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ORIGINAL ARTICLE

Post Operative Pain Management for Open Inguinal Hernia Repair under Ultrasound Guidance with two Different Regional Analgesia Techniques: Transversus Abdominis Plane Block VS Ilioinguinal / Iliohypogastric Nerves Block

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Summary
Introduction. An effective postoperative analgesia is of key importance to facilitate recovery during the immediate postoperative period and to ensure early ambulation. The transversus abdominis plane block (TAP) and ilioinguinal / iliohypogastric nerves block (IHN) are a relatively new regional analgesia techniques that provide a postoperative analgesia in patients undergoing lower abdominal surgery.
Aim of the Study. The objective of this study was to compare the analgesic effectiveness of ultrasound guided TAP block versus ultrasound guided IHN block in the post-operative period of unilateral open inguinal hernia repair.
Materials and methods. One hundred five consented adult patients scheduled for unilateral open inguinal hernia repair were enrolled in this randomised controlled clinical study. US-guided regional analgesia with 0.5 % of levobupivacaine was performed after induction of general anaesthesia (GA). Patients were randomly allocated into two groups: Group A- 53 patients underwent TAP block vs. Group B- 52 patients underwent IHN block. All patients received a standardised GA. Both groups were comparable for age, gender, ASA, and weight. All patients were scheduled for postoperative pain assessment using a visual analogue scale (VAS) at two definite times: 1- VAS1: when patient was awake and conscious post GA; 2- VAS2: when patient requested a rescue analgesia or patient reached 17 hours post block performance.
Results. There were no significant differences in age, gender, ASA, or weight between both groups (p=0.9; p=0.8; p=0.6; p=0.9 respectively).
We found out significant differences comparing VAS score over the time, the IHN block had better effect than the TAP block on relieving pain at the VAS1 (p=0.03) and VAS2 (p=0.04).
The duration of the blocks in group A and group B was as the following:
2-6.5 hrs= [Mean ± SD: 4.2 ± 1.5 vs. 5 ± 0.8 respectively and p=0.03]; 6.5-17 hrs= [Mean ± SD: 11.9 ± 2.3 vs. 14.4 ± 1.7 respectively and p=0.203]; ≥ 17 hrs= [Mean ± SD: 19 ± 1.1 vs. 20.1 ± 2 respectively and p=0.003]. The results of our study were more favourable for the IHN block in all the 3 timing groups.
Conclusions. Ultrasound-guided IHN block provides better pain control and longer duration of action than ultrasound-guided TAP block in the post-operative period of unilateral open inguinal hernia repair.
Both regional analgesia techniques: TAP block and IHN block under ultrasound guidance for open inguinal hernia repair are simple, safe and effective pain control methods.
Key words: postoperative analgesia, regional analgesia, TAP block, IHN block

INTRODUCTION

Poorly controlled acute pain during the postoperative setting after lower abdominal surgery may produce a range of detrimental acute (e.g., adverse physiological responses) and chronic effects (e.g., delayed long-term recovery and chronic pain). The provision of effective postoperative analgesia is of key importance to facilitate recovery, and to ensure early ambulation during the immediate postoperative period (1). Attenuation of postoperative pain, especially with certain types of regional analgesic techniques (like TAP and IHN blocks), may decrease perioperative morbidity and mortality (2). Unfortunately current pain management for the postoperative lower abdominal surgery relies heavily on traditional analgesia (like opioids, NSAIDS etc…), which is associated with many unwanted side effects (like respiratory depression, major organ toxicity, and depression of gastrointestinal motility) (3, 4, 5).
A revolution in the management of acute perioperative pain has occurred during the past 4 decades. Nowadays, interest surrounding regional anaesthesia and analgesia has been growing owing to its demonstrated efficacy and safety outcomes. The transversus abdominis plane (TAP), and ilioinguinal / iliohypogastric nerves (IHN) blocks are relatively new regional analgesia techniques that provide analgesia to the parietal peritoneum as well as the skin and muscles of the anterior abdominal wall. They have a high margin of safety, are technically simple

to perform, and with a rare complications especially under ultrasound guidance (6).

