Nayyeri S, Eftekhariyazdi M, Gilani MT, Khalili-Shomia S. Relationship between the patient's time in bed and the onset of surgery with postoperative shivering in patients undergoing abdominal surgery. Pakistan Journal of Medical and Health Sciences. 2020;14(3):1357-1360.

14.Qiu H, Sun Z, Shadhiya F, Arulthas R, Priya GV, Christopher P, et al. The influence of dexmedetomidine on remifentanil-induced hyperalgesia and the sex differences. Experimental and therapeutic medicine. 2018;16(4):3596-3602.

15.Shukla U, Malhotra K, Prabhakar T. A comparative study of the effect of clonidine and tramadol on post-spinal anaesthesia shivering. Indian J Anaesth. 2011;55(3):242.

16.Nasseri K, Ghadami N, Nouri B. Effects of intrathecal dexmedetomidine on shivering after spinal anesthesia for cesarean section: a double-blind randomized clinical trial. Drug design, development and therapy. 2017;11:1107.

17. Ameta N, Jacob M, Hasnain S, Ramesh G. Comparison of prophylactic use of ketamine, tramadol, and dexmedetomidine for prevention of shivering after spinal anesthesiaJ Anaesthesiol Clin Pharmacol. 2018;34(3):352.

18.Venkatraman R, Karthik K, Pushparani A, Mahalakshmi A. A prospective, randomized, double-blinded control study on comparison of tramadol, clonidine and dexmedetomidine for post spinal anesthesia shivering. Revista Brasileira de Anestesiologia. 2018;68:42-48.

19. Yu G, Jin S, Chen J, Yao W, Song X. The effects of novel α2-adrenoreceptor agonist dexmedetomidine on shivering in patients underwent caesarean section. Bioscience Reports.2019;39(2).

20. Omar H, Aboella WA, Hassan MM, Hassan A, Hassan P, Elshall A, et al. Comparative study between intrathecal dexmedetomidine and intrathecal magnesium sulfate for the prevention of post-spinal anaesthesia shivering in uroscopic surgery;(RCT). BMC anesthesiology. 2019;19(1):1-10.

21. Jones H, McLaren C. Postoperative shivering and hypoxaemia after halothane, nitrous oxide and oxygen anaesthesia. BJA: British Journal of Anaesthesia. 1965;37(1):35-41.

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