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Research Article

Nicotine smoking: Influences on perioperative pain management

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KEYWORDS

Perioperative pain;
Nicotine;
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Abstract *Background:* The complex relationship between smoking and pain has clinical relevance in the practice of anesthesiology and pain medicine. The present study investigated the effect of heavy nicotine smoking on perioperative pain management.

Methods: This prospective controlled study was carried out in Alexandria Main University hospital on 80 adult ASA I and II patients scheduled for lower limb fractures fixation under general anesthesia after an informed written consent and approval of the Medical Ethics Committee. Patients were divided into 2 groups: group N included nonsmokers and group S included the heavy smokers. Intraoperative heart rate (HR), mean arterial blood pressure (MAP) and intraoperative analgesia were recorded. Postoperatively; HR, MAP, pain visual analog scale (VAS) and total postoperative analgesic requirements were recorded.

Results: Intraoperative and postoperative HR and MAP showed significantly higher values in group S patients than group N patients. VAS values were significantly lower in group N than group S at recovery, 8 and 24 h postoperatively. Total intraoperative and postoperative analgesic requirements of meperidine were significantly lower in group N than group S.

Conclusions: Chronic nicotine smoking increases the incidence of perioperative pain. Heavy smokers need more perioperative analgesia than nonsmokers.

1. Introduction

Cigarette smoke, which serves as a nicotine delivery vehicle produces profound physiological changes [1]. Chronic exposure to nicotine and other tobacco constituents is associated with an increased prevalence of painful conditions in many studies [2,3]. Among those with chronic pain, smokers report greater pain intensity and functional impairment [4]. On the other hand, nicotine itself can produce analgesia when administered acutely [5]. The complex relationship between smoking and pain has clinical relevance in the practice of anesthesiology and pain medicine [1].

Nicotine exhibits its pharmacological effects by interacting with ion channels of the peripheral and central nicotine acetylcholine receptors (nAChR) family [6]. When nAChR are exposed chronically to low agonist concentrations, of nicotine typically seen in chronic heavy smokers results in

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an up to 2-fold up-regulation of nAChR expression in the brain [7]. Reduction in channel opening rates results in a closed, desensitized state and tolerance to nicotine-induced antinociception [8–10]. Chronic nicotine exposure results in interaction between nAChRs and opioid receptor pathways may contribute to the increased use of opioid analgesics by smokers than nonsmokers that may be explained by an up-regulation of mu opioid receptors in the striatum and decreasing striatal met-enkephalin levels which had observed in some animal studies [11,12].

The aim of the present study was to investigate the effect of chronic heavy smoking on perioperative pain and perioperative analgesia in patients undergoing lower limb fractures fixation surgery under general anesthesia.

2. Methods

This prospective controlled study was carried out in Alexandria Main University hospital on 80 adult ASA I and II patients scheduled for lower limb fractures fixation under general anesthesia (GA) after taking an informed written consent and approval of the Medical Ethics Committee. Patients were divided into two equal groups (40 each): group N included the nonsmokers patients and group S included the heavy smokers (smoking more than 20 cigarettes per day) [13]. Patients with history of allergy to meperidine, use of psychotropic medications, alcohol or substance abuse, morbid obesity and patients with chronic pain were excluded from the study.

The day before surgery, patients were familiarized with visual analog scale (VAS) for pain (0 = no pain, 10 = worst pain imaginable) [14]. All patients were subjected to the same anesthetic protocol for GA; using intravenous (IV) midazolam 0.05 μg/kg as premedication, IV fentanyl 1.5 μg/kg, IV propofol 2–3 mg/kg and IV cis-atracurium 0.15 mg/kg to facilitate endotracheal intubation. Patients were monitored by using Hewlett Packard Viridian 24 multichannel monitor. Anesthesia was maintained by sevoflurane (2–3%) in oxygen and cis-atracurium increments guided by nerve stimulator. HR and MAP were recorded intraoperatively every 15 min. IV meperidine 0.5 mg/kg was given when HR and/or BP were increased 20% above the patient's preoperative reference level. At the end of operation, residual neuromuscular blockade was reversed with IV neostigmine 0.04 mg/kg and atropine 0.01 mg/kg and duration of anesthesia was recorded.