In many review articles were mentioned that anaesthesia and analgesia of the trunk can be achieved with perineural injections, which could have several advantages compared with neuraxial blockade; i.e. reduced sympathectomy, less severe consequences of infection or bleeding at the injection site, minimal interference with bladder and bowel function, and less incidence of lower extremity motor weakness (Abrahams 2010). In these articles were also clearly stated that TAP block, and ilioinguinal / iliohypogastric nerves (IHN) block can provide anaesthesia and analgesia of the abdominal wall (7).

The TAP block is a local anaesthetic block used to provide analgesia to the anterior and lateral abdominal wall. Rafi *et al* (2001) and McDonnell *et al* (2004) were the first to describe this novel abdominal field block. They described an anatomical landmark technique and provided evidence of blockade to the mid/lower thoracic and upper lumbar spinal nerves as they travelled in the fascial plane between the transversus abdominis and internal oblique muscles. Hebbard *et al* (2007) have subsequently described an ultrasound-guided approach to the TAP block [8].

Ponka was one of the first to describe a technique of IHN, and twelfth intercostal nerves blocks. Several modifications of this technique have been created, which vary mainly in the choice of local anaesthetics and the injection sites. In 1978 a major article in the surgical literature propounded the broad use of this nerve block in adult herniorrhaphy (7).

AIM OF THE STUDY

The objective of this study was to compare the analgesic effectiveness of ultrasound guided TAP block versus ultrasound guided IHN block in the post-operative period of unilateral open inguinal hernia repair.

MATERIALS AND METHODS

This was a prospective randomised study conducted at the anaesthetics clinical department of Riga Eastern Clinical University Hospital "Gailezers", during the period from November 2013 to July 2014.

The study was approved by the University of Latvia institute of experimental and clinical medicine scientific research ethics commission. Protocols and guidelines were written for each block. The demographic data including age, weight, ASA physical status, drugs given, and post operative nausea vomiting were recorded in a data collecting sheet (pro-forma).

Patients who had a history of relevant drug allergy were excluded from this study.

One hundred five consented adult patients scheduled for unilateral open inguinal hernia repair were enrolled in this randomised controlled clinical study. US-guided regional analgesia with 0.5 % of levobupivacaine was performed after induction of general anaesthesia (GA). Patients were randomly allocated into two groups: Group A- 53 patients underwent TAP block vs. Group B- 52 patients underwent IHN block. All patients received a standardised GA. All the patients received the followings: after pre-oxygenation, intravenous induction with propofol 3-5 mg/kg, fentanyl 100 mcg, and atracurium 0.3-0.6 mg/kg; tracheal intubation was performed with cuffed tube; anaesthesia was maintained with oxygen, sevoflorane of 1% MAC (age dependent), atracurium 0.15mg/kg, fentanyl 100 mcg (it was given before surgical incision) and ketarolac 30 mg (it was given at the end of surgery).

The blocks were performed using the following steps: a full aseptic procedure; using a high resolution US (Fig. 2); calculating the volume and concentration of levobupivacaine (0.5 %) 2mg/Kg (Max. 150 mg) and with a maximum of 30 mls; using a 5 or 10cm stimuplex needle depending on the thickness of patient abdominal wall with an extension catheter; careful placement of the needle was essential to avoid peritoneal penetration (Fig. 3, 4); ensuring negative aspiration before injecting this large dose of local anaesthetic.

All patients were scheduled for postoperative pain assessment using a visual analogue scale (VAS) from (0-10) at two definite times: 1- VAS1: when patient was awake and conscious post GA; 2- VAS2: when patient requested a rescue analgesia or patient reached 17 hours post block performance. The VAS evaluation regarded as the followings: 0= No pain; 1-4= Mild pain; 5-7= Moderate pain; 8-10= Severe pain. The VAS score of more than 4 used as cut point at which additional analgesia was given.

