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Prospective Randomized Study Comparing Analgesic Effect of Ultrasound-Guided Ilioinguinal/Ilio hypo gastric Nerve Block with Ultrasound-Guided TAP Block for Inguinal Hernia Repair

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Abstract

Background: Both transversus abdominis plane (TAP) block and ilioinguinal-iliohypogastric (IIN/IHN) blocks are used regularly, under ultrasound (USG) guidance for reliving postoperative pain in patients planned for inguinal hernia surgery.

Aim of Study: Was to compare post-operative analgesic efficacy of USG guided TAP Vs. IIN/IHN block in adults scheduled for inguinal hernia surgery.

Patients and Methods: Seventy male patients aged 18 to 50 with American Society of Anesthesiologists' grade I and II were involved. After end of surgery, patients in Group I received USG guided unilateral TAP block using 20mL bupivacaine 0. 5% and those in Group II received IIN/IHN block using 20mL bupivacaine 0.5%, intravenous (IV) morphine was used as a rescue analgesic postoperatively. Assessment of postoperative pain was the primary outcome, total analgesic consumption in the first 24h, first time of analgesic request, post-operative hemodynamics and any complications related to technique or to rescue analgesia were also recorded.

Results: Comparison of the median values of NRS at rest and at movement among the studied groups revealed that there was a significant increase in its values in group I compared to group II at 2 and 4 hours post-operatively, time to first analgesic request was statistically prolonged in group II than group I with the median time of 8 and 4 hours postoperatively respectively. Morphine consumption which was statistically reduced in group II in comparison with group I with the median value of 6mg and 9mg respectively. Significant hemodynamic stabilization (mean arterial blood pressure and heart rate) was recorded with TAP group compared with II/IH group. Neither complications due to the block (as hematoma and local anesthetic toxicity) nor due to the rescue morphine analgesia (as respiratory depression nausea and vomiting) occurred in both groups.

Conclusions: Ultrasound guided transversus abdominis plane (TAP) block reduces the postoperative pain and analgesic consumption compared to ultrasound guided ilioinguinal and iliohypogastric nerve (IL/IH) block in patients undergoing inguinal hernia repair.

Key Words: *Transverus abdominis plane block – Bupivacaine - Inguinal hernia surgery.*

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Introduction

DESPITE improvements in patient care, data suggest that postoperative pain is not managed correctly and many patients still experience pain after surgery **[1,2]**.

Inguinal hernia repair, a frequently performed surgical technique **[3]**, is accompanied by around 60% incidence of moderate to severe postoperative pain **[4]**. It is also linked with a 0-54% incidence of chronic pain, particularly in patients suffering from significant preoperative and instant postoperative pain **[5]**.

Regional nerve block procedures propose a great degree of post-operative pain relief thus helping early ambulation and discharge.

The transversus abdominis plane (TAP) block is a sole, quickly rising regional anesthesic technique that give analgesia to the parietal peritoneum as well as the skin and muscles of the anterior abdominal wall following abdominal surgery. It has become progressively popular worldwide because of its relative ease and efficiency **[6]**.

On the other hand, iliohypogastric/ilioinguinal nerve block (IH/IN) is mainly used for inguinal herniorrhaphy in addition to procedures such as orchiopexy, hydrocelectomy, cesarean section, circumcision, varicocelectomy alone or in combination with other blocks such as genitofemoral nerve block **[3]**.

The efficacy of TAP and IIN/IHN blocks for post-operative pain following inguinal hernia surgeries has previously been compared by a few authors, but the results are conflicting [7,8].

Aim and objectives:

The aim of this study was to compare the analgesic efficacy of Ultrasound-guided ilio-inguinal and ilio-hypo gastric (II/IH) nerve block with Ultrasound-guided transversus abdominis plane (TAP) in adult patients planned for elective unilateral inguinal hernia repair.

Patients and Methods

This prospective randomized blind study was conducted in Tanta University Hospitals, on 80 male patients aged from 18 to 50 years, ASA class I-II assigned for inguinal hernia repair for six months started at June 2017 after approval from ethical committee of Tanta University with approval code 31627/06/17. A written informed consent had been obtained from all patients. Every patient received an explanation for the purpose of the study and had a secret code number to ensure privacy of the participants and confidentiality of the data, and research results only used for scientific purposes. Patients with known allergy to local anesthetics or history of opioid or analgesic intake 48 hours before surgery were excluded.

Patients were randomly allocated with computer generated random numbers and closed envelops into two equal groups 35 patients for each: Group I: Ilio-inguinal and ilio-hypo gastric (II/IH): Patients of this group underwent ultrasound-guided ilio-inguinal and ilio-hypo gastric (II/IH) nerve block after the end of surgery with 20ml of 0.5% bupivacaine and Group II: Transversus abdominis plane (TAP): Patients of this group underwent uultrasound-guided transversus abdominis plane (TAP) block after the end of surgery with 20ml of 0.5% bupivacaine. The measurements were taken by another anesthetist who has no subsequent involvement in the study.