Postoperatively; HR, MAP and pain VAS were recorded at recovery, then hourly for four hours, and 4 hourly till 24 hours postoperative. Patients received IV analgesia according to VAS (0–3 score: nothing was given, 4–6 score: diclofenac sodium 75 mg was given, with a maximum dose of 150 mg/day, score >6: meperidine 0.5 mg/kg was given). Total intraoperative and postoperative analgesic requirements in the first 24 h after surgery were recorded.

2.1. Statistical analysis

Data were statistically analyzed by SPSS^R software (Statistical package for social science for personal computers) using "*t*" and chi-square (X^2) testes, and data were expressed as mean ± SD and $P \leqslant 0.05$ considered significant.

3. Results

The present study showed no significant differences between the two studied groups regarding demographic data; age, sex, body weight, ASA physical status and duration of anesthesia (Table 1).

Preoperative hemodynamic parameter; HR and MAP showed no significant statistical differences. Intraoperative HR and MAP showed significantly higher values in group S patients than group N patients at 60, 75, 120, 135 and 165 min. postoperatively HR and MAP showed significantly higher values in group S patients than group N patients at 3, 8, 20 and 24 h (Figs. 1 and 2).

VAS values were significantly lower in group N than group S at recovery, 8 and at 24 h postoperatively (Fig. 3). Total intraoperative and postoperative analgesic requirements of meperidine were significantly lower in group N than group S, while analgesic requirements of diclofenac sodium showed no significant differences (Table 2).

4. Discussion

The present study investigated the influence of heavy nicotine smoking on perioperative pain and analgesic requirements. Intraoperative and postoperative HR and MAP showed significantly higher values in group S patients than group N patients. VAS values were significantly lower in group N than group S at recovery, 8 and 24 h postoperatively. Total intraoperative and postoperative analgesic requirements of meperidine were significantly lower in group N than group S.

Volkan et al. [15], study on 220 patients divided into two equal groups (smokers and nonsmokers) to determine whether or not smoking has an effect on pain perception of venous can-

Table 1 Comparison between the two studied groups regarding demographic data.

	GN	GS	P
Age (yr)	35.2 ± 7.4	38.1 ± 7.33	0.32
Sex (M/F)	33/7	35/5	0.33
Weight (kg)	78.32 ± 11.7	76.44 ± 10.51	0.298
ASA I/II	25/15	28/12	0.107
Duration of anesthesia (min)	161.50 ± 10.15	160.30 ± 12.15	0.788

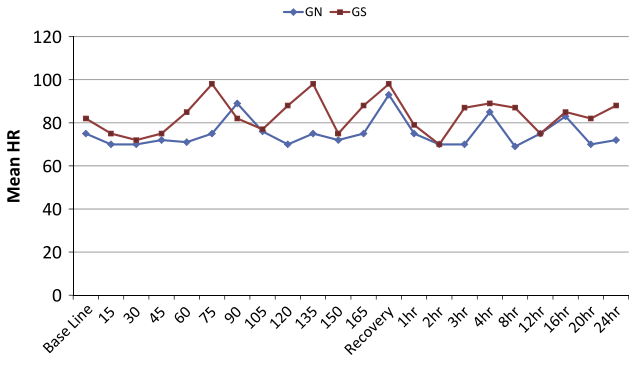

Figure 1 Comparison between the two studied groups regarding HR.

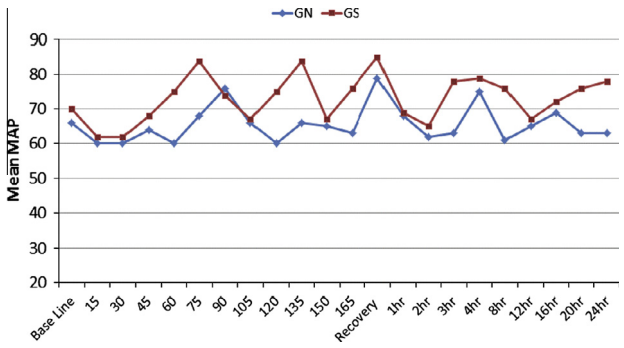

Figure 2 Comparison between the two studied groups regarding MAP.

