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Epidural analgesia vs. surgical wound analgesia to control acute post-operative pain in open colon surgery

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ABSTRACT

Objective: To establish if the incisional catheters provide the same analgesia for the control of DAP (postoperative acute pain) with fewer side effects than epidural analgesia in postoperative patients of open colon surgery.

Material and methods: This is a retrospective cohort study of 33 patients in whom epidural analgesia was used between November 2013 and November 2014, and prospective where a catheter placed in the surgical wound was used between November 2014 and November 2015 in 25 patients. The variables studied were: demographic (sex, date of birth, BMI, weight and height, drug allergies, personal history and anesthetic risk according to the ASA scale), duration of the intervention from the time of the surgical incision to the wound closure, surgical technique (right left or sigma colon) and number of catheters used.

Results: We included 58 patients. 56.9 % were given epidural analgesia. Patients in the Incisional group had a significant increase in pain between 150 minutes and 24 hours (1.20 *vs.* 3.50 $p < 0.001$). In the Epidural group, this increase did not become significant (1.18 *vs.* 2.06, $p = 0.069$). There was a significant decrease in pain between 24 and 48 hours in both the Incisional group (3.50 *vs.* 2.67, $p = 0.004$) and in the Epidural group (2.06 *vs.* 1.58, $p = 0.021$). The presence of side effects at 24 hours was observed in 20 % of patients in the Incisional group and 27.3 % in the Epidural group ($p = 0.522$).

Conclusions: The pain perceived by patients in the Epidural group was lower than that perceived by patients in the Incisional group at both 24 and 48 hours. In both groups there was an increase of pain at 24 hours of the intervention, however this increase was lower in the Epidural group. Regarding the presence of side effects, both groups had a similar behavior.

Key words: Analgesia epidural, analgesia incisional, pain acute postoperative, surgery of colon open.

RESUMEN

Objetivo: Establecer si los catéteres incisionales proporcionan la misma analgesia para el control del DAP (dolor agudo postoperatorio) con menor número de efectos secundarios que la analgesia epidural en pacientes postoperados de cirugía de colon abierta.

Material y métodos: Se trata de un estudio de cohortes retrospectivo de 33 pacientes en los que se ha utilizado analgesia epidural entre noviembre de 2013 y noviembre de 2014 y prospectivo donde se utilizó un catéter colocado en la herida quirúrgica entre noviembre de 2014 y noviembre de 2015 en 25 pacientes.

Las variables a estudio fueron: demográficas (sexo, fecha de nacimiento, IMC, peso y altura, alergias medicamentosas, antecedentes personales y riesgo anestésico según la escala ASA), duración de la intervención desde la hora de la incisión quirúrgica hasta la del cierre de la herida, técnica quirúrgica (colon derecho, izquierdo o sigma) y número de catéteres utilizados.

Resultados: Se incluyeron a 58 pacientes. Al 56,9 % se les suministró analgesia epidural. Los pacientes del grupo Incisional presentaron un aumento significativo del dolor entre los 150 minutos y las 24 horas (1,20 frente a 3,50 $p < 0,001$). En el grupo Epidural este aumento no llegó a ser significativo (1,18 frente a 2,06, $p = 0,069$).

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Se obtuvo una disminución significativa del dolor entre las 24 y las 48 horas tanto en el grupo Incisional (3,50 frente a 2,67, p = 0,004) como en el grupo Epidural (2,06 frente a 1,58, p = 0,021).

La presencia de efectos secundarios a las 24 horas se observó en el 20 % de los pacientes del grupo Incisional y en el 27,3 % del grupo Epidural (p = 0,522).

Conclusiones: El dolor percibido por los pacientes del grupo Epidural fue menor al percibido por los pacientes del grupo Incisional, tanto a las 24 como a las 48 horas. En ambos grupos se produjo un aumento del dolor a las 24 horas de la intervención, sin embargo este aumento fue menor en el grupo Epidural.

En lo referente a la presencia de efectos secundarios ambos grupos tuvieron un comportamiento similar.

Palabras clave: Analgesia epidural, analgesia incisional, dolor agudo postoperatorio, cirugía de colon abierta.

INTRODUCTION

Effective postoperative analgesia is an essential requirement for improving patients' recovery process and reducing morbidity (1).

