

Control of Pain Through Epidural Block and Incidence of Cardiac Dysrhythmias in Postoperative Period of Thoracic and Major Abdominal Surgical Procedures: a Comparative Study

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Summary: Oliveira RM, Tenório SB, Tanaka PP, Precoma D – Control of Pain Through Epidural Block and Incidence of Cardiac Dysrhythmias in Postoperative Period of Thoracic and Major Abdominal Surgical Procedures: a Comparative Study.

Background and objectives: Upper abdomen and thorax surgeries cause intense pain. Some of postoperative pain main complications are cardiocirculatory complications. The objective of this study was to test the hypothesis that postoperative analgesia with employment of local anesthetics plus spinal opioids may reduce the incidence of cardiovascular complications in postoperative period of patients in these conditions, comparing with classical methods of postoperative analgesia, opioids and NSAIDs, administered upon patient's demand.

Method: Eighty adult patients, ASA I and II, without ECG alterations, were allocated into two groups of 40: Group A, patients under general anesthesia with propofol, cisatracurium and isoflurane, associated with epidural anesthesia with catheter and control of postoperative analgesia with bupivacaine and epidural morphine; and Group B, patients under general anesthesia with the same drugs and doses of A, plus postoperative analgesia carried out with NSAIDs and intravenous morphine at the end of surgery and in regular intervals. In both groups Holter was applied for 24 hours. Pain evaluation was carried out through visual analog scale.

Results: In pain evaluation, an evident predominance of 0 score ($p < 0.001$) was observed in Group A and there was also reduction of blood pressure levels in postoperative period in a more accentuated way. Ventricular and supraventricular dysrhythmias were five times more frequent in Group B ($p = 0.00001$), in which a tendency to a higher frequency of ventricular extrasystoles in age > 50 years (22.2% versus 0.0%. $p = 0.26$) was also detected. No significant difference of heart rate among groups ($p > 0.05$) was observed.

Conclusions: The best quality of analgesia in postoperative period, carried out in Group A, reduced the incidence of cardiovascular complications.

Keywords: Anesthesia, Epidural; Pain, Postoperative; Analgesia; Arrhythmias, Cardiac.

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INTRODUCTION

Major surgeries carried out both in upper abdomen and in thorax cause intense pain and, if not properly treated, may cause deep physiological ^{1,2} and hormonal ³ alterations in the body. Some of the main complications of untreated postoperative pain are cardiocirculatory complications like tachycardia, hy-

pertension, increase of cardiac output, increase of heart work and dysrhythmias ⁴, increasing the risk of ischemia or myocardial infarction in the postoperative period ⁵⁻⁷.

Since the discovery of a pain inhibitory system modulated specially in the spinal cord by neurotransmitters like endorphins, serotonin and others, there were possibilities of using substances ⁸⁻¹⁰ that imitate the action of these inhibitory neurotransmitters in the epidural or subarachnoid spaces as means for controlling postoperative pain. Atrial or ventricular dysrhythmias are commonly observed in the postoperative period of big surgeries and are an important morbidity source ^{11,12}. Pain is admittedly an important factor of postoperative stress and may be associated with increased frequency of dysrhythmias.

Considering the hypothesis that postoperative pain is the cause of dysrhythmias after surgeries in upper abdomen and thorax, this study was prepared to test the hypothesis that the employment of local anesthetics associated with spinal opioids in postoperative analgesia may reduce the incidence of cardiac dysrhythmias and alterations in ST segment (evaluated through the use of Holter) if compared with the classical methods of postoperative analgesia: opioids and NSAIDs intravenously administered upon patient's demand.

Received from Graduation in Surgery Principles of Universidade Federal do Paraná (UFPR), Brazil.

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Submitted on September 9, 2008.
Approved on May 19, 2011.