The statistical computation was performed using the Microsoft Office (Excel and Word), and the IBM SPSS statistics version 22. The continuous variables were described as mean standard deviation (SD) and categorical variables as percentages (%). The level of significance in all statistical tests and comparisons was set at P. value ≤ 0.05 to be considered as significant difference (9, 10).

RESULTS

As it had been shown by table 1; there were no significant differences (Mean ± SD) in number of patients, sex ratio, ASA, age or weight between both groups, and the P. values were > 0.05 in all comparisons

From other point of view, we found out significant differences comparing the VAS score over the time, the IHN block had better effect than the TAP block on relieving pain at the VAS1 and VAS2, and the P. values were < 0.05 in all comparisons (Table 2).

The findings had showed (Table 4 and Fig. 1) that the majority of the IHN block 54% (28/52 patients) had a long duration of action of more then 17 hours and they reached up to 24 hours (as a sole analgesics) and the minority of the IHN block 6% (3/52 patients) had a short duration of action ranged between 4 – 6 hours in comparison to TAP block only the minority 15% (8/53 patients) had a duration of action of more then 17 hours and they reached up to a maximum of 20 hours, and 23 % of the TAP block (12/53 patients) had a short duration of action ranged between 2 - 6 hours with a

highly significant differences (P. values were 0.003 and 0.032 respectively).
There was no significant difference in comparing TAP and IHN at 6.5 – 17 hours (P. value 0.203). But the results of the Mean ± SD were more favourable for the IHN block. They were 11.9 ± 2.3, and 14.4 ± 1.7 for the TAP block and the IHN block respectively.
There were no post operative nausea and vomiting and were no complications (e.g.: local anaesthetic toxicity, bowel injury, and/or intraperitoneal injection) attributable to TAP or IHN blocks performance identified in both groups.