Epidural analgesia has become a routine technique for managing pain in a post-operative context. Infusion of LA and opioids in the epidural space has historically provided better pain management, surgical stress mitigation and improved cardiorespiratory function than the systemic administration of opioids. However, epidural analgesia is not risk-free and may cause neurological damage arising from the puncture itself, up to side effects such as hypotension or urinary retention (2).

Advances in surgery have led to a reduction in surgical tissue handling with earlier discharge from hospital, circumstances that require new techniques with fewer side effects, such as incisional catheters placed in the surgical wound (3), as continuous administration of LA in several segments of the nociceptive pathway of the surgical wound itself seems the most logical way to reduce nociceptive afferents, inflammatory response and, accordingly, pain and response to surgical stress (4).

Any analgesic technique must meet the requirements of safety, simplicity and availability (demonstrating a positive cost-benefit balance) and LA infiltration in the surgical wound seems to comply with these requirements, in addition to providing beneficial effects in analgesia quality and a reduction in opioid consumption, facilitating early mobilization and, therefore, patient rehabilitation. Its success has been due to the development of long-lasting LA, to technological improvements in the design of infusion catheters, to the commercialization of safer elastomeric pumps and to progress in patient-controlled regional analgesia techniques (5).

Reviewing the current literature, we can suggest a number of situations where it would be beneficial to use these types of catheters in surgical wounds: hysterectomies (6), nephrectomies, initially laparoscopic surgeries that end up becoming open, surgeries where an epidural catheter is not normally used, such as cholecystectomies (7) and other surgeries such as the one analyzed here and which are under review (8).

Our objective in this study was to establish whether incisional catheters provided the same analgesia to manage acute postoperative pain with fewer side effects than epidural analgesia in postoperative patients following open colon surgery.

MATERIALS AND METHODS

This is a retrospective cohort study of 33 patients, in whom epidual analgesia was used between November 2013 and November 2014, and a prospective study of 25 patients, where a catheter was placed in the surgical wound, between November 2014 and November 2015.

The study population was, in both cases, patients >18 years old subjected to programmed open colon surgery. The study excluded patients with BMI >40, allergy to LA or the opioid used, with a history of drugs or narcotics abuse or who had contraindications to regional anesthesia: refusal or inability to collaborate, increased intracranial pressure secondary to brain injury with mass lesion, systemic or local cutaneous or subcutaneous infection in the catheter placement site, coagulopathy, platelets <80.000 and/or Quick index <50% and anti-aggregation therapy.

Study variables were: demographic (sex, date of birth, BMI, weight and height, allergies to medicines, personal histories and anesthetic risk according to the ASA scale), intervention duration from the time of the surgical incision to closure of the wound, surgical technique (right, left colon or sigma) and number of catheters used.

Both groups were subjected to standard monitoring: ECG, NIBP, EtCO2 and SaO2 and a urinary catheter was placed in the event they did not have one. A thermal mattress was used to maintain normal temperature.

Standard anesthetic practice at our center for this type of surgery consists of general anesthesia, which is carried out the same way for all patients. to induce anesthesia, remifentanil 1 mcg/kg, propofol 2 mg/kg and rocuronium 0.6 mg/kg were infused. Atropine 0.01 mg/kg was administered if HR <60 bpm. After orotracheal intubation, patients received 0.5-3% sevoflurane to maintain a BIS between 40-60; bolus of rocuronium at 10% of the initial dose to maintain a radial nerve TOF of 1-2 twitches. Continuous perfusion with remifentanil 0.05-2 mcg/kg/min was put in place, bearing in mind that we calculate dosage for obese patients according to ideal weight and in patients >70 years old, we reduce the dose by 50%. Perfusion began at 0.25

mcg/kg/min and increased or decreased when there were simultaneous variations of 20% in baseline HR and BP.

After anesthetic induction and tracheal intubation, patients were administered pressure-controlled ventilation.

Therapy was also applied to reduce postoperative nausea and vomiting (PONV). To stratify risk, we used the Apfel score. If risk was low or moderate, dexamethasone 4 mg was administered in the induction, and if it was high, ondansetron 4 mg was also added 30 min before finalizing surgery. In the event of high risk, patients were reverted with sugammadex to avoid the effects of neostigmine on PONV.

Paracetamol 15 mg/kg, dexketoprofen 1 mk/kg and morphine hydrochloride 0.1 mg/kg were administered for postoperative analgesia 30 min before the end of surgery.