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METHODS

After informed consent of patients and approval by Ethics Committee in Research in Human Beings of *Hospital Nossa Senhora das Graças*, 80 patients of both genders undergoing major surgeries in thorax and abdomen with the following characteristics were studied: age group above 21 years old; physical status ASA I or ASA II; no electrocardiographic alterations.

Exclusion criteria were: coagulation disorders and/or patients who received heparin or low molecular weight heparin through subcutaneous or intravenous routes for a period below 12 hours before surgery; anatomical alterations in the spine that prevented epidural anesthesia; impossibility of introducing epidural catheter; sepsis; emergency surgery; mental impairment; chronic use of opioids; and allergy to the medication used.

Patients were randomly and alternately allocated from an initial raffle into two groups of 40 people. Group A underwent epidural and general anesthesia and Group B general anesthesia only.

Patients received midazolam as pre anesthetic medication in a 15 mg oral dose on the night before surgery and one hour before the procedure, including 8 hours of fasting. All patients were monitored with continuous cardioscopy in DIII and V5 bypasses and analysis of ST segment, pulse oximetry and capnography and non invasive blood pressure.

The general anesthesia carried out in both groups consisted of induction with propofol (2.0 mg.kg⁻¹), alfentanil (25 to 150 µg.kg⁻¹) and cisatracurium (0.2 a 0.3 mg.kg⁻¹); maintenance was done with isoflurane and a mix of gases (oxygen/nitrous oxide 50%-50%) and additional doses of opioids.

Patients of Group A received epidural anesthesia. Those patients underwent epidural puncture between T5 and L3, with catheter placement and injection of 15 mL of 0.25% bupivacaine associated with morphine (2 mg). Doses between 5 and 8 mL were administered in patients with postoperative pain of weak intensity, according to the visual analog scale (VAS). In patients with pain of moderate intensity, ¼ of the initial dose of morphine was associated with local anesthetic. Ketoprofen (100 mg) and dipyron (1,000 mg) were administered every 8 hours, and the first dose was administered at least 30 minutes before the end of surgery. In Group B patients, the analgesia plan included ketoprofen (100 mg), dipyron (1,000 mg) and tramadol (100 mg) administered every 8 hours, and the first dose was administered at least 30 minutes before the end of surgery – associated with surgery wound infiltration with 0.5% bupivacaine, around 8-10 mL. All patients of this group who had postoperative pain from moderate to strong intensity according to VAS received intravenous morphine. Ventilation parameters were adjusted in both groups to keep ET_{CO}₂ between 30 and 35 mmHg and at the end of surgery, tracheal extubation was performed.

A Holter was also installed at the end of surgery in all studied patients. Through the Holter the following parameters were evaluated in the first 24 hours of postoperative period: a) total number of QRS complexes; b) ventricular dysrhythmias iso-

lated, in cycles, pairs, tachydysrhythmias; c) supraventricular dysrhythmias, isolated, in cycles, pairs, tachydysrhythmias; d) minimum, medium, maximum heart rate; e) alteration of ST segment. Pain was measured in the following moments: a) right after extubation; b) every 60 minutes in the first 6 hours; c) every 120 minutes in the following 6 hours; e) every 360 minutes in the last 12 hours. Evaluation of pain performed by the patient himself, according to VAS, from zero to 10, in which zero corresponds to absence of pain and 10 to maximum pain already experienced by the patient.

The difference between continuous variables was evaluated by the Student's *t* test while the difference between proportions in both groups was evaluated by Fisher's exact test. The ANOVA model for repeated measures (Analysis of Variance) was applied to evaluate the profile of continuous measures registered during postoperative period (systolic blood pressure, diastolic blood pressure and heart rate). Bicaudal tests were used for all patients considering that the differences could be distributed on both sides of curve with minimum significance level of 5%.

RESULTS

Demographic characteristics of the populations were similar in both groups according to Table I.