DISCUSSION

Nowadays, interest surrounding regional analgesia has been growing owing to its demonstrated efficacy and safety outcomes. Despite the majority of the studies published (i.e. McDonnell team 2008 and a meta-analysis done by Sddiqui MR and his colleges in UK in 2011) have showed that the TAP and the IHN blocks reduce the need for postoperative traditional analgesia use (like opioids, NSAIDS, etc…), increase the time of first request for further analgesia during the first 24 hrs after surgery in a series of lower abdominal or pelvic surgical procedures, provide more effective pain relief, and reduce traditional analgesia-associated side effects, widespread adoption of this analgesic adjunct has been slow in the world and in Latvia as well (11-17).
Levobupivacaine (Chirocaine) is chosen amongest the other local anaesthetic agents due to the following reasons: 1. Is apparently less cardiotoxic; 2. Have a greater vasoconstrictive action; 3. Reduces pain within less then 15mins and last up to 6.5 – 17 hours postoperatively (longer then Bupivacaine by 2 hours) (18).
Up to now, many studies included a limited number of patients for each surgical procedure, and comparisons were performed with a control group receiving systemic analgesia. Complementary information is still required concerning the TAP block compared with other techniques of regional analgesia in terms of efficacy and side-effects. Hernia repair induces parietal pain depending on IHN distribution. Parietal nerves infiltration, usually performed blindly, has been documented to provide pain relief during the first postoperative hours (11).
In a study where a comparison is done between ultrasound-guided TAP and conventional IHN blocks for day-case open inguinal hernia repair, the IHN block was performed blindly and it is likely that in some patients local anaesthetics (LA) solution could have been distributed into the s.c. layer or within muscle planes explaining less efficient anaesthesia (19, 20). In agreement, Weintraud and colleagues have reported in children that suitable diffusion of the LA solution between the internal oblique and transversus abdominis muscles occurred only in 14% when the block was performed blindly. They documented an 80% incidence of failed block when LA was injected deeper than the transversus abdominis muscle and 100% when injected superficially to the internal oblique muscle (21). In addition, the location of the IHN varies with frequent division of the nerves at the level of the iliac crest [22]. The site of penetration of the two nerves towards the abdominal wall muscles also varies, so that the more proximal the nerves are blocked, the more effective the block could be. Nerve endings anaesthetised by the TAP block originate from T7 to L1 and include the IHN (23). The ultrasound guidance is likely to improve the reliability of the block. Ultrasound allows to precisely visualise the three muscle layers, the peritoneum and intraperitoneal visceral structures, and also the real-time assessment of the LA distribution characterized by an anechoic image below the aponeurosis of the internal oblique and transversus abdominis muscles.
In this study, the pain intensity at VAS1 and VAS2 were lower during the first 24 hours after an ultrasound-guided IHN block compared with an ultrasound-guided TAP block for unilateral open inguinal hernia repair. Comparing the effectiveness of the TAP block versus the IHN block analgesia post unilateral open inguinal hernia repair and the results obtained declared that the IHN block had a better effect on pain reliving, with longer duration of action with a highly significant differences. The findings in this study are might be due to using US guidance in performing the IHN blocks and blocking specifically the sensory afferent of the IHN nerves supplying L1 dermatome with a higher volume and concentration of the local anaesthetics.
The traditional analgesia demand is decreased in patients who benefited from both TAP block and IHN block. The lack of excessive use of systematic opioids, non-steroidal anti-inflammatory drugs and N2O are probably implicated in the absence of post operative nausea and vomiting.
We have strongly followed our protocols and guidelines in this study to avoid any complications. There were no any complications attributable to TAP or IHN blocks identified (e.g.: local anaesthetic toxicity, bowel injury, and/or intraperitoneal injection) in our study.
The study has several limitations. The anaesthetist in charge of the patient has not been blinded for the block technique. However, patients and surgeons have been blinded for the block type. A control group without a block has not been included but the aim have been mainly to evaluate the analgesic efficacy comparing both blocks (TAP vs. IHN) techniques knowing that each of them had documented analgesic effect versus placebo (20, 21).

CONCLUSIONS

1. Ultrasound-guided IHN block provides better pain control and longer duration of action than ultrasound-guided TAP block in the post-operative period of unilateral open inguinal hernia repair.
2. Both regional analgesia techniques: TAP block and IHN block under ultrasound guidance for open inguinal hernia repair are simple, safe and effective pain control methods.

Table 1: Preoperative patients characteristics.

Characteristics		TAP Block	IHN Block	P. Value
Number of patients		53	52	-
ASA (I/II/III)		20/21/12	16/27/9	0.656
Sex (Male/Female)		46/7	43/9	0.843
Age (Year)	Mean ± SD	54.6 ± 18.5	54.8 ± 17.5	0.944
	Range	19 - 82	23 – 82	-
Weight (Kg)	Mean ± SD	86.3 ± 12.5	85.3 ± 11.8	0.976
	Range	61 - 115	52 – 110	-

Table 2: A comparison of mean numerical visual analogue scale over time.

Time		TAP Block	IHN Block	P. Value
VAS 1	Mean ± SD	1.1 ± 1	0.6 ± 0.6	0.037
	Range	0 – 3	0 – 3	-
VAS 2	Mean ± SD	4.9 ± 1.2	3 ± 1	0.048
	Range	4 – 8	0 – 5	-

Table 3: A comparison of the duration of action of the blocks.

