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Original Research Article

Efficacy of laparoscopic guided transversus abdominis plane block in post-operative analgesia requirement in elective laparoscopic cholecystectomy

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ABSTRACT

Background: Minimal invasive surgery has many advantages. In order to maintain and control pain, one of the most effective technique is Transversus abdominis plane (TAP) block technique. Aim of the study was to demonstrate the efficacy of laparoscopic guided transversus abdominis plane block in post-operative analgesia requirement in elective laparoscopic cholecystectomy.
Methods: It was a hospital based prospective interventional study. Sample size was calculated at 0.05 α error and 80% study power assuming mean difference of VAS score between TAP block +/A group and TAP block- /B group is 1 and standard deviation of VAS score 1.3 among patients undergoing elective laparoscopic cholecystectomy.
Results: A total of 60 patients were enrolled in this study. The mean age of group A was 48.56 years and for group B was 43.53 years. In group A 80% patients were females and for group B 83.3% patients were females. There was significant difference in VAS score at immediate post operation, at 1 hour, at 6 hours, at 18 hours and at 24 hours as p value was <0.0001 for all these groups. The mean VAS score was recorded less in group A at all the time duration compared to group B.
Conclusions: With advantages like maximum safety, efficacy, potential for lower visceral injury risk and shorter operational time and other numerous advantages (decreased analgesic requirements, etc.) laparoscopic-guided TAP block counts as an ideal abdominal field block in the patients.

Keywords: Laparoscopic guided, Laparoscopic cholecystectomy, Transversus abdominis plane, TAP block, VAS

INTRODUCTION

One of the most effective and efficient surgical procedure with statically minimal invasion for removal of diseased gallbladder is Laparoscopic cholecystectomy (LC). Starting from the early 1990s this procedure has successfully taken over the open technique for routine cholecystectomies.[1] with various factors coming into play like sooner recovery, less hospitalisation time, lesser wound complications it (LC) has set a class standard for treatment of benign gallbladder diseases in contrast to open cholecystectomy.[2-5] Nonetheless, in order to perform a safer dissection of Calot's triangle - outlined by the cystic duct, right liver lobe, and the common hepatic duct, it is imperative to have a clear view of the cystic duct and cystic artery so as to operate effectively on cholecystectomy.[6] The most noted advantages of minimally invasive surgery are less post-operative pain and increased chances of improvement in physical activity.[7] In order to achieve quick relief and minimum pain, post open or laparoscopic abdominal surgery, different local methods of anesthesia are resorted to. Till date, transverses abdominis plane (TAP) block technique, is recorded in most patients as the most effective and

efficient way that helps achieve local pain control. The transversus abdominis plane (TAP) block technique dates back to 2001, and the first person who is credited for the introduction of the same is Rafi8, which until now is considered a landmark-guided technique via the triangle of Petit that helps to obtain a field block. The technique is achieved by injecting a local anaesthetic solution into a plane between the internal oblique muscle and transversus abdominis muscle. The thoracolumbar nerves from the spinal roots T6 to L1 join this plane and provide the anterolateral abdominal wall with sensory nerves, the local anesthetic distribution in this plane will obstruct the neural afferents and provide the anterolateral abdominal wall with analgesia.

Most anaesthesiologist resort to inject bolus anesthetic in neurovascular fascial plane that blocks the dermatomal afferents of T7-11 intercostal nerves, T12 subcostal nerve, ilioinguinal and iliohypogastric nerves, and cutaneous branches of L1-3 nerves. It is a well noted fact that there are anatomical variations of the nerve entries and exits of the TAP. The location of inferior lumbar triangle (triangle of Petit), which is an upright triangle and has three main layers from superficial to deep: Subcutaneous fatty tissue, the internal oblique muscle and transversus abdominis muscle and their fascias, is among the anterior margin of the latissimus dorsi muscle, posterior margin of the external oblique muscle and inferiorly the crista iliaca.

The major landmark of the intersection as per anatomic view is its apex.[9] As per the first reports, the apex of the triangle of Petit was the "blind" insertion point of the needle.[10,11] However, in the recent researches, it has been proposed to opt for an ultrasound to rightly ascertain needle placement owing to the probable risk for damage to adjoining structures. As per the procedure undertaken by Magee et al, direct laparoscopic vision TAP block before laparoscopic surgical intervention is much safer in reducing iatrogenic injuries.[12]

METHODS

It was hospital based prospective interventional study conducted in department of General Surgery, SMS Medical College and Hospital, Jaipur, Rajasthan from March 2019 to September 2020. Patients admitted in wards of SMS Hospital Jaipur for elective laparoscopic cholecystectomy were included after taking written informed consent. Patient allergic to injection bupivacaine, GB malignancy, infection at site of injection, patients with bleeding disorders, chronic opioid dependency, patients undergoing laparoscopic cholecystectomy which were later converted to open cholecystectomy due to technical difficulties or anatomical variations were excluded in our study. Consent was taken from each patient after informing them the objectives of the study, the risks and benefits, confidential handling of personal information, the voluntary nature of participation and the rights to withdraw from study. Detailed study related information was read out and explained in printed hand-out.