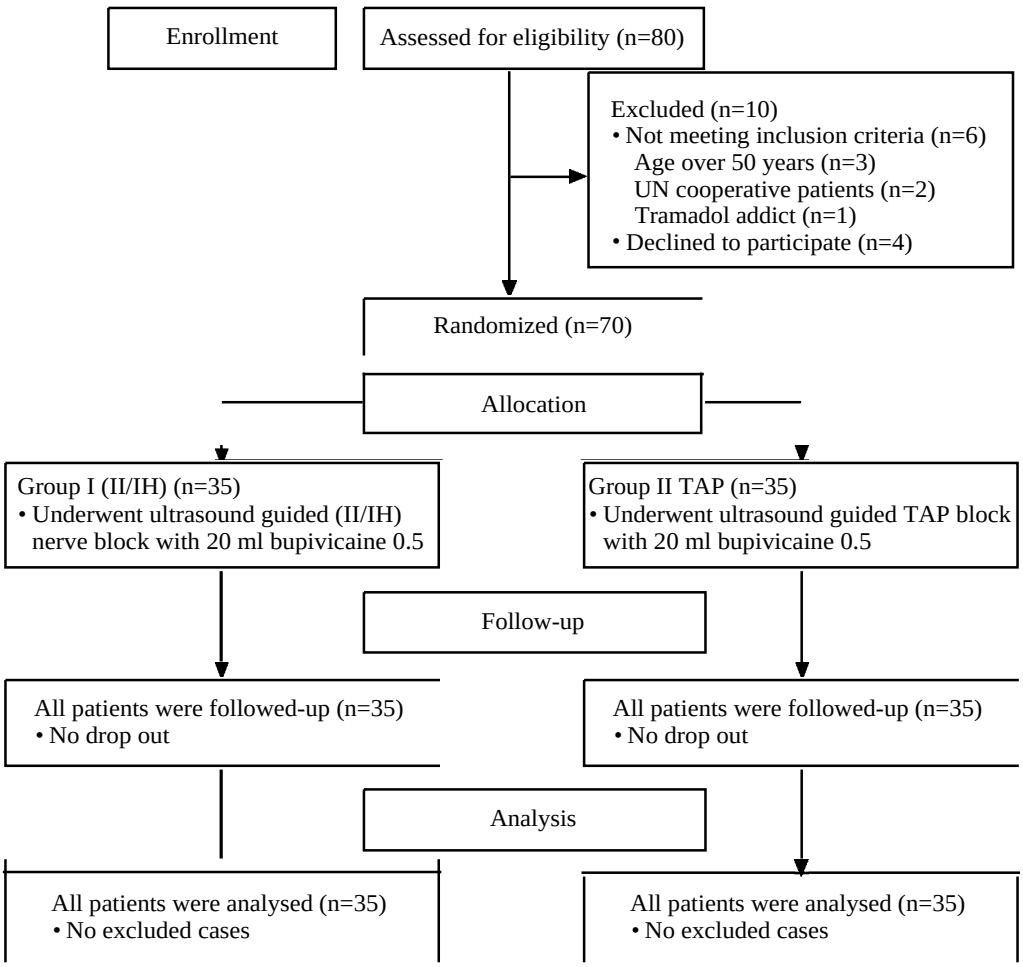

Fig. (1): Patient flowchart summarizing enrollment, allocation, follow-up and analysis in the study protocol.

In group I: After the end of surgery, while the patient was anesthetized under complete aseptic technique, the linear 12 MHz probe of ultrasound machine (Philips CX50) was placed just medial and slightly cephalic to the upper aspect of the anterior superior iliac spine, the 22G spinal needle was advanced using an out-of-plane technique, placing the needle tip 1 cm caudal to the probe surface and 1 cm deep to allow for optimal needle tip visibility. Advancement of the needle was continued until a specific 'tenting' of the boundary between the internal oblique and transversus abdominis muscles in this level the two nerves were detected and small vessels were seen near to them. The needle was then further advanced deep to this boundary (usually associated with a sensation of 'give-pop'). At this point 20ml of bupivacaine 0.5% was injected.

In group II: After the end of surgery, while the patient was anesthetized under complete aseptic the linear 12MHz probe ultrasound machine (Philips CX50) was placed in the mid-axillary line just above the iliac crest in a transverse plane to the lateral abdominal wall. The three muscle layers were observed (external oblique muscle, internal oblique muscle and transverses abdominis muscle. The 22G spinal needle was advanced immediately anterior to the probe using in-plane needle-probe orientation and advanced posteriorly until the needle was observed to penetrate the interface between the internal oblique and transverses abdominis muscles. Thereafter, 20ml of bupivacaine 0.5% was injected.

After the termination of the surgery, all patients were monitored for 24 hours, and there was no drop out.

Measurements: Assessment of postoperative pain (as primary outcome): Pain intensity was measured and documented by numerical rating scale (NRS) in the postoperative period at rest (NRS -R) and at movement (NRS -M), and was recorded at 30 minutes after recovery and 2 nd, 4th, 8th, 12th, 18th and 24th hours post operatively. If the NRS value is >3 the patient was given rescue analgesia in the form of 2mg morphine IV bolus if the