COMPARISON BETWEEN ROPIVACAINE 1,5 MG ML^{-1} PLUS FENTANYL 2 MG ML^{-1} AND ROPIVACAINE 1,5 MG ML^{-1} PLUS CLONIDINE 1 MG ML^{-1} AS ANALGESIC SOLUTION AFTER ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION: A RANDOMIZED CLINICAL TRIAL*

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Abstract

Backround: Ropivacaine is commonly used as local anesthetic for postoperative analgesia through an epidural catheter. Data show that several adjuvants influence the analgesic effect of local anesthetic potency.

Objective: The aim of the study was to compare fentanyl and clonidine as adjuvants to 1,5 mg ml^{-1} ropivacaine in terms of motor blockade, pain relief and side effects.

Methods: In this single center, randomized, clinical trial, 52 patient scheduled for arthroscopic anterior cruciate ligament reconstruction were radomly allocated in two groups**.** At twenty-six patient a solution with ropivacaine 1,5 mg ml^{-1} plus fentanyl 2 μg ml^{-1} (group F) was administered through patient controlled epidural analgesia (PCEA) as postoperative analgesia and ropivacaine 1,5 mg ml^{-1} plus clonidine 1 μg ml^{-1} (group C) was administered at the remaining twenty-six patients. The VAS score, the Bromage scale and total solution consumption were documented and compared between the two groups for 24 hours after the end of the operation.

Results: The mean patient control consumption of the solution was higher at group C respect group F ($p = 0,007$). At the 8th hour after the operation we register a statistical significant difference at the mean VAS score between the two groups ($p<0, 05$) with clonidine group achieving a higher score. At the 8th and 12th hour clonidine group register a lower Bromage score than fentanyl group ($p<0,005$ and $p = 0,002$).

Conclusion: Ropivacaine 1,5 mg ml^{-1} plus fentanyl 2 μg ml^{-1} administred through PCEA compared with ropivacaine 1,5 mg ml^{-1} plus clonidine 1 μg ml^{-1} h guarantee higher quality analgesia after ACL reconstruction.

Keywords: Ropivacaine, fentanyl, clonidine, anterior cruciate ligament.

Conflict of interest: The study has been supported solely from the departmental sources.

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Introduction

Placement of an epidural catheter allows to provide better postoperative analgesia for abdominal and lower extremity surgery respect parenteral opioid administration[1]. Several studies comparing PCEA over conventional epidural continuous infusion have found several benefits, including better analgesia and superior patient satisfaction[2].

Ropivacaine and bupivacaine are the most common local anesthetics administrated for epidural anlgesia. Usually adding adjuvants such opioids, a_2-adrenergic agonist, neostigmine, ketamine reduce side effects of local anesthetics and increase the analgesic propriety of the mixture[3].

The aim of this study was to compare motor blockade, pain relief, drug consumption and side effects during patient controlled epidural analgesia (PCEA) with ropivacaine 1,5 mg ml^{-1} plus fentanyl 2 μg ml^{-1} versus ropivacaine 1,5 mg ml^{-1} plus clonidine 1 μg ml^{-1}.

Methods

After thorough explanation of the parameters of the study 52 ASA 1-2 patients agreed to sign the consent form and participate in our study.These patients were scheduled for arthroscopic anterior cruciate ligament (ACL) reconstruction. After the admission of the patient in the operating room, adequate monitoring for each patient was commenced. To all patients 2,8 ml of heavy bupivacaine 5 mg ml^{-1} was administrated intrathecally for surgical anesthesia. We used a kit of combined spinal epidural anesthesia and an epidural catheter was advanced 3cm into the epidural space for postoperative analgesia. The puncture level was L_2-L_3 or L_3-L_4. All the patients were operated by the same surgeon. The epidural infusion was started in the recovery room. Every patient was randomized (sealed and opaque envelopes) in one of the two groups. 26 patients for fentanyl (F) and 26 patients for clonidine (C). The study solution was prepared by an anaesthesia nurse, who was not involved in the treatment of the patients. In group F the epidural mixture consisted of ropivacaine 1,5 mg ml^{-1} plus 2 μg ml^{-1} fentanyl and in group C was ropivacaine 1,5 mg ml^{-1} plus 1 μg ml^{-1} clonidine. The infusion rate postoperatively was 5ml h^{-1} for either solutions regulated by an electronic pump. All the patients were instructed to self administrate epidural bolus doses of 5 ml on demand using the same pump. The lockout interval was 20min. An investigator blinded to the identity of the solution visited every patient 2, 4, 8, 12, 24 hours after the operation. At every visit he examined the motor blockade using the Bromage scale (modified Bromage's score: 0 = no motor block, 1 = hip blocked, 2 = hip and knee blocked, 3 = hip, knee and ankle blocked) and pain using VAS score. Solution consumption, urination, hypotension, nausea and vomiting were also recorded. If any patient wasn't content from the analgesic regiment (suffered pain VAS>6) automatically was excluded from the trial and another pain rescue regiment was started additionally.

Statistical analysis was performed using the SPSS 15.0. Continuous variable were evaluated with t-test. The Mann-Whitney test was used if data were not normally distributed. A p value less than 0, 05 was considered statistically significant.

