

Laparoscopic transversus abdominis plane block is useful in pain relief after laparoscopic stapled repair of diastasis recti and ventral hernia

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Abstract

Background: There is still no consensus on perioperative pain control techniques in patients undergoing laparoscopic surgery; protocols of conventional therapy can be improved by the use of perioperative anaesthesiologic techniques, such as epidural or loco-regional analgesic administration as transversus abdominis plane (TAP) block. The aim of this evaluation was to investigate the role of laparoscopic-assisted TAP block during repair of diastasis recti associated with primary midline hernias in term of post-operative pain relief.

Materials and Methods: This was a retrospective evaluation of a prospectively maintained database including patients undergoing laparoscopic repair of diastasis recti associated with primary ventral hernia. Patients were divided into two groups: Group A patients ($n = 34$) received laparoscopic-assisted bilateral TAP-block of 7.5 mg/ml ropivacaine for each side and Group B patients ($n = 29$) received conventional post-operative therapy. All patients received 24 h infusion of 20 mg morphine; pain was checked at 6, 24 and 48 h after surgery by numeric rating scale (NRS) score. A rescue analgesia by was given if NRS score was >4 or on patient request.

Results: No differences in operative time, complications and post-operative stay, no complications related to TAP-block technique were found. Post-operative pain scores (determined by NRS) were found to be significantly different between groups. Group A patients showed a significant reduction in NRS score at 6, 24 and 48 h ($P < 0.005$) and in the number of patients requiring further analgesic drugs administration ($P < 0.005$) compared to Group B patients.

Conclusions: Laparoscopic-guided TAP-block can be considered safe and effective in the management of post-operative pain and in the reduction of analgesic need in patients undergoing laparoscopic repair of diastasis recti and ventral hernias. The non-randomised nature of the study and the lack of a consistent series of patients require further evaluations.

Keywords: Diastasis recti, hernia, laparoscopy, transversus abdominis plane block

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Submitted: 04-Apr-2022, **Revised:** 08-Aug-2022, **Accepted:** 17-Oct-2022, **Published:** 09-Jan-2023

Access this article online

Quick Response Code:



Website:

www.journalofmas.com

DOI:

10.4103/jmas.jmas_111_22

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How to cite this article: Cavallaro G, Gazzanelli S, Iorio O, Iossa A, Giordano L, Esposito L, *et al.* Laparoscopic transversus abdominis plane block is useful in pain relief after laparoscopic stapled repair of diastasis recti and ventral hernia. *J Min Access Surg* 0;0:0.

INTRODUCTION

Diastasis recti is a very common condition due to abnormal distance between the rectus abdominis muscles (at least 2 cm), with no fascial defects.^[1-3] This condition is typically due to an increased intra-abdominal pressure that can cause excessive stretch to the linea alba with subsequent increase in inter-rectus distance. Pregnancy is one of the most common causes of acquired diastasis recti, even if it can also be caused by previous abdominal surgery or morbid obesity, for example.^[2] This condition is frequently associated with primary (more commonly) or incisional hernias lying on the midline,^[4-6] due to progressive laxity of the linea alba. Repair of diastasis recti has evolved through more recent years, and nowadays, mini-invasive approaches represent the first choice to treat it, even when associated with midline hernias. Most of these techniques contemplate the plication of anterior or posterior rectus fascia to approximate muscles on the midline or (more recently) the use of a linear endoscopic stapler to divide anterior and posterior fascia and join together left and right fascia, as a reproduction of Rives–Stoppa technique.^[3,7-9] Most of these approaches contemplate the use of a synthetic mesh to reinforce the suture. As for other surgical fields, many studies through the last 20 years have demonstrated clear advantages for mini-invasive approach to abdominal wall repair, in terms of recurrence rates, complications and outcomes, hospital stay, cosmetic results and even pain relief.^[4-9] Regarding the latter item, there is still no clear consensus on the optimal perioperative pain control in patients undergoing mini-invasive abdominal surgery (i.e. cholecystectomy, hernia, gynaecologic and bariatric surgery); in fact, nowadays, conventional pain control, obtained by intravenous (IV) drugs or epidural analgesia seem to be at least partially replaceable by intraoperative neural block by ultrasound (US) guidance or laparoscopic assisted transversus abdominis plane (TAP) block with the use of local anaesthetic drugs.^[10-14] Furthermore, several reports show that laparoscopic-assisted TAP block may be considered equally effective as the standard US-guided TAP block and can be considered the choice in centres where US is not always available in operating rooms.^[13-15] More recently, intraoperative laparoscopic-assisted trocar site bupivacaine infiltration has shown promising results, in terms of post-operative pain relief, in different kinds of mini-invasive surgery.^[12,14,16-18] Hence, the aim of the present study was to investigate the possible role of laparoscopic-guided TAP block during mini-invasive repair of diastasis recti associated with primary midline hernias in terms of post-operative pain control.