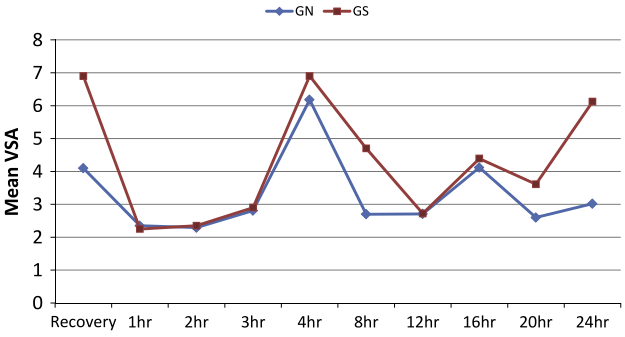

Figure 3 Comparison between the two studied groups regarding VAS.

Table 2 Comparison between the two studied groups regarding analgesic requirements.

	GN	GS	P
Intraoperative meperidine (mg)	37.3 ± 5.2	70.3 ± 7.35	0.001*
Postoperative diclofenac Na (mg)	150	150	–
Postoperative meperidine (mg)	50.8 ± 5.7	107.3 ± 11.3	0.001*

* Significant.

nulation, numerical rating scale (NRS) was used for evaluation of pain perception after peripheral venous cannulation at the dorsum of the hand. Pain perception was higher in smokers than nonsmokers (NRS was 3.31 ± 1.56 and 1.65 ± 1.23 respectively) (P 0.001) [15].

A retrospective review by Creekmore et al. [16], on patients undergoing coronary artery bypass grafting (CABG) demonstrated a 33% greater opioid requirement in smokers than nonsmokers during the first 48 h after surgery [16].

In addition, Woodside and Jack [17], retrospective study on the influence of tobacco use on postoperative narcotic requirements of female patients following pelvic surgery. Postoperative narcotic use for patients who never smoked was significantly less than former smokers ($p = 0.02$) or current smokers ($p = 0.007$) with no significant difference between current and former smokers. Patients who have smoked required more narcotic for postoperative pain control; this effect was equally strong for former as for current smokers [17].

Warner et al. [18], reported in a general surgical population, smokers recorded higher pain scores both before and after surgery but may not experience greater increases in pain postoperatively compared with nonsmokers [18]. Thus, increased postoperative analgesic requirements might be anticipated in cigarette smokers, and this effect is of sufficient magnitude to consider a change in clinical approach as more aggressive use of regional analgesia [1].

However, factors other than smoking status that are known to influence postoperative opioid use, such as age, sex and surgical characteristics, may be not well controlled. Toby et al. [19], study on the hypothesis that tobacco use status is independently associated with increased postoperative opioid requirements in patients undergoing CABG surgery when demographic variables such as age and gender are taken into account concluded that; tobacco users undergoing CABG surgery receive more opioids postoperatively than nonusers, but still studies of how tobacco use affects postoperative pain must adjust for other clinical variables that influence postoperative pain specifically younger age and male gender [19].

On the other side; Ionescu et al. [20], study on 71 patients scheduled for elective laparoscopic cholecystectomy under GA investigated the effect of smoking on postoperative nausea and vomiting and postoperative pain. The mean maximum degree of pain was significantly lower in the smokers' group (1.82) as compared with nonsmokers (2.8) ($p < 0.05$) and concluded that smoking may reduce the incidence of postoperative pain [20].

Svetlana et al. [21], study to evaluate prospectively smoking dependence as a predictor of repeated use of prescribed opioids in noncancer patients conducted a prospective population-based study cohort of 12,848 men and 15,894 women 30–75 years of age. The prevalence of repeated prescription frequency of opioids was higher for men and women with a history of smoking; suggested that smoking dependence may predict more frequent use of opioids [21].

5. Conclusion

Chronic nicotine smoking increases the incidence of perioperative pain. Heavy smokers may require more intra- and postoperative analgesia than nonsmokers.

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None.

Conflict of interest

No conflict of interest.

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