

## Multimodal medication to decrease postoperative pain after inguinal plasty managed with regional anesthesia

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### SUMMARY

**Objective:** To demonstrate that multimodal pre-anesthetic analgesia offers a decrease in pain perception in those patients subjected to inguinal plasties. **Material and methods:** Forty-four patients, ASA I and ASA II, subjected to free-of-tension inguinal plasty, and managed through local peridural anesthesia, were included in this study. The patients were divided into two groups: the Group 2 received dexmedetomidine IV (1 µg/kg) and celecoxib 200 mg orally, 30 minutes before entering the operating room. They were also infiltrated with ropivacaine (0.75%) before the incision. The Group 1 received ketorolaco IV (1 mg/kg) during the transanesthetic period. Pain perception was evaluated by VAS (Visual Analogue Scale) and vital signology in the post-operative period every 30 minutes up to their discharge and at 24 hours. **Results:** Vital signology (blood pressure and heart rate) and the VAS presented significant differences in the stay period at Postanesthesia Care Unit (PACU), and at 24 hours. The Group 1 required rescue analgesia in the 81% of the cases, while in the Group 2, the 73% presented analgesia. **Conclusion:** Multimodal analgesia based upon dexmedetomidine and celecoxib, along with local infiltration of ropivacaine (0.75%) decrease post-operative pain perception.

**Key words:** Analgesia, multimodal, post-operative pain.

### RESUMEN

**Objetivo:** Demostrar que la analgesia multimodal preanestésica brinda una disminución en la percepción del dolor en pacientes sometidos a plástica inguinal. **Material y métodos:** Se incluyeron a 44 pacientes, ASA I y ASA II, sometidos a plástica inguinal libre de tensión, manejados bajo anestesia regional peridural. Se dividieron en dos grupos: El grupo 2 recibió dexmedetomidina IV (1 µg/kg) y celecoxib 200 mg VO, 30 minutos antes de su paso a quirófano y se infiltró ropivacaína al 0.75% previo a la incisión. El grupo 1 recibió ketorolaco IV (1 mg/kg) durante el transanestésico. Se evaluó la percepción del dolor con el EVA y la signología vital, en el postoperatorio cada 30 min hasta su alta y a las 24 h. **Resultados:** La sinología vital (tensión arterial y frecuencia cardíaca) y el EVA presentaron diferencias significativas en el período de estancia en UCPA, alta de recuperación y a las 24 h. En el grupo 1 se requirió analgesia de rescate en el 81% de los casos, mientras que en el grupo 2, el 73% presentó analgesia. **Conclusión:** La analgesia multimodal preanestésica a base de dexmedetomidina y celecoxib, junto con infiltración local de ropivacaína al 0.75% disminuye la percepción del dolor postoperatorio.

**Palabras clave:** Analgesia, multimodal, dolor postoperatorio.

## INTRODUCTION

Pain is a complication in the postoperative recovery process, it is presented even with the use of analgesics. Postoperative pain is an essential type of acute pain and it has high impact in the area of health, affecting surgical patients who suffer it, the family suffering together with the patient and the involved treating physicians and institutions<sup>(1)</sup>. Taking into account that annually at least 10% of the population will be hospitalized for some reason, and that 10 to 45% of these problems will be solved surgically<sup>(2)</sup>, the high possibility that this group of patients develops postoperative pain makes necessary the development of appropriate and effective treatment that meets their needs for analgesia.

The inguinal hernia is the most common surgical condition in Mexico and worldwide. It is estimated that from 3 to 5% of the general population suffer from this problem. Strictly speaking, 300 to 500 thousand cases occur annually, so it can be considered a public health problem<sup>(3)</sup>.

It has been tried to solve this condition by different techniques, both plastic and prosthetic techniques, and within the latter, peritoneal or transperitoneal laparoscopic approaches. A primary interest in this condition lies in the costs associated with their management for hospitalization and disability, as the major percentage of patients suffering from this pain is in productive age<sup>(2)</sup>.

In daily clinical practice, it frequently is observed patients suffering from postoperative pain of different intensities, even long term and sometimes disabling type. Often, these symptoms are interpreted as functional in nature, causing the extension of the period of rest<sup>(4)</sup>. Factors that have been implicated as causes of postoperative pain are numerous; however by reviewing the medical literature on the topic, only some few well-documented cases can be found<sup>(2)</sup>. The frequently-involved nerves are: ilioinguinal and genitofemoral nerves. These nerves may be injured in the intraoperative period, either by section, stretching or crushing, appearing acutely and chronically with the formation of a neuroma, or by leaving it in the suture<sup>(3)</sup>.