Prior to extubation, neuromuscular blocking was reverted with neostigmine or sugammadex, guided by TOF, according to each patient's concomitant pathology. Neostigmine dose was 0.04-0.06 mg/kg accompanied by atropine 0.01-0.02 mg/kg. Sugammadex dose depended on TOF responses: for 1-2 twitches, 4 mg/kg and if > 2 twitches, 2 mg/kg.

Once surgery had finished, the patient was extubated and transferred to the Post-Anesthesia Recovery Unit (URPA).

In the retrospective cohort group: prior to anesthetic induction, a 20G Perifix® multiperforated epidural catheter (0.85 x 0.45 x 1,000 mm) was placed in the lower thoracic epidural space, positioning the tip of the catheter between T8-T10. An 18G Tuohy needle (0.3 mm), 80 mm in length, was used to insert it. It was connected to CADD-Legacy® model 6300 PCA volumetric infusion pump with fentanyl 3 mcg/ml + levobupivacaine 1.25 mg/ml. When surgery was finished and before extubating patients, they were infused with a bolus of levobupivacaine 5 ml (0.25%) and continuous perfusion began at a rate of 3.5-4 ml/h, increasing by 0.1 ml for every 5 cm above 175 cm in height and reducing by the same amount below 160 cm.

In the prospective cohort group, after closing the peritoneum, the surgeon inserted the wound soaker catheter from the lower end of the incision to approximately 3 cm along it, using a 17G insertion needle, positioning it between the peritoneum and the lower side of the fascia, along the full length of the wound. Next, the fascia and the skin were closed and the catheter was attached to the skin near the insertion site. Once the skin was closed, a bolus of 0.25% levobupivacaine 10 ml was administered and the infuser system was then connected with perfusion of 0.25% levobupivacaine 5 ml/h. Finally, the catheter was covered with a transparent dressing (9).

On their arrival in the URPA, standard reception protocol was carried out on both groups, consisting of constant monitoring (ECG, SatO2, NIBP) and thermal blanket. VAS and Aldrete were evaluated on arrival, and evaluated again at 60 min, 120 min and 150 minutes. Rescue analgesia was based on the VAS score and was carried out with bolus of morphine hydrochloride 2 mg/10 min until pain was controlled. Patients were discharged with pain under control, hemodynamic stability and a modified Aldrete test score of 10 points, remaining a minimum period of 2 h.

Once patients were transferred to normal ward, in addition to continuous perfusion of LA, 15 mg/kg of intravenous paracetamol was administered every 8 h. In the event the patient reported pain, 1 mg/kg of intravenous dexketoprofen was prescribed, and if even then pain was not controlled, 100 mg of intravenous tramadol was administered every 8 h; in the event this were insufficient, an intravenous bolus of morphine hydrochloride was administered. If PONV appeared, 10 mg of intravenous metoclopramide was administered every 8 h.

Control of pain and side effects continued to be carried out for the following 48 h, evaluating: pain level according to the numerical VAS scale (which scores pain intensity from 0 to 10, where 0 is no pain and 10 unbearable pain) at 24 h and 48 h from closure of the surgical wound, pain with mobile activity (movement, changes in posture or coughing) and nocturnal pain, sedation assessment according to the Ramsay scale and presence of side effects or otherwise, such as motor and sensory block, orthostatic hypotension, gastric discomfort, dizziness or disorientation, infection of the catheter entry point, respiratory depression, pruritus and urinary retention if they were not catheterized.

Ethical and legal aspects

The study was carried out following the standards of good clinical practice and the agreements of the Conference of Helsinki. Data was processed according to the provisions of Organic Act 15/1999, of 13 December, regarding personal data protection and by its regulations (Royal Decree 1720/2007).

It was accepted by our hospital's Investigation Committee and informed consent was requested from all patients participating in the study. When patients were unable to understand the information provided, authorization was requested from the family and/or legal representative.

Patients who were part of the retrospective cohort were contacted by taking advantage of their General Surgery check-up visit and they were asked for their informed consent at that time.

Statistical analysis

A descriptive analysis of data was carried out. Qualitative variables were presented with their absolute frequency and percentage. Quantitative variables were presented with their mean and standard deviation (SD) or percentiles if they did not fit a normal distribution.

To study the relationship between qualitative variables and the two groups, data was analyzed with the Chi-squared test and Fisher's exact test.

For comparison of quantitative variables, normality of data distribution was analyzed in each group with the Kolmogorov-Smirnov test. The Student-t test was applied for independent samples or the Mann-Whitney test to compare values among the groups and to find out whether statistically significant differences existed.