Table I – Characteristics of Study's Population

		Group A (n = 40)	Group B (n = 40)
Gender	Female	60%	35%
	Male	40%	65%
Age		49.50 ± 12.95	58.40 ± 14.62
Weight		72.26 ± 13.54	72.20 ± 12.73
Height		1.61 ± 0.09	1.64 ± 0.12
ASA	I	65%	55%
	II	35%	45%

A tendency of greater extrasystole frequency in Group B patients was observed (12.5% *versus* 2.5%, *p* = 0.10). Ventricular and supraventricular dysrhythmias were around five times more frequent in this group (*p* = 0.00001) (Figure 1). A statistically significant difference between minimum, medium and maximum heart rates between groups (*p* > 0.05) was not observed.

With regard to VAS to evaluate pain, an evident predominance of zero score (*p* < 0.001) was observed in Group A (Figure 2). Also observed was a greater use of intravenous analgesia in the postoperative period in Group B (*p* < 0.001). But, patients of Group A proportionally used more analgesia since they used epidural analgesia added to intravenous analgesia.

There was a significant and progressive reduction of systolic blood pressure levels in the postoperative period similar in both groups, being more evident in Group A. The diastolic blood pressure variation was similar between groups, except

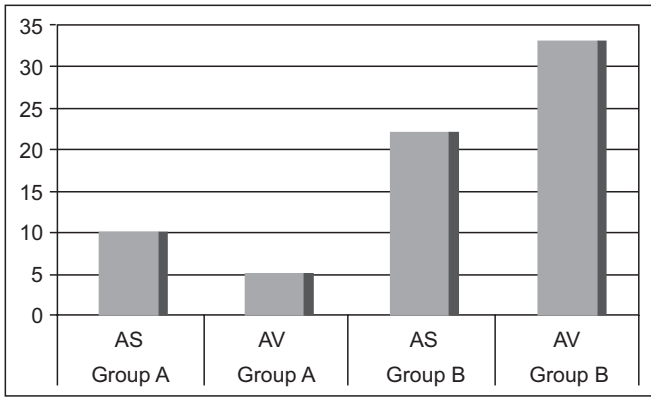


Figure 1 – Ventricular and Supraventricular Dysrhythmias.

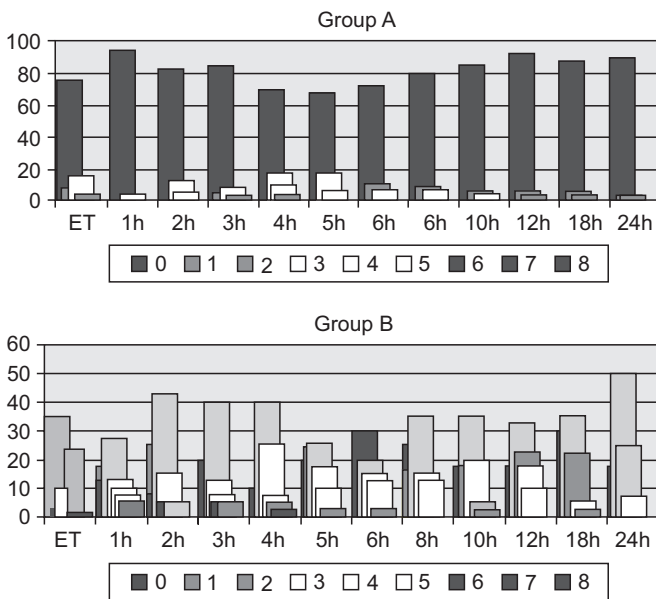


Figure 2 – Pain Evaluate with Visual Analog Scale.

in the first hours of postoperative period. A progressive decrease of heart rate levels was observed in the postoperative period in both groups, being more evident in the first hours of the postoperative period of Group A.

When patients of Groups A and B are compared, no statistically significant difference between types of surgeries carried out in both groups was observed, not even in the average time of surgery or physical status in different ages ($p > 0.05$). Ventricular dysrhythmias were registered in 27 cases (55.0%) and supraventricular ones occurred in 19 patients (47.50%). There was a tendency of greater frequency of extrasystoles in patients of Group B (12.5% *versus* 2.5%, $p = 0.10$). Ventricular and supraventricular dysrhythmias were around 5 times more frequent in this group ($p = 0.00001$).