Results

A total of 2 patients were excluded from the statistical analyses. Reasons for withdrawal are presented in Table 1. There were no significant differences between the two groups in the demographic data. (Table 2) Hypotension and vomiting was rare. The first urination timing between the two groups was statistically insignificant too (Table 3). There was a statistical difference at the mean patient control consumption of the solution. The mean patient control consumption of the solution was higher at group C respect group F (p = 0,007) (Table 3). The pump indication during the 24 hours was statistical different except the 4^{th} hour (p<0, 05). In fact at the 2^{nd} hour group F consumed more solution than group C. At the rest measuring hours (8^{th}, 12^{th}, 24^{th}) group C consumed more (Fig. 1). At the 8^{th} hour after the operation we register a statistical significant difference at the mean VAS score between the two groups (p<0, 05) with group C achieving a higher score (Fig. 2). At the 8^{th} and 12^{th} hour group C register a lower Bromage score than group F (p<0,005 and p = 0,002 respectively) (Table 4).

Table 1

Reason for withdrawal

Patient group	Reason for withdrawal	Comment
Group F	Insufficient analgesia	Replace with a more dense epidural solution
Group C	Technical problem	Epidural catheter dislocation

Table 2

Demographic characteristics

Groups	Age	Weight	Height	BMI
Fentanyl	27,4 (4,28)	85,04 (8,43)	180 (5,66)	26,24 (2,4)
Clonidine	28,76 (4,43)	81,88 (7,68)	178,76 (5,87)	25,59 (1,73

Values in parentheses indicate standard deviation.

Table 3

Patient controlled local anesthetic consumption, time of first urination and cases of hypotension and vomiting

Groups	PCEA	Hypotention		Vomit		Urination					
		Yes	No	Yes	No	2h	4h	8h	12h	24h	No
Fentanyl	13,40 (14,629)	0	25	0	25	0	11	6	3	4	1
Clonidine	27,80 (26,22)*	3	22	1	24	6	7	11	1	0	0

- Values in PCEA column indicate the extra mean patient-controlled local anesthetic consumption in addition to the base dose (5 ml h^{-1}) and values in parentheses indicate standard deviation.

- Values in other columns indicate frequency.

* Statistical difference between the groups.

Fig. 1

Mean pump indication in 24 hours

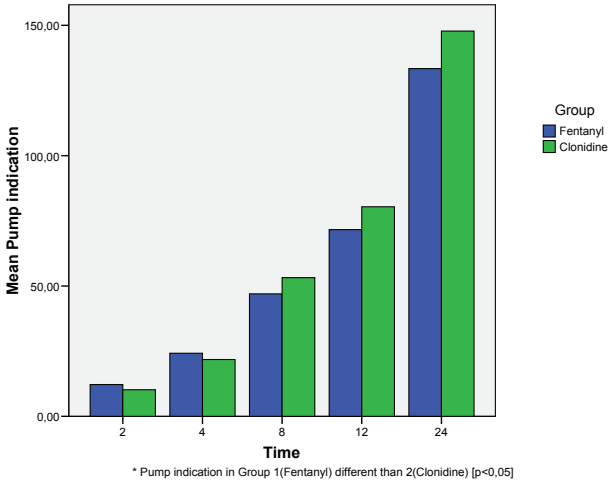

Fig. 2:

VAS score of the patients

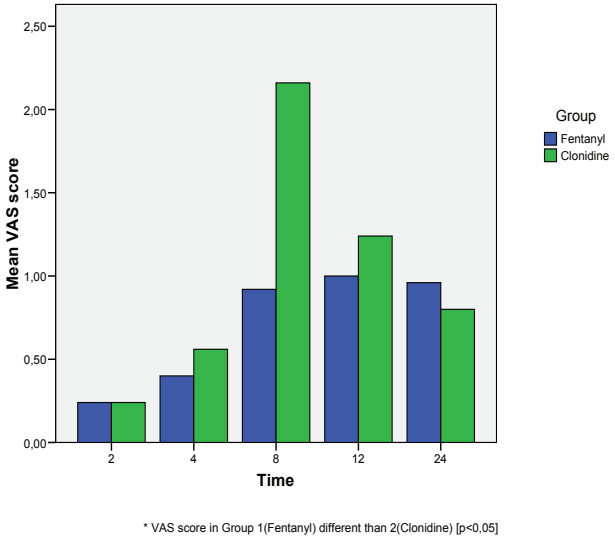

Table 4

Bromage level of kinetic blockade

Time / Group score	2	4	8	12	24
	F/C	F/C	F/C	F/C	F/C
0	3/2	4/7	4/18	12/21	22/25
1	11/6	14/11	16/4	10/4	0/0
2	11/17	7/7	5/3	3/0	3/0
3	0/0	0/0	0/0	0/0	0/0

Discussion

Epidural analgesia is more effective for postoperative pain relief respect other regiments[4]. But pain relief isn't the only goal for a successful postoperative outcome. Other variants such as early mobilization and fewer side effects from the analgesic regiment are some aspects. With this study we compare two analgesic solutions trying to achieve excellent pain relief without any motor blockade and no side effects. Ropivacaine is an amide local anesthetic with a high pKa (8.1). At the same concentration ropivacaine produce less motor block than bupivacaine[5].

Opioids used epidurally, and especially fentanyl, as adjuvant to local anesthetics reduce the dose and side effects of both drugs and achieve better analgesia. Opioids mediate their analgesic effect by acting at their receptors in the substantia gelatinosa of the spinal cord[6,7]. These results have been underlined by Berti et al where a combination of ropivacaine and opioid were

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