To study evolution of the VAS at 150 min, 24 h and 48 h from closure of the surgical wound, the Wilcoxon signed-rank test was used.

Level of α significance accepted for all hypothesis contrasting was 0.05.

Data was analyzed using PSPP Software.

RESULTS

On studying the evolution of the VAS at 150 min, 24 h and 48 h from closure of the surgical wound,(Tablas I, II and III), we observed that in the incisional group with a mean age of 69.68 years old, the VAS at 24 h was significantly higher than at 150 min from closure of the surgical wound and than at 48 h. It was also significantly higher at 48 h than at 150 min from closure of the surgical wound.

In the epidural group, with a mean age of 73.21 years old, the VAS decreased significantly between 24 h and 48 h. The VAS at 24 h and 48 h was higher than at 150 min from closure of the surgical wound, but these differences were not statistically significant.

When calculating the differences between VAS at 150 min from closure of the surgical wound and at 24 h, we found that patients in the incisional group suffered a significantly greater increase in pain than those in the epidural group.

No statistically significant differences were observed between the VAS at 150 min from closure of the surgical wound and at 48 h between the two groups, although the increase in VAS was greater in the incisional group (Figure 1).

No significant differences between the two groups were observed in the presence of side effects at 24 h and 48 h (Figure 2).

In the incisional group, nauseas were the most frequent side effect, with a few cases of pruritus, while in the epidural group pruritus was the most frequent side effect, observing cases of nausea and dizziness, in addition to one case of motor and sensory block due to epidural hematoma following puncture.

DISCUSSION

Advances in surgery have led to an effort to reduce surgical tissue handling with earlier discharge, circumstanc-

TABLE I

Group			Age	BMI	ASA	Duration
Epidural	N	Valid	33	33	33	33
		Lost	0	0	0	0
	Mean		73,21	27,30	2,79	251
	Median		76	26,67	3	2,25
	St. Dev.		13,37	6,01	0,60	1,08
	Range		55	28,90	2	4,75
	Minimum		35	17,97	2	1,25
	Maximum		90	46,87	4	6
Incisional	N	Valid	25	25	25	25
		Lost	0	0	0	0
	Mean		69,68	29,11	2,60	2,39
	Median		69	27,85	3	2,30
	St. Dev.		13,7	5,51	0,76	0,93
	Range		49	15,87	3	2,85
	Minimum		43	22,41	1	1,25
	Maximum		92	38,28	4	4,10

TABLE II
TYPE OF SURGERY

Group			Frequency	%	% valid	% accumulated
Epidural	Valid	Colon D	18	54,5	54,5	54,5
		Colon I	3	9,1	9,1	63,6
		Sigma	12	36,4	36,4	100
Incisional	Valid	Colon D	12	48	48	48
		Colon I	6	24	24	72
		Sigma	7	28	28	100

TABLE III
SEX

Group			Frequency	%	% valid	% accumulated
Epidural	Valid	Woman	13	39,4	39,4	39,4
		Man	20	60,6	60,6	100
Incisional	Valid	Woman	13	52	52	52
		Man	12	48	48	100

es that require new alternative techniques as effective as epidural catheters, but with fewer complications and side effects, as could be the case of incisional catheters placed in the surgical wound.

Reviewing the current literature, we can suggest a series of situations where the use of these types of catheters is beneficial:

1. In hysterectomies, it has been shown to be an effective analgesic technique providing very good control of acute postoperative pain with reduced opioid consumption, few side effects, a high patient satisfaction rate and their perception that they receive quality analgesia (6).
2. Partial nephrectomies where the use of an incisional catheter could be a valid alternative to provide analgesia (9).
3. Initially laparoscopic surgeries where an epidural catheter is not used as it presents a greater risk than benefit. However, part of them end up becoming open surgery open, and an incisional catheter would be a good alternative, as it is placed when surgery concludes. It represents a considerable benefit for patients, because as it controls pain better, mobility comes earlier and it has fewer complications and reduced hospitalization (10).
4. Surgeries for which an epidural catheter is not normally used, such as cholecystectomies, as it has been observed that correct application of multimodal analgesia is associated with correct management of acute postoperative pain, which increases the quality of intrahospital care and is a factor that should be taken into account to prevent the appearance of chronic post-surgical pain (7).