MATERIALS AND METHODS

The present study was a retrospective evaluation of a prospectively maintained database including patients submitted to laparoscopic repair of diastasis recti associated with umbilical or epigastric hernias in two academic centres, from January 2020 to December 2021. All patients included in the study have been operated using routine standards, and the techniques reported in the present article follow the current state-of-the-science of operative management of this specific pathology. The study was registered on the Research Registry database (researchregistry 7455) and approved by the Internal Department Board. All patients received pre-operative dynamic US scan to evaluate the features of diastasis (inter-rectus distance and length of diastasis) and hernia width. Patients were divided into two different groups, depending on the centre where they underwent surgical repair:

1. Group A, 34 patients receiving bilateral laparoscopic-guided TAP block
2. Group B, 29 patients not receiving TAP block (control group).

Patients receiving pre-operative botulinum toxin A to achieve lateral muscle relaxation were not included in this evaluation, since the possible interference of muscle relaxation and post-operative pain relief. Post-operative management of both the groups was the same, and already protocolised; all patients received 24-h IV continuous infusion of 20 mg morphine; pain was checked at 6, 24 and 48 h after surgery by numeric rating scale (NRS) administration. A rescue analgesia by 1 g IV paracetamol was given if NRS score was >4 or on patient's request. Data regarding NRS score and rescue analgesia were reported. The protocol of NRS score evaluation at 6, 24 and 48 h post-operatively has entered in routine management of all patients undergoing mini-invasive (laparoendoscopic or robotic) surgery, independently from analgesia management technique, in both surgical departments (joined to each other) since 2018, as previously proposed and published.^[18]

Statistical analysis

The data were analysed with a computer software programme (SPSS version. 25.0.0.1; SPSS, Chicago, IL, USA, for MacOS High Sierra version. 10.13.4, Apple Inc. 1983–2018 Cupertino, CA, USA). All results were expressed as the mean \pm standard deviation. Due to sample sizes, non-parametric tests were applied. The Mann–Whitney *U*-test was used to analyse continuous variables. The Chi-square test or the Fisher's exact test was used to study categorical variables. Differences with α -level of < 0.05 were considered statistically significant.

