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ORIGINAL ARTICLE

The survey of Rrespiratory Rate, SPO2, nausea and vomiting in the use of three methods (warmed intravenous fluids, combined warming and pethidine) in patients with shivering

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Abstract

Introduction: Shivering after anaesthesia and surgery is a common complication. Different methods are used for control of shivering in the recovery room. The opioids such as pethidine are very common in shivering control. Pethidine can be induced apnea, respiratory depression and nausea &vomiting. The respiratory rate and spo2 can lead to more rapid diagnosis and treatment of serious hypoxemia and possibly avoid serious complication.The present study is a randomized clinical trial aimed to survey Rrespiratory Rate, SPO2, nausea and vomiting in the use of three methods(warmed intravenous fluids, combined warming and pethidine) in the abdominal surgery patients with shivering.

Methods: 87 patients in randomized clinical trial study with abdominal surgery by general anesthesia were assigned to three groups (two intervention groups in comparison with pethidine as routine) randomly. When patients meeting inclusion criteria were enrolled in the study, entered one of the three groups by simple Lottery. Patients in warmed intravenous fluids group received pre-warmed Ringer serum (38°C), patients in combined warming group received pre-warmed Ringer serum (38°C) accompanied by humid-warm oxygen, and patients in pethidine group received intravenous pethidine routinely. The Respiratory Rate and SPO2 of the participants were assessed for 20 min postoperatively in the recovery room. Then the collected data they were analyzed by chi-square, ANOVA, repeated ANOVA test, Kruskal–Wallis test, Wilcoxon test, Mann–Whitney U test, Tukey test, Friedman test, and repeated measurements through software SPSS (v. 18) with the significance level ($P<0.05$).

Results: The mean of SPO2 and RR in the pethidine group was decreased, spo2 from 98% to 97% and RR from 16 to 15. But those changes weren't statistically significant ($p>0.05$). In the combined warming groups the mean of SPO2 was clear increased from 96% to 98% and this change was statistically significant ($p=0.031$) but the mean of RR have no change. In the warmed intravenous serum group, the RR and SPO2 were slight decreased and weren't statistically significant ($P >0.05$). In the pethidine group 11% of patients have nausea& vomiting.

Conclusions: The pethidine induce apnea and respiratory depression. despite this effects and other side effects, the combined warming can be useful for shivering treatment.

Key Words: Meperidine; Infusions; Intravenous; Shivering; Respiratory Rate; Vomiting

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Introduction

Respiratory rate is the vital sign least often recorded and most frequently completely omitted from hospital documentation. Pulse oximetry measurement is not a replacement for respiratory rate measurement. The two measurements are complementary and can lead to a more rapid treatment of serious hypoxemia and possibly avoid serious complication. (1) In the general anesthesia, the patient's alertness is eliminated by medication and surgical procedure is performed (2). During general anesthesia and the use of drugs such as propofol, the system regulation of hypothalamic are disrupted and causes shivering. (3). Using pethidine as a treatment for shivering causes complications such as respiratory depression and vomiting. The incidence of respiratory depression (respiratory rate <8) with pethidine was about 7%, nausea and vomiting (13%) (8). One of the routine drugs for controlling postoperative shivering is pethidine (9, 10). Administration of opioids to control postoperative shivering can lead to respiratory depression, airway and nausea (4, 6). It is obvious that pethidine has many complications, including respiratory depression and nausea vomiting (10, 11, 12). Many studies have investigated the effects of pethidine, which include the ventilation reduction, respiratory rate reduction and apnea, nausea and vomiting, and tachycardia (7, 18, 21). Due to these complications, alternative treatments for controlling postoperative shivering have always been considered (13). Although pharmacological methods are used to control the shivering of postoperative shivering, non-pharmacological methods are also used to prevent hypothermia by using blanket, humid warming oxygen inhalation, and warmed fluids infusion (9, 11, 14, 15). Inhalation of humid warming oxygen can be preventing the complications such as epistaxis, dry mucus, thick secretion which are difficult to eliminate (16). In addition, this method can prevent hypothermia and shivering (17). Infusion of warmed fluids can be effective in controlling postoperative shivering (13). In the present study, the Respiratory Rate, SPO2, nausea and vomiting have been survey in the use of three methods (warmed intravenous fluids, combined warming and pethidine) in patients with shivering after general anesthesia. But in the two intervention groups haven't any nausea and vomiting.