When groups were divided according to the age (< 40 years, between 40 and 50 years and > 50 years), some differ-

ences were found. There was a tendency of higher frequency of extrasystoles in patients of Group B > 50 years (22.2% *versus* 0%, $p = 0.26$). Four patients < 40 years had ventricular dysrhythmias, three of them belonging to Group A ($p = 1.00$). Among patients aged between 40 and 50 years, 7 had ventricular dysrhythmias, 6 belonging to Group B ($p = 0.08$). Fifteen patients of Group B > 50 years of age had ventricular dysrhythmias ($p = 0.0001$). No statistically significant difference between minimum and medium heart rates between groups in different ages was observed, but with regard to maximum heart rate the difference was statistically significant in patients > 50 years in both groups (111.87 ± 5.05 bpm in Group A *versus* 128.62 ± 14.24 bpm in Group B; $p = 0.004$).

With regard to VAS for evaluation of pain, an evident predominance of zero score was observed in Group A, especially among patients < 40 years ($p < 0.01$). For the other age groups the same predominance takes place, but differences are close to the significance limit (group with age between 40 and 50 years, $p = 0.13$; > 50 years, $p = 0.15$).

When patients are divided according to age no statistically significant difference in systolic blood pressure and diastolic blood pressure variation was observed, being however smaller in Group A regardless of age. Nevertheless, in the group of patients > 50 years, the heart rate was lower in Group A in the first 6 hours of postoperative period.

DISCUSSION

This study had the objective of comparing two methods of treatment of postoperative pain and the main variable evaluated was the presence of cardiovascular complications like cardiac dysrhythmias and alterations in ST segment analyzed through Holter in the first 24 hours. Upper abdomen and thorax surgeries were selected for the study since they are procedures with great algic stimulation, in which possible differences between the both analgesia techniques studied are more easily recognizable. Clinical evaluation of pain was carried out by VAS^{13,14}. This one, like other evaluation methods, have limitations due to the own subjective nature of pain. A significant difference in analgesia quality was observed between the studied groups. Patients who received epidural anesthesia with local anesthetic and opioids (Group A) had less complaints of pain in the first 24 hours of postoperative period than patients of Group B treated with venous anesthetics administered upon demand.

Researches demonstrated that opioids prescribed to be administered after patient's complaint of pain are rarely done in the necessary quantity to proper pain relief due to fear of side effects, like respiratory depression, substance dependence and other complications, as demonstrated in a meta-analysis with 18 studies^{15,16}. We observed in the present study that in Group B, of 40 patients studied, 33 received only one dose of morphine and seven did not receive any dose.

Even though patients of Group B had highest pain score in the postoperative period, no differences in hemodynamic variables between both groups were detected. Nevertheless,

one difference was evident between groups: the incidence of ventricular and supraventricular dysrhythmia was significantly higher in Group B. The continuous observation of ECG for 24 hours showed that 55% of patients of Group B and 10% of Group A had ventricular dysrhythmias. Dysrhythmias are common complications in immediate postoperative period^{17,18}, even more common after thorax surgeries. A study registered dysrhythmias in the postoperative period of 20% of 185 patients undergoing thoracotomies¹⁹. Dysrhythmia may be associated with improper treatment of pain²⁰, and have the excess of circulating catecholamines as the most important physiopathological mechanism, producing an imbalance between oxygen offer and consumption by the myocardium²¹.