Time	Characteristics	TAP Block	IHN Block	P. Value
2 – 6.5 hrs	Nb of Patients	12	3	0.032
	Range	2 – 6	4 – 6	
	Mean ± SD	4.2 ± 1.5	5 ± 0.8	
6.5 – 17 hrs	Nb of Patients	33	21	0.203
	Range	7 – 16	10 – 16	
	Mean ± SD	11.9 ± 2.3	14.4 ± 1.7	
≥ 17 hrs	Nb of Patients	8	28	0.003
	Range	17 - 20	17 – 24	
	Mean ± SD	19 ± 1.1	20.1 ± 2	

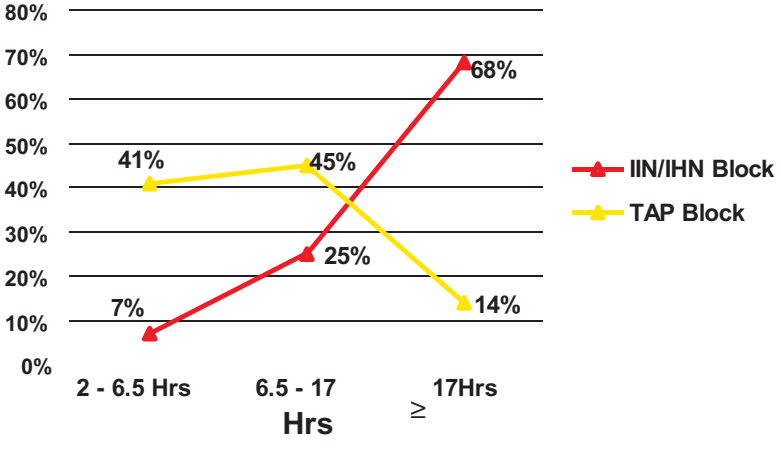

Fig. 1. The percentage of duration of action of TAP and IHN blocks.

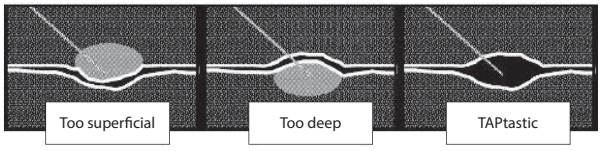

Fig. 2. Figure highlighting the optimal needle position during ultrasound-guided TAP/IHN blocks.

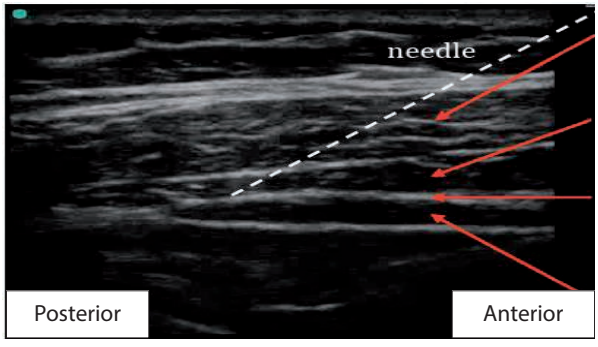

Fig. 3. Ultrasound image during posterior TAP Block. The transversus abdominis muscle can be seen to taper into a fascial line. The approximate needle insertion angle is indicated.

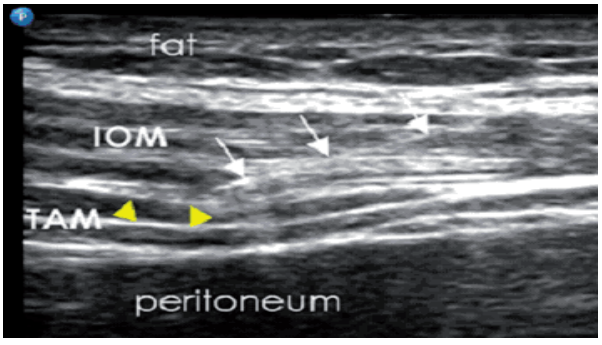

Fig. 4. A needle (arrows) inserted in plane with its tip above the IHN (arrowheads) is seen on ultrasound. IOM = Internal oblique muscle; TAM = Transverse abdominis muscle.

Conflict of interest: None

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