Methods

The present study was registered in IRCT with the code 2014012016278N1. This double‐blind clinical trial was performed with 87 patients, each group with 29 patients (based on study of oshvandi et al 2012 (17)) who were candidates for abdominal surgery under general anesthesia in the Emam Reza hospital in Birjand from June to September 2014. To begin with, the goal and method of the study were explained to the patients and written consents were obtained from them in accordance with ethical considerations; then they were randomly assigned to three groups including two interventiongroups and a pethidine group as routine treatment. The SPO2 of the participants were assessed for 20 min postoperatively at three time intervals (0, 10, and 20 min after entry to the recovery room)(19) . The Spo2 recorded with non-invasive monitoring and pulse oximetery with finger prob. All patients were covered with a normal bed room blanket after the operation in the recovery room. In the recovery room, the presence or absence of shivering was assessed and recorded in the three groups: Patients in warmed intravenous fluids group received pre‐warmed ringer serum (38°C) accompanied by room temperature‐humid oxygen and 3 ml of intravenous normal saline as placebo, Patients in combined warming group received pre‐warmed Ringer serum (38°C) accompanied by 8 l/min humid‐warm oxygen (37°C) and 3 ml of normal saline as a placebo for pethidine, Patients in pethidine group received 0.4 mg/kg intravenous pethidine accompanied by room temperature serum (25.5°C) and room temperature‐humid oxygen. Inclusion criteria were: American Society of Anesthesiologist (ASA) class 1 and 2 patients (People with normal health without any systemic disorder). ASA2 patients: People with a mild controlled systemic disease which did not limit their activities); 20–60 years old; undergoing abdominal surgery under general anesthesia; duration of surgery between 1 and 3 h; consenting to participate in the study till the end; patients with shivering grade 2 or 3 (patients in grade 4 had severe shivering); normothermic patients (preoperative tympanic temperature); not receiving any drug, blood and blood products; not having any disorder.

Exclusion criteria were: Spinal or epidural anesthesia, younger than 20 or older than 60 years, length of surgery less than 1 h or more than 3 h, score 4 of shivering (because it requires immediate treatment) and ASA class 3 and 4 patients.

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Induction method of anesthesia in all patients was same which used fentanyl, propofol, and atracurium. Maintenance of anesthesia in all patients was performed with propofol and atracurium every 30 min and fentanyl later at 1.5 h for not feeling pain. All patients received 7 ml/kg Ringer serum at room temperature. The recovery temperature and humidity were measured and recorded with wall thermometer (Beurer Medical TFA, Wertheim, Germany). The Monitoring device (saadat) was manufactured in Iran. Data collection tool consisted of a questionnaire to record patients' demographic information and a checklist of the recorded postoperative parameters. Validity and Reliability of measurement were confirmed (21). The devices (pulse oximetery and monitoring) were calibrated. The research colleague filling the forms of data record and the subjects were blinded to the study to increase the validity of the data. In addition, patients were blinded from their groups. Upon arrival to the recovery room, the degree of shivering of patients who experienced shivering was first determined; then the patients were randomly assigned to one of three study groups. In this study, the letter A, B, and C were typed on 87 cards in equal numbers. Letter A represented the pethidine group, letter B the intravenous warm serum group, and letter C represented the combined warm group. When patients meeting inclusion criteria were enrolled in the study, entered one of the three groups by simple Lottery. After the data were collected, they were analyzed with chi-square, ANOVA, repeated ANOVA test, Kruskal–Wallis test, Wilcoxon test, Mann–Whitney U test, Tukey test, Friedman test, and repeated measurements through SPSS version 18. The significance level was considered as $P < 0.05$. The study was approved by the Ethics and Research Committee of Birjand University of Medical Sciences.