Sample size

Sample size calculated at 0.05 α error and 80% study power assuming mean difference of VAS score between TAP block + and TAP block- is 1 and standard deviation of VAS score 1.3 among patients undergoing elective laparoscopic cholecystectomy. Thus the minimum sample size is 26 in each group which is further rounded off to 30 patients in each group.

Statistical methods

Visual analog scale of pain will be applied in all patients and compared using the McNemar chi-square test. Qualitative data will be expressed in the form of proportion and percentages. Quantitative data will be expressed in mean±SD (complications). Qualitative data will be compared by Chi square test. Unpaired t test will be used to infer the difference in means. For significance, following at the level of "p" value will be taken ($p<0.05$ =significant).

RESULTS

A total of 60 patients were enrolled in this study 50% patients were TAP block +/A group and 50% patients were TAP Group -/B group. Demographic and other characteristics including VAS score, rescue analgesia, the length of hospital stay of the patients in two groups was presented. The mean age of group A was 48.56 years and for group B was 43.53 years.

Table 1: Distribution according to age.

Age distribution (in years)	Group A		Group B	
	No. of patients	Percentage	No. of patients	Percentage
<20	1	3.3	1	3.3
20-40	10	33.3	14	46.6
41-60	11	36.6	11	36.6
61-80	8	26.6	4	13.3
Total	30	100	30	100
Mean±SD	48.56±16.28		43.53±15.93	

In group A out of 30 patients 80% patients were female and for group B 83.3% patients were female. Mean VAS score was calculated immediately after operation, at 1 hour, at 6 hours, at 12 hours, at 18 hours and at 24 hours for both group A and B. There was significant difference in VAS score at immediate post operation, at 1 hour, at 6 hours, at 18 hours and at 24 hours as p value was <0.0001 for all these groups. The mean VAS score was recorded less in group A at all the time duration compared to group B (Table 2).

Table 2: Distribution according to VAS score.

VAS score	Group A		Group B		P value
	Mean	SD	Mean	SD	
Immediate Post Op	0.3	0.46	5.4	0.72	<0.0001
At 1hour	0.36	0.49	4.83	0.83	<0.0001
At 6 Hours	0.96	0.85	3.8	0.76	<0.0001
At 12 Hours	2.43	1.1	2.7	0.62	0.24
At 18 Hours	3.3	0.53	3.56	0.56	0.04
At 24 Hours	2.43	0.56	3.26	0.44	<0.0001

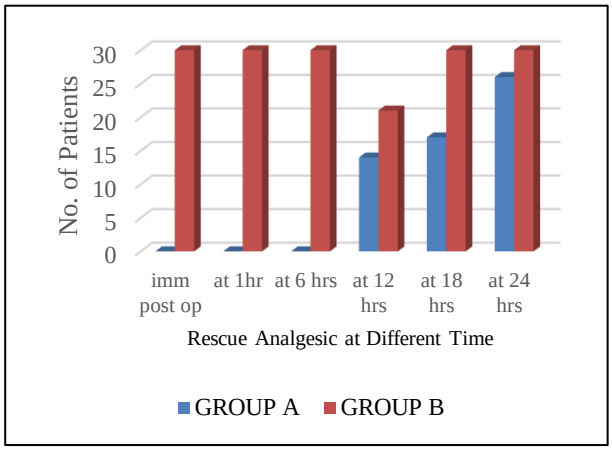

Figure 1: Distribution according to rescue analgesic requirement.

Table 3: Distribution according to hospital stay.

Hospital Stay (days)	Group A		Group B	
	No. of Patients	%	No. of Patients	%
0-1	1	3.3	1	3.3
>1	29	96.6	29	96.6
Total	30	100	30	100
Mean±SD	1.48±0.09		1.48±0.09	

In this study we have used rescue analgesia which was calculated immediate after operation, at 1 hour, at 6 hours, at 12 hours, at 18 hours and at 24 hours for both group A and B. There was significant difference in rescue analgesic at immediate post operation, at 1 hour, at 6 hours, at 12 hours, at 18 hours and at 24 hours as p-value was <0.05 for all these groups. Rescue analgesia requirement in group A was less compared to group B (Figure 1).

We found 96.6% patients stayed at hospital for more than 1 day in group A and group B. The mean duration of hospital stay was 1.48 days for both the groups. There was no significant difference between these group as p value was 1 which was >0.05 (Table 3).