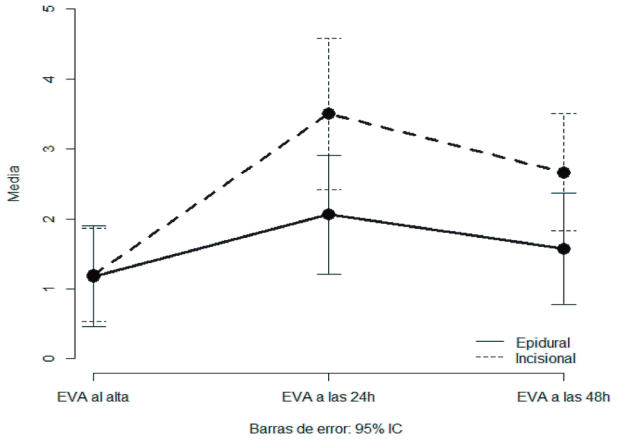

Fig. 1. VAS evolution over 48 hours.

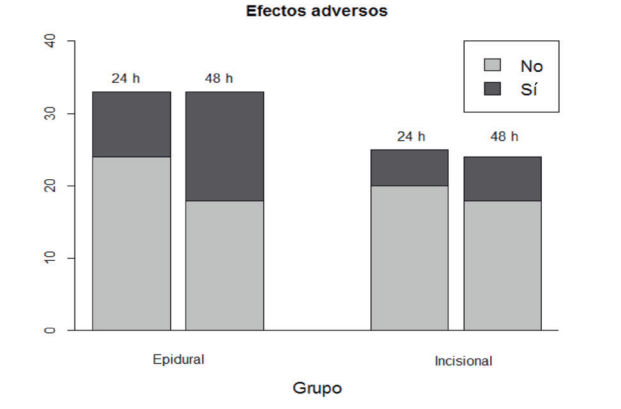

Fig. 2. Side effects at 24 and 48 hours.

5. Other abdominal surgeries: its use is under review (8). Accordingly, we have conducted this study in our center to establish whether an incisional catheter is an effective alternative in open colon surgery.

The somatic pain component of abdominal interventions is derived from muscle, skin, fascia and subcutaneous tissue. With a preperitoneal catheter, the anesthetic agent is distributed at deeper levels of the abdominal wall, including the peritoneum, with the possible beneficial effect on the postoperative ileus (11).

From a physiopathological point of view, it has been shown that central nervous blockades, such as thoracic epidural, inhibit stress response with a significant decrease in mediating hormones. It has also been shown that they significantly reduce cardiovascular complications and respiratory morbidity in postoperative patients. Improved exercise capacity and reduced postoperative ileus have also been observed, as the sympathetic thoracolumbar system is segmentally blocked (12).

Bearing in mind the study results and its limitation owing to the low patient number (impossibility of having more incisional catheters) and the subjectivity of the VAS, we may conclude that epidural analgesia continues to be the most effective technique for managing acute postoperative pain following open colon surgery with few side effects (without statistically significant differences with respect to the control group). Nevertheless, we cannot reject incisional analgesia, because despite what we expected when carrying out the study, it has proven to be an effective technique with very few side effects, and may be reserved for cases where the epidural technique is contraindicated or where it is impossible to apply due to technical or anatomical difficulties.

As regards side effects, we should not forget that no technique is harmless and there exists morbidity associated with the epidural infusion of local anesthetics and/or opioids, its side effects including low blood pressure, urinary retention, infection of the urinary tract, epidural infection and epidural hematoma among the most serious, which may lead to an increase in hospitalization time (13).

Concern for infection of the surgical wound with the serious consequences this may have, leads to misgivings among certain surgical groups regarding the placement of infusion catheters. In 2006, Liu et al. conducted a systematic review of the controlled, randomized clinical studies carried out so far, assessing the effectiveness of administering LA through catheters placed in the surgical wound, finding a decrease in opioid consumption and the incidence of PONV, especially in general and genito-urinary surgery, along with an increase in patient satisfaction. They also observed a one-day reduction in hospitalization. Surgical wound infection showed a similar incidence in active groups (0.7%) and control groups (1.2%) (14). Furthermore, we should not forget that the incisional catheter has minimum effects on the cardiovascular system and the motor and sensory function of the lower limbs, unlike the epidural catheter.

We found no statistically significant differences over 48 h between the two groups, although a larger number were observed in relation to epidural analgesia, as described above.

CONFLICT OF INTEREST

The authors declare they have no conflicts of interest.

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