Results

The variables of gender, age, length of surgery, and the temperature and humidity of recovery room were analyzed by statistical tests (ANOVA) and were not found to be statistically significant ($P>0.05$) [Table 1].The average time of shivering to finish in the pethidine, warmed intravenous serum group and the combined warming group was 2.8 min, 7 min, and 6 min, respectively, which was statistically significant ($P<0.001$) [Table 2]. At the 10th and 20th minutes of intervention, shivering was not seen in patientsThe pre‑intervention Respiratory Rate and Spo2 in the two intervention groups and the pethidine group were not significant ($P>0.05$). At the 10th of intervention, The difference between warmed intravenous serum with pethidine and combinedwarming weren't significant ($p>0.05$). But the Mann–Whitney U test showed, the difference between spo2 in the Combined warming group and pethidine group was statistically significant ($p=0.02$). At the 20th intervention, the difference between pethidine and both intervention groups weren't significant ($p>0.05$).The Friedman test showed, the spo2 in the combined warming group at the three times of intervention was clear increased. But, the spo2 in pethidine group was slight decreased and wasn't significant ($p>0.05$). For RR: the difference between pethidine and warmed intravenous serum was statistically significant ($p=0.009$). But the difference between combined warming with pethidine and warmed intravenous serum weren't significant ($p>0.05$)[Table 3]. The repeated measure showed the respiratory rate in the pethidine group at the three times intervention was clear decreased ($p=0.01$). But the respiratory rate in the combined warming group at the three times intervention Haven't been change ($p>0.05$) [Table 3]. In the pethidine group 10.3% of patients have nausea& vomiting but in the two intervention groups haven't any nausea and vomiting [Table 2].

Table 1: Comparison of some characteristics of participants in the three groups

Variables	Group 1 Mean(SD)	Group 2 Mean(SD)	Group 3 Mean(SD)	P
Age(years)*	51.4(15.2)	51(9.6)	53.3(12.2)	0.751
Gender(F/M), n(%)**	9(20)	14(15)	15(14)	0.234
Length of surgery (min)*	37.7(12)	43(10)	40(10)	0.145
Temperature of R.R (°C)*	23(0.84)	23.03(0.82)	23.03(0.83)	0.981
Humidity of R.R(%)*	34.5(1.2	33.8(1.7)	33.7(1.8)	0.152

*ANOVA test
**chi-square test
R.R=Recovery Room. Group 1= Pethidine Group 2=Warmed intravenous serum
Group 3=Combined warming. F=female M=male

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Table 2: Comparison of elapsed time in the three groups during the study

Time(min)	Group 1 Mean (SD)	Group 2 Mean(SD)	Group 3 Mean(SD)	P
Elapsed time*	2.8(0.7)	7(1.5)	6(1.5)	<0.001
N/V(n(%))	3(11.0%)	0(0.0)	0(0.0)	NS

*Kruskal–Wallis test & Mann–Whitney U test
Elapsed time: Shivering stop time
N/V: Nausea &Vomiting NS: Not Significant

Table3: Comparison of Spo2 and Respiratory Rate at the three groups and three intervention times during the study

Variables	Group 1 Mean(SD)	Group 2 Mean(SD	Group 3 Mean(SD	P
RR(arrival to R.R)*	16(1.4)	17.1(1.3)	16.2(1.3)	0.341
RR (after 10min)	14.8(1.5)	16.8(1.3)	16.5(1.4)	0.000
RR (after 20min)	15.2(1.2)	15.6(4.5)	16.8(1.3)	0.010
P	0.010	0.211	0.095	---
Spo2,%(arrival to R.R)**	98(2)	98(1.5)	96(6.2)	0.945
Spo2,%(after 10min)	97.5(2.5)	97.5(1.5)	98(1)	0.035
Spo2,%(after 20min)	97(3.5)	97.5(2.5)	98(1)	0.180
P	0.031	0.521	0.412	---

* Repeated Measure
**Friedman test
0=arrival to recovery room. 1=after 10min. 2=after 20min
RR=respiratory rate. Spo2=oxygen saturation