In inguinal plasty, acute postoperative pain, so called because it covers the period from the immediate postoperative period to 30 days, appears in virtually all patients at greater or lesser degree. However, it is easily controlled by analgesics and antiinflammatory drugs well known in most cases. There is a percentage around 40% in which treatment is difficult and it is cause of hospitalization and disability<sup>(5)</sup>.

While the incidence of postoperative pain is, in a greater or smaller magnitude, of 100%, as there is no painless surgery, it becomes important to understand that it does not is

a tiny problem and is part of our responsibility as anesthesiologists its proper approach.

It is understood by multimodal analgesia those optimal treatment and prevention of postoperative pain mainly applied in the preoperative period able to prevent pathological pain. It avoids or minimizes alodinea, primary and secondary hyperbaric pain management, persistent pain, and spatial and temporal summation of perceptual fields<sup>(6)</sup>.

The preemptive analgesia techniques are: preincisional surgical infiltration, preoperative infiltration of the nerves involved in the innervation of tissues subjected to surgical aggression, plexus block, epidural or subdural analgesia, preoperative intravenous administration of drugs and physical methods such as cryotherapy, acupuncture, etc.

The potential benefits of preemptive analgesia are: the delayed onset of and decreased pain intensity; decreased incidence of pain-related complications; decreased progression from normal to chronic pain; decreased consumption of analgesics after surgery; decrease in the adverse effects and complications attributed to the use of high-dose analgesics; faster recovery resulting in fewer days of hospitalization; reduced overall costs and improved quality of postoperative patient<sup>(7)</sup>.

## MATERIAL AND METHODS

A study was performed with authorization from the Research Ethics Committee of HCNCN Azcapotzalco.

In the outpatient department of Anesthesiology Service or in the preoperative room, it was proceeded to recruit patients who met the inclusion criteria for this study, in the period from March to July of 2007, after signing informed consent. The patients were randomly divided into two groups called Group 1 and Group 2. Group 1 was defined as the experimental group, in which dexmedetomidine hydrochloride, celecoxib and ropivacaine hydrochloride as preventive analgesia in pre-anesthesia were used.

In the anesthetic recovery room, continuous monitoring was performed by electrocardiogram, heart rate, blood pressure, oxygen saturation. Supplemental oxygen was given (3 liters/minute) via nasal prongs. An upper-extremity venous access was taken.

To patients in Group 2, 200 mg celecoxib by oral route 1 hour before surgery and 30 minutes intravenously before anesthesia by peridural block, 100 mL 0.9% NaCl solution with dexmedetomidine calculated to 1 µg/kg weight (maximum dose of 60 µg) were given as placebo to infuse in 20 minutes.

After which they were brought to the operating room and once there monitoring was began. Epidural regional anesthesia was applied using 2% lidocaine with epinephrine in all cases. Waiting the necessary time of latency, local infil-

tration was used in the surgical site with 75 mg 0.75% ropivacaine before the accomplishment of the surgical procedure, in the Group 2.

Moreover, 1 mg/kg ranitidine, 0.1 mg/kg metoclopramide, 1 mg/kg ketorolac were administered as adjuvant medication to both groups.

At the end of the procedure, epidural catheter was removed and the patients were transferred to the postanesthesia care unit. In when the patients were assessed for pain intensity by numerical scale of pain upon admission and thereafter every 30 minutes until they were discharged. If there was pain during stay period, the patients were medicated with a rescue dose of 15 mg/kg of metamizol sodium. Vital signs were continuously monitored and all circumstances occurred during stay were recorded.

The patients met the discharge criteria for ambulatory surgery. After they were discharged, ketorolac 30-mg tablets every 8 hours as pain medication as well as treatment by treating service were prescribed. Monitoring was continued for 24 hours at home by telephone to assess postoperative pain intensity. Subsequently, statistical study was performed.

### STATISTICAL ANALYSIS

Parametric scales were determined by calculating measures of central tendency with a average and standard deviation. The differences were calculated by analysis of variance of the averages using the Student t to calculate the «perception of pain» as a variable, which was being in ordinal scale, so that calculated measures of central tendency with median and 25 and 75 percentiles were used. For measuring demographics according to the scale, frequencies were obtained and their normal or free distributions were analyzed. Significant values of  $P \leq 0.05$  were considered in all cases.

### RESULTS

This study was performed in a total of 44 patients divided into two groups. All patients were subjected to elective tension-free inguinal plasty with physical status ASA-I and ASA-II.