DISCUSSION

In order to achieve low morbidity rates, reduced severity of pain, minimise the period of recovery and improve metabolic response due to the surgery, it is imperative to administer adequate post-operative pain control, which helps in the abovementioned.[13] The effectiveness of TAP block with reference to post-operative pain control in contrast to the general anesthesia has been recorded and demonstrated in many studies, in the past decade.[14] In our study, out of 60 patients 50% patients were TAP block + (Group A) and 50% patients were TAP Group - (Group B). The study undertaken by Rao et al the researcher observed the mean age for TAP+ group to be 44.37 years and TAP- group to be 45.42 years.[15]

While in another study conducted by Siriwardhana et al, he concluded the Median age of the study population to be 50 years (range 19-80) where 72.2% patients were females.[16] Whereas, in the observation of Tihan et al, the median (±IQR) age of the patients stands at 69 (±65-86). Therefore, statistically among total 147 patients, the number of male patients were 37 (25.2%) and female stands at 110 (74.8%).[17]

In our study 96.6% patients in both group A and B stayed at hospital for more than 1 day. In the study by Tihan et al, the research did not conclude any significant benefit of TAP block in term of post-operative length of stay. Whereas, in order to study the benefit of the TAP block the same was tested in a trial of Keller et al where 200 patients underwent colorectal surgery and the results were compared with various similar studies that were conducted previously.[17,18]

In our study rescue analgesic given to patients was calculated immediate after operation, at 1 hour, at 6 hours, at 12 hours, at 18 hours and at 24 hours for both group A and B. Ra et al found that the US-TAP block was performed at both left and right sides with 0.25% and 0.5% levobupivacaine 15 ml for each side, and the pain control was medicated depending on the verbal numerical rating scale (VNRS) and the request of the patients to control the pain, not generally conducting the postoperative analgesia by means of IV-PCA.[14] Although the same conclusion that the US-TAP block has good analgesic effect after a laparoscopic cholecystectomy was derived from both of the studies, our result cannot be compared with that of Ra et al, since VNRS was not assessed in our study.[14] Thus, though the US-TAP block

can be an effective analgesic method, further research is needed to investigate whether it is more efficient than IV-PCA and what effects can be drawn by the combination method of both of them.

In the present study mean VAS score was calculated immediate after operation, at 1hour, at 6 hours, at 12 hours, at 18 hours and at 24 hours for both group A and B. There was significant difference in VAS score at immediate post operation, at 1 hour, at 6 hours, at 18 hours and at 24 hours as p value was <0.0001 for all these groups. McDonnell et al as per the study concluded that in post-operative wound pain relief, TAP block was found "highly" effective and show optimum results.[13] According to the study results, in TAP block group VAS scores has been reduced at all post-operative time points and at the 24th hour after surgery mean VAS scores were lower. While differing from the current study, the authors evaluated the patients' post-operative sedation scores, which were found to be reduced after surgery at 4th and 6th hour. In a similar study by Favuzza et al they studied 100 patients for the use of laparoscopic-guided TAP block who had laparoscopic colorectal surgery.[19] Without any statistical and mathematical comparisons their raw data and preliminary results pointed out efficient pain relief for abdominal incisions; even in obese patients reduced narcotic use and short hospital stay were provided with the help of this method. According to our knowledge and research, the number of studies that has been published about TAP block under direct laparoscopic vision during laparoscopic abdominal operations is limited in number.[20-23]

However, a few published studies are in public domain about the usage of ultrasound to perform TAP block.[24] Despite various people conducting the research in different places and on varied sample, most of them rightfully concluded that the ultrasonographic guidance could permit a precise and safe placement of the anesthetic agent for TAP block. The identification of muscle planes can be challenging in some cases, even though ultrasound guidance is present. In the year 2011, Owen et al in his research described a new approach: TAP block under direct vision in open surgery.[25] Under this, they concluded that with help of this easier technique the risks associated with the conventional approach could be prevented. In the same year, one case was reported based on the same idea by Magee et al.[12] Both have opted to perform TAP block under direct vision but on laparoscopic procedures. Chetwood et al, following this report, in his study described quite similar laparoscopic-guided TAP block technique, which was during laparoscopic nephrectomy and it was suggested as a result that safety and time profit were the main advantages of this approach.[26]

Limitation

The most important limitation of our research is the lack of a prospective, controlled, blind study. Focusing more various data of patients, such as sedation scores, nausea, vomiting, return of intestinal function, the quantity of opioid or NSAIDs consumption after the operation and general anesthesia requirements, will help us to demonstrate significant results in further studies.

CONCLUSION

After the comprehensive study it can be concluded that laparoscopic guided TAP block proves to be one of the cost effective, safest, easiest and the has effective supplemental techniques as part of the multimodal post-operative analgesic regimen, all of these makes it a promising novel post-operative pain treatment procedure. It also helps to deal and improve the pain scores in minimally invasive surgery specially involving the anterior abdominal wall. Furthermore, even during any laparoscopic procedure, this approach can be easily performed. After the thorough study it can be concluded that this technique is an ideal abdominal field block in patients as it proves to be effective, safe and reduces opioid and non-steroid anti-inflammatory drugs requirement.

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