One can speculate that the improved control of pain in postoperative period is the main factor for the differences in the incidence of dysrhythmias between both groups in this study. Other authors observed that in high-risk patients undergoing epidural analgesia there is a lower incidence of cardiovascular complications in the postoperative period when compared with patients treated with traditional analgesia methods²². Using local anesthetics through the epidural route in a sufficient level to block sympathetic nervous system, improves oxygen supply to myocardium through heart rate reduction without altering coronary blood flow²³. Even though dysrhythmias are usually benign, they may have a great physiological impact in the body depending on the duration, ventricular response and cardiac function. They can also run through the increase in consumption and reduction in the offer of oxygen to the myocardium, in addition to the possibility of cardiac arrest and death²⁴.

In this study, no alterations in the ST segment in the first 24 hours of postoperative period were observed between both groups. Studies demonstrated that stimulation of autonomic sympathetic nervous system is the main responsible for myocardial ischemia²⁵. The occurrence of myocardial ischemia is a possible complication in patient with intense sympathetic stimulation, but it is even more frequent in patients with previous alterations in the electrocardiogram²⁶.

Postoperative analgesia obtained with epidural anesthesia was superior in Group B. Local anesthetics are currently the most powerful pain inhibitors. They are able to reduce neuroendocrine response and improve diaphragmatic and respiratory function. The injection of local anesthetic between T5 and L3, as it was used in this study, blocks the sympathetic fibers and can produce side effects like hypotension through the vasodilation in lower limbs and splanchnic region and bradycardia if the block reaches the segment between T1 and T4^{27,28}.

In this study a more accentuated reduction in blood pressure of Group A was observed without reaching statistically significant differences with Group B, suggesting that the compensation mechanisms, especially baroreceptors and circulating catecholamines, were enough to maintain blood pressure. The duration of analgesia of a single bupivacaine dose is insuffi-

cient to block pain during the period of biggest algic stimulus in the postoperative period for most patients undergoing major surgeries. Intermittent injection of local anesthetic through the epidural catheter may indefinitely extend analgesia duration and does not require equipment like infusion pumps. It is suggested that local anesthetic must be repeated whenever there is a regression of two segments in the sensitive block, using half of the initial dose²⁹.

In this study, the local anesthetic was repeated whenever the patient complained of pain using 0.125% bupivacaine in volumes between 5 and 8 mL. Those concentrations and volumes were adequate to pain relief and did not produce any hemodynamic alteration. This is, however, a possible complication because neurons of the sympathetic nervous system are blocked even with low concentrations of local anesthetic³⁰.

Two milligrams of morphine were added to the local anesthetic in Group A. Morphine was the chosen agent for its long duration of action especially due to the high hydrosolubility. The analysis of a great series of patients who received epidural morphine suggests that if some conditions are met like the non-employment of opioids concomitantly through another route and the exclusion of patient in general bad state, the risks of respiratory depression are low³¹. Nausea does not have the lethality potential of respiratory depression, but it causes lots of discomfort in patients and may interfere with surgical outcome through the risk of suture dehiscence, extracellular space depletion, among others. The incidence of post-morphine epidural nausea may reach 29%³². However, the incidence of nausea was low and did not differ between the studied groups. The association of morphine with the local anesthetic in the epidural space has a synergic action³³, enabling the reduction of bupivacaine and morphine concentrations without prejudice to obtained effects³⁴. In Group A, patients mentioned pain on average 4.95 hours after epidural block, varying from 1 to 23 hours. This duration of action, smaller than in other studies, was possibly due to the small doses of morphine used. Literature suggests 4 to 6 mg of morphine for use in the epidural space, followed by continuous infusion of 0.5 a 0.8 mg.h⁻¹³⁵.

Both groups received as base analgesia ketoprofen and dipyron. Patients in Group B received, in addition to ketoprofen and dipyron, a single dose of 100 mg of tramadol. The 100 mg of tramadol dose, considered low, was used in the present study with the purpose of reducing side effects, specially nausea and vomit³⁶.

CONCLUSION

The best quality of analgesia in the postoperative period in Group A reduced the incidence of dysrhythmias. The analgesia technique used did not interfere with occurrence of ischemic phenomena of myocardium, since it no alterations on ST segment were observed in either groups studied.

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