Group 1 was comprised of 21 individuals and it was managed with regional peridural anesthesia and intravenous analgesic application (1 mg/kg ketorolac) during the perioperative. On the other hand, 23 patients were included in Group 2 (peridural regional anesthesia and previous application of celecoxib, dexmedetomidine hydrochloride and infiltration of the surgical site with ropivacaine hydrochloride (Table I)).

The results of laboratory studies taken during the pre-anesthetic assessment such as hemoglobin, hematocrit, platelets, glucose, urea, creatinine, PT and PTT were analyzed between the two groups and no statistically significant results were found (Table II).

We serially monitored vital signs such as systolic and diastolic blood pressure, partial oxygen saturation, heart rate and respiratory rate of each group. Vital signs showed statistical significance with respect to the parameters of blood pressure and heart rate, which are considered as indirect indicators of pain perception.

Vital signs showed statistically significant differences for the following events: blood pressure (BP at admission, perioperative, PACU and discharged with a  $P < 0.001$ ) and heart rate (HR in the perioperative, PACU and discharged with a  $P < 0.001$ ), which are considered indirect indicators of the perception of pain (Figures 1 and 2).

The visual analogue scale (VAS) of pain had statistically significant differences in the length of stay at PACU, high recovery and 24 hours after the anesthetic procedure with  $P < 0.001$  (Figure 3).

**Table I.** Demographic variables.

Variable	Group 1	Group 2
Age	61.42 ± 12.84	57.08 ± 13.21
Weight	74.28 ± 11.38	74.65 ± 11.39
Height	162.00 ± 9.68	161.04 ± 8.89
Sex	♂ 61.9%; ♀ 38.1%	♂ 43.5%; ♀ 56.5%
Surgical time	84.33 ± 10.06	71.21 ± 20.01
Anesthetic time	118.28 ± 11.55	111.43 ± 19.31
Analgesia time	141.01 ± 13.91	338.69 ± 85.08

Values expressed in mean and standard deviation.  
No statistics significant differences were found.

**Table II.**

Variable	Group 1	Group 2
Hemoglobin	14.22 ± 2.12	13.07 ± 1.56
Hematocrit	43.31 ± 7.07	38.73 ± 6.29
Platelets	254.03 ± 75.95	267.34 ± 90.80
Glucose	110.04 ± 24.92	104.26 ± 25.94
Urea	34.15 ± 5.80	33.06 ± 6.70
Creatinine	1.14 ± 0.55	1.32 ± 0.74
PT	13.65 ± 1.11	13.81 ± 2.90
PTT	24.85 ± 1.81	23.68 ± 2.31

Values expressed in mean and standard deviation.  
No statistics significant differences were found.

**Table III.** Additional use of analgesics.

Variable	Group 1		Group 2	
	Patients	%	Patients	%
No analgesic	3	14.3	17	73.9
In PACU	9	42.9	0	0.0
Within 24 h	1	4.8	3	13.3
During PACU and 24 h following	8	38.1	3	13.3

Rescue analgesia was required in the Group 1, in the postanesthesia care unit, in 81% of cases, whereas in group 2, 73% had analgesia.

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## DISCUSSION

Multimodal analgesia is a concept used in anesthesiology and more specifically in the area dedicated to acute postoperative pain control, administering drugs before the occurrence of nociceptive stimuli.

The primary goals of preemptive analgesia are: 1) Avoid the central and peripheral sensitization caused by surgical injury; 2) Decrease the hyperactivity of nociceptors; 3) Avoid the amplification of nociceptive message.

Peripheral sensitization will produce direct tissue injury (surgery) which mediates an inflammatory reaction, which produces a sympathetic arousal. These reactions in turn will trigger the release of algogenic substances that cause the decrease of the threshold of nociceptors.

Central sensitization is due to: 1) Increased excitability of neurons in the cornu posterius medullae spinalis able to trigger a reflex sympathetic activity; 2) Stimulation of circulatory and respiratory control centers of medulla; and 3)

Stimulation of hypothalamic centers, which will generate neuroendocrine responses able to maintain and enhance the surgical stress response.

That's why multimodal pain treatment is only the combination of two or more analgesic methods and/or drugs in order to enhance analgesia, provide comfort and safety for patients and reduce side effects from the use of potent analgesics.

So, evidence about that multimodal analgesia tends to decrease postoperative pain perception was looked in this study.

With respect to our study groups, no significant differences were found in their demographic variables such as age, sex, weight, and height, thus avoiding their impact in favor of or detrimental to the perception of pain from any of the studied patients.