RESULTS

Patients' demographics and pre-operative features are summarised in Table 1. Since the retrospective nature of this evaluation, exclusion criteria are basically the same criteria used in daily clinical practice for this kind of surgery: body mass index BMI >35; ongoing oncologic therapy; liver cirrhosis; uncontrolled diabetes and chronic corticosteroid therapy. Patients having one or more than these characteristics are usually included in a pre-habilitation programme to improve their clinical status and have access to hernia repair, as recently recommended by the European Hernia Society (EHS).^[1] No differences were reported regarding age, sex, BMI, width of diastasis and type of associated ventral hernia (we used International EHS-EHS classification both for diastasis and hernias). All patients underwent laparoscopic stapled repair with the use of two 10–12 mm trocars and one 5 mm trocar, placed in sovrapubic region (10–12 mm) left (10–12 mm) and right iliac fossa (5 mm). The laparoscopic access was performed through the 'open' technique on left iliac fossa, with progressive ropivacaine infiltration on each muscular plane, until the pre-peritoneal space. The other two trocars were inserted after pre-peritoneal direct vision infiltration of 2–3 ml 7.5 mg/ml ropivacaine). Then, prior to any surgical dissection, Group A patients received bilateral laparoscopic-guided TAP block by transversus abdominis plane infiltration of 20 ml of 3.75 mg/ml ropivacaine on each side; infiltration was performed on the anterior axillary line, in three different points from the subcostal margin to the iliac crest. The mean distance between infiltration points was 3.4 cm (± 1.1), depending on the distance from subcostal margin to iliac crest. All patients underwent laparoscopic stapled repair, mini-invasive stapled abdominal wall reconstruction technique (MISAR) with use of a non-coated macropore polyester mesh, placed in retromuscular plane with no fixation devices, as described by Manetti *et al.*^[3] Regarding perioperative outcomes [Table 2], no significant differences were found in operative time, post-operative complications and post-operative stay, thus attesting the homogeneity between the two groups. No complications related to TAP block technique (like hematoma) were reported. Regarding post-operative pain management, 6-h NRS scores were found not to be significantly different (4.43 ± 0.9 for Group A patients and 4.65 ± 1.2 for Group B), while a significant difference was found in NRS score at 24 h after surgery (3.89 ± 0.8 for Group A patients and 4.52 ± 1.3 for Group B patients, $P < 0.005$) and at 48 h after surgery (3.41 ± 0.9 for Group A patients and 4.02 ± 0.7 for Group B patients, $P < 0.005$). The number of patients requiring further analgesic drugs administration for high

Table 1: Pre-operative patients demographics and tumor characteristics

	Group A	Group B	P
Number of patients (male/female)	34 (4/30)	29 (3/26)	NS
Age (mean \pm SD)	41.3 \pm 11.2	40.5 \pm 8.8	NS
Mean inter-rectus distance (cm) \pm SD	4.8 \pm 1.7	5.1 \pm 0.9	NS
Diastasis width classification (20)			
W1	4	3	NS
W2	21	18	NS
W3	9	8	NS
Associated hernia classification			
M2	14	11	NS
M3	20	18	NS
W1	19	20	NS
W2	15	9	NS
BMI (mean \pm SD)	25.4 \pm 3.2	26.1 \pm 3.0	NS

BMI: Body mass index, SD: Standard deviation, NS: Not significant

Table 2: Perioperative outcomes, technique, Numeric Rating Scale score

	Group A (n=34)	Group B (n=29)	P
Operative time (min), mean \pm SD	72.3 \pm 18.6	76.6 \pm 21.8	NS
Perioperative complications			
I	5	3	NS
II	1	2	NS
IIIa	-	-	NS
IIIb	1	-	NS
Post-operative stay (mean \pm SD)	2.3 \pm 0.9	2.1 \pm 0.7	NS
6 h NRS score (mean \pm SD)	4.43 \pm 0.9	4.65 \pm 1.2	NS
24 h NRS score (mean \pm SD)	3.89 \pm 0.8	4.52 \pm 1.3	<0.005
48 h NRS score (mean \pm SD)	3.41 \pm 0.9	4.02 \pm 0.7	<0.005
Patients requiring analgesic assumption, n (%)	12 (35.2)	28 (57.4)	<0.005
Mean analgesic demands for requiring patients	2.6 \pm 0.4	2.88 \pm 0.9	NS

NRS: Numeric Rating Scale, SD: Standard deviation, NS: Not significant

NRS score or on personal request was higher in Group B patients (35.2% in Group A vs. 57.4% in Group B, $P < 0.005$). No difference was found in the mean number of analgesics administration for patients who required it (2.6 ± 0.4 doses of 1 mg paracetamol in Group A and 2.88 ± 0.9 in Group B).