Discussion

The more previous studies on this subject have focused on the effect of drugs, and none have compared non‐pharmacological methods with pharmacological ones. In our study the Respiratory Rate, SPO2, nausea and vomiting were investigated in the use of three methods (warmed intravenous fluids, combined warming and pethidine) in patients with shivering after general anesthesia that tolerated abdominal surgery. Our before study showed the pethidine was better than two intervention groups in controlling of shivering but it has various effects in Spo2 and RR in comparison with non-pharmacological methods(21). In our study, the spo2 and respiratory rate in the pethidine group at three times intervention were decreased, and patients in pethidine group have nausea and vomiting. those effects approved that the pethidine can be induced apnea, respiratory depression and nausea &vomiting . But in the combined warming group, the spo2 was increased and the respiratory rate did not fall after three times intervention. And any patients haven't nausea and vomiting. According to the study of Leena Mildh , No decrease in respiratory rate was detected at 5 minutes after a i.v. bolus of 112.5 mg pethidine, however during the 3 hours infusion of 187.5mg pethidine respiratory rate decreased slightly but significantly ($p<0.05$). Whereas pethidine 112.5 mg bolus decreased oxygen saturation from 97% to 94% ($p<0.05$) (22). This finding is in line with our study findings. The respiratory effects of pethidine bolus were predictable with decreasing spo2. In contrast, during pethidine infusion, adequate respiration was preserved despite the large amount of pethidine infused(23). These findings are in conjunction with the study of Orkin et al (1955), in which 100 mg an intravenous bolus dose of pethidine showed the respiratory rate did not fall (10). In a study of Tarkkila et al (1998), a bolus dose of pethidine 0.6 mg/kg decreased both respiratory rate and Spo2. (24). This finding was agreeing with our study.

In our study, the injection of 0.4 mg / kg of pethidine in the form of pethidine caused decrease in respiratory rate and spo2. Kryger et al. Also showed that pethidine infusion reduced ventilation, respiratory rate and spo2 after the three hours (11). In our study, nausea and vomiting were reported after injection of pethidine 11%. Sahmedini MA et al. in his study represent that the respiratory depression (respiratory rate <8) was 7% and nausea and vomiting (13%) (15). In the study conducted by Javar Fereshzadeh et al., The incidence of nausea and vomiting was 15% with pethidine (25). Complications were observed with pethidine injection, and in the combined warming group none of the patients suffered from respiratory depression and Nausea &vomiting. Therefore, despite the complications of pethidine injection, Use alternative methods to control grade 1 to 3 shivering.

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Conclusions

Considering the side effect of pethidine, such as apnea, respiratory depression and nausea & vomiting, the pethidine can't be a good choice for shivering control, and the combined warming, be suggested in patients tolerating abdominal surgery with grades 2 and 3 of shivering.

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Authors' contributors

All authors discussed the results and contributed to the final manuscript.
Ayob Akbari: conception and designing, Data collection, literatures search, Writing the manuscript, critical revision of the manuscript;
Ahmad Nasiri: conception and designing, critical revision of the manuscript;
Alireza Amirabadize: analysis and interpretation.
Mahdi Heidari: translated the project, critical revision of the manuscript;
Feraidon Keramatinia: critical revision of the manuscript.

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References

1. Cretikos MA, Bellomo R, Hillman K, Chen J, Finfer S, Flabouris A. Respiratory rate: the neglected vital sign. Med J Aust. 2008 Jun 2;188(11):657-9.

2. Torpy JM. MD; CassioLynm, MA; Robert M. Golub, MD. The Journal of the American Medical Association (JAMA). Hyperthyroidism. 2011 Jul 20.

2- Torpy JM, Lynm C, Golub RM. General Anesthesia. JAMA. 2011;305(10):1050. doi:10.1001/jama.305.10.1050

3. Alternatives R, Alert SE. Preventing, and managing the impact of, anesthesia awareness. Sentinel Event Alert. 2004 Oct 6;(32):1-3.

4. Takki S, Tammisto T. A comparison of pethidine, piritramide and oxycodone in patients with pain following cholecystectomy. Anaesthesist. 1973 Apr;22(4):162-6.

5. Ali HH, Utting JE, Gray C. Stimulus frequency in the detection of neuromuscular block in humans. Br J Anaesth. 1970 Nov;42(11):967-78.

6. Bailey PL, Egan TD, Stanley TH, Miller RD (Editor). Intravenous opioid anesthetics. Anesthesia. 5th ed. New York: Churchill Livingstone; 2000. 273p

7. Jordan C. Assessment of the effects of drugs on respiration. Br J Anaesth. 1982;54(7):763-82.

8. Pugsley MK. The diverse molecular mechanisms responsible for the actions of opioids on the cardiovascular system. Pharmacol Ther. 2002 Jan;93(1):51-75.