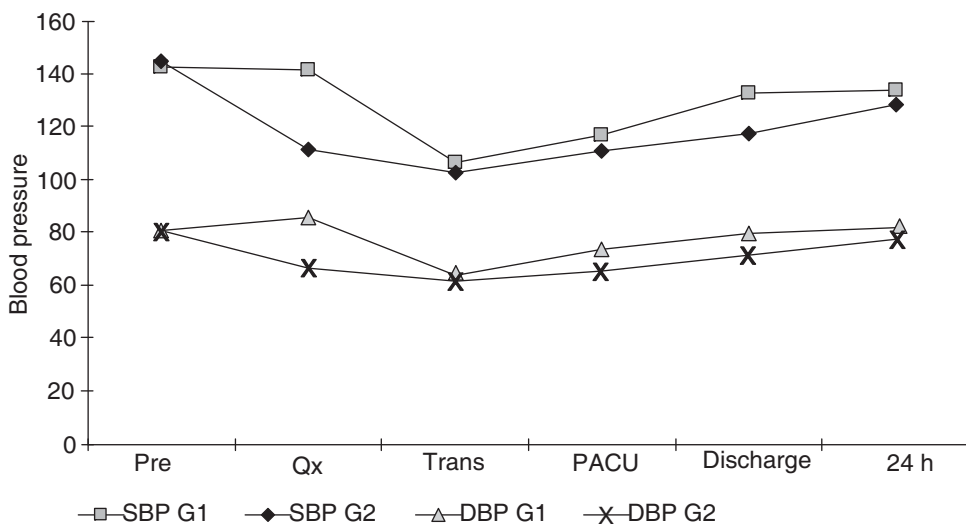
In regard to laboratory tests, the differences between our study groups were not significant and not reported in the literature that some variation on our study groups impacts directly on the perception of pain. Only Collins<sup>(8)</sup> mentions that the diabetic patient with metabolic dyscontrol may report a higher tolerance to pain; however this work was conducted in patients with physical status ASA I and II. Wil-

lard<sup>(9)</sup> et al. studied the blood pressure effects on response to pain using the measurement of thresholds during thermal stimulation and ischemia, they found a higher pain threshold with both methods, in a group of control subjects with higher blood pressure figures at rest. Therefore, they concluded that resting blood pressure has an influence on the central mechanism of pain regulation and thus becomes an indirect indicator of the intensity of pain perception. The difference between groups was evident in our study. Group 2 had less elevated heart rate and blood pressure over the traditional group, which it is understood as a lower perception of pain in the aforementioned group and it can be considered as a success for pain medication.

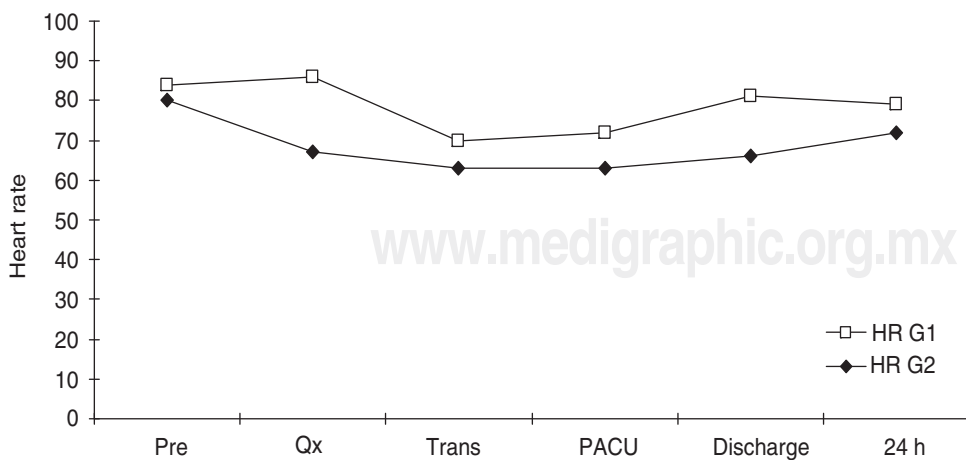
With the administration of dexmedetomidine as a pre-anesthetic medication, we observed decreased postoperative pain perception by assessing the patients by VAS; in addition to minimize requirements for additional analgesia,

these results are similar to those reported by Steffen<sup>(10)</sup> who investigated whether preoperative administration of dexmedetomidine causes a significant reduction in NSAID requirement in the first 24 hours after postoperative; he also investigated whether these savings are produced in different types of interventions and whether it impacts on results of the implementation of VAS. He obtained favorable results in the pain measurement and mentioned that the best results were when dexmedetomidine was administered prior to the installation of regional anesthesia.