DISCUSSION

Mini-invasive surgery has gained great diffusion and popularity worldwide since its well-known advantages for patients: less risk of comorbidities related to surgery, better cosmetic outcomes, better pain management and a quicker recovery of life activities. In this view, early post-operative pain management remains a crucial issue, in order to achieve a better patient recovery and quicker hospital stay.^[19-22] For these reasons, many analgesic schemes have been proposed in several fields of laparoscopic surgery, starting from cholecystectomy and colorectal surgeries and going through gynaecologic, urologic bariatric and endocrine surgery.^[10-14,18] Among different

kinds of mini-invasive surgery, abdominal wall surgery still represents a challenge, due to its peculiarity to work on planes rich of sensitive nerve endings and to perform tension sutures, staples or tacks application, foreign body (mesh) placement.^[6,23,24] All these manoeuvres can be responsible of acute post-operative pain, even more than other common surgical procedures (for example colorectal surgery), and this may explain the need of a correct perioperative pain management strategy. In recent years, the most used systems for perioperative pain management during laparoscopy are epidural analgesia^[22,25] with reported controversial results in terms of effective pain control and procedural complications, and US-guided TAP block, that has been demonstrated to be really effective in reducing post-operative pain and analgesic assumption, with low drawbacks.^[18,25-28] Nevertheless, this procedure needs specific skill and the presence of available USs in the operative theatre, and this may be considered a limitation in some settings. Furthermore, sometimes, the procedure can be time-consuming and even this aspect should be considered as a potential drawback in a high volume public health setting. Recently, a direct intraoperative laparoscopic view guide has been proposed, as an alternative to the standard US-guide, to perform a TAP block; this technique has been demonstrated, even if in limited experiences, to be as effective as the US-guided block.^[13,15] Even so, there is still no evidence on the effectiveness of this specific technique of pain management in patients undergoing abdominal wall surgery that requires high level of care in perioperative pain relief, since post-operative acute (and chronic in selected cases) pain can be considered not just a consequence of surgery, but a real complication affecting quality of life and normal daily activities. We choose to use the technique of laparoscopic-assisted TAP block, according to the rising evidence on the effectiveness of the 'standard' US-guided TAP block, since it is easy and very low time consuming, and can be performed in every laparoscopic procedure, even in the absence of USs in the operating theatre. As in our previous paper, we decided to use ropivacaine, since its prolonged effect when compared to lidocaine and bupivacaine, in order to achieve a longer pain control.^[18] Results this study show an improvement in post-operative pain control in patients submitted to intraoperative ropivacaine TAP block when compared to the control group, and this becomes significant at 24 and 48 h after surgery, probably due to the prolonged half-life of this drug when compared to other anaesthetics (lidocaine or bupivacaine). Furthermore, the need for rescue analgesics was reduced in these patients (with a lower number of patients requiring it), thus confirming the effectiveness of the proposed analgesic protocol. Moreover, this procedure has demonstrated to be easy to perform, even

for surgeons having no specific experience in loco-regional anaesthesia protocols or US guidance. It is safe, very low time-consuming, no reported side effects, and has theoretically no contraindication (except for patients reporting allergy to specific drugs). Hence, it can be used in all patients undergoing laparoscopic abdominal wall surgery (specifically for diastasis recti and midline hernias) as an important adjunct to perioperative analgesic protocols.

CONCLUSIONS

This study is the first evaluation on the effectiveness of intraoperative laparoscopic-guided TAP block on perioperative pain control in patients undergoing mini-invasive repair of diastasis recti and midline primary hernias with MISAR technique. Its results show that this procedure can be considered safe and effective in the management of early post-operative pain and in the reduction of analgesic need. Nevertheless, the retrospective nature of the study and the lack of a consistent series of patients does not permit to formulate definitive conclusions on this matter. Hence, we need further investigations to formulate definitive conclusions and may be guided by prospective, randomised trials.

Authors contribution

- GC, AP and DC designed the study
- OI, MT contributed by patients selection and clinical evaluation
- OI and SS wrote the manuscript
- GC and AI were the operating surgeons
- SG and SB helped in performing TAP block
- LE and LG revised the manuscript and statistics.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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