9. Waldhoer M, Bartlett SE, Whistler JL. Opioid receptors. Annu Rev Biochem. 2004 Jul;73(1):953-90.

10. Orkin LR, Egge RK, Rovenstine EA. Effect of Nisentil®, Meperidine and Morphine on meeting abstracts in man. Anesthesiology. 1955 Sep 1;16(5):699-707.

11. Kryger MH, Yacoub O, Dosman J, Macklem PT, Anthonisen NR. Effect of meperidine on occlusion pressure responses to hypercapnia and hypoxia with and without external inspiratory resistance. Am Rev Respir Dis. 1976 Aug;114(2):333-40. DOI: 10.1164/arrd.1976.114.2.333

12. Poorsheykhian M, Emami Sigaroodi A, Kazamnejad E, Raoof M. Incidence of post general anesthesia complications in recovery room. J Guilan Univ Med Sci. 2012 Jul 15;21(82):8-14. [Persian]

13. Miller RD, Pardo M. Basic of anesthesia. 7th ed. Elsevier; 2007. pp: 641-5.

14. Emadi SA, Nasiri E, Zamani A, Kabirzade A, Ebadi A. A comparison of pethidine and tramadol on post operative shivering. J Mazand Univ Med Sci. 2010;20(78):36- 40.

15. Sahmeddini M, Khademi S, Majidi F. Comparison of effect of Meperidine and Tramadol Treatment on Postoperative Shivering in Elective Cesarean Section. Razi J Med Sci. 2008;14(57):83-90. [Persian]

16. Modir H, Norouzi A, Pazoki Sh. Comparing the efficacy of different classes of drugs for the prevention of shivering after general anesthesia. Arak Med Univ J. 2013; 16(72): 71-8. [Persian]

17. Oshvandi K, Hasan Shiri F, Safari M, Fazel MR, Salavati M, Hassan Tehrani T. Effect of pre-warmed intravenous fluid therapy on prevention of postoperative shivering after Caesarean section. Hayat. 2012; 17(4): 5-15. [Persian]

18. Hoseinkhan Z, Behzadi M. Morphine, Pethidine and Fentanyl in postoperative shivering control: A randomized clinical trial. Tehran Univ Med J. 2007; 64(12): 57- 63. [Persian]

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19. Atashkhoyi S, Niazi M, Iranpour A. Effect of tramadol administration previous to induction of general anesthesia on prevention of postoperative shivering. J Zanjan Univ Med Sci. 2008 Sep 1;16(64):31-8. [Persian]

20. Lobato SD, Alises SM. Effectiveness of high-flow oxygen therapy with warm humidification in a COPD patient with chronic cough. Arch Bronconeumol. 2011;47(8):420-1. DOI: 10.1016/j.arbr.2011.05.002

21. Nasiri A, Akbari A, Sharifzade G, Derakhshan P. The effects of warmed intravenous fluids, combined warming (warmed intravenous fluids with humid-warm oxygen), and pethidine on the severity of shivering in general anesthesia patients in the recovery room. Iran J Nurs Midwifery Res. 2015 Nov-Dec;20(6):712-6. doi: 10.4103/1735-9066.170014.

22. Mildh L. Effects of opioids on ventilation and hemodynamics [dissertation]. [Helsinki]: University of Helsinki;2007.70p.

23. Mildh LH, Leino KA, Kirvelä OA. Effects of tramadol and meperidine on respiration, plasma catecholamine concentrations, and hemodynamics. J Clin Anesth. 1999 Jun;11(4):310-6.

24. Tarkkila P, Tuominen M, Lindgren L. Comparison of respiratory effects of tramadol and pethidine. Eur J Anaesthesiol. 1998 Jan;15(1):64-8.

25. Javaherforoosh F, Pipelzadeh M, Bagherybarma F. Comparison of clonidin, pethedin and fentanyl for post-spinal anesthesia shivering in elective caesarian sections. Armaghan-e-Danesh. 2006;11(3):59-67.

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