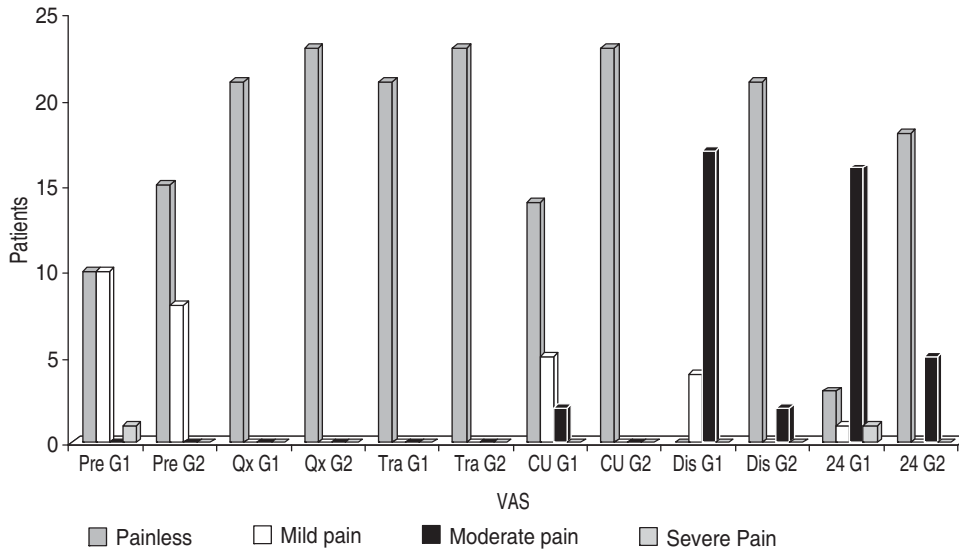
The literature on the efficacy of preemptive analgesia by infiltration of the surgical site with local anesthetics reports varying results. Cervini<sup>(11)</sup>, in his work about laparoscopic appendectomies using preoperative infiltration of the wall area with ropivacaine, found that 52% of treated patients required postoperative parenteral narcotics; in control group, he also found that 86% of patients required these narcotics in



**Figure 1.** Blood pressure expressed in mean and standard deviation. Were found significant statistical differences in BP Qx, BP PACU, BP 24 h, with P < 0.001.



**Figure 2.** Heart rate expressed in mean and standard deviation. Presented significant statistical value in HR trans, HR PACU with P < 0.001 for group 2.



**Figure 3.** VAS. Were found significant statistical differences in Qx, PACU and discharge with  $P < 0.001$ .

a greater number of doses. Smith<sup>(12)</sup>, in herniorrhaphy, infiltrated 0.75% ropivacaine at the surgical site after surgery, and obtained very satisfactory results using measurement elements as VAS and supplementary analgesic consumption. These results are similar to those found in our research.

Alexander<sup>(13)</sup> conducted a double blind study which compared the effectiveness of the use of celecoxib as compared to with placebo (both used preoperatively) to achieve decrease in postoperative pain, he used VAS scale and postoperative consumption of NSAIDs as measurement parameters. In groups where COX-2 was used, as in our study, there were lower readings of VAS.

With this work it is possible to infer that the celecoxib (administered as preanesthetic medication) is effective in preventing postoperative pain; however, better results are obtained if it is complemented with intravenous dexmedetomidine, these results are further enhanced if the surgical zone is infiltrated with 0.75 % ropivacaine. These results are statistically supported.

### CONCLUSIONS

The use of preanesthetic multimodal analgesia based dexmedetomidine hydrochloride and celecoxib intrave-

nously along with local infiltration of 0.75% ropivacaine hydrochloride decreases postoperative pain perception, which is supported by the differences found between groups with respect to vital signs especially heart rate and blood pressure, considered as indirect indicators of the perception of pain intensity. Thus, we can conclude the following:

- 1) Age, weight and height had no statistical difference regarding the magnitude of pain perception.
- 2) Sex does not influence on pain perception.
- 3) The surgical and anesthetic time remained statistically uniform and did not influence on the results.
- 4) Multimodal analgesic medication impacts vital signs specifically respiratory rate and blood pressure.
- 5) The hemodynamic changes are related to the patient's degree of analgesia.
- 6) The Group 2 remained without pain as compared to Group 1.
- 7) The group which received multimodal analgesia decreased its analgesic requirements, which gave them a greater analgesic period.
- 8) There were no clinically significant complications.
- 9) There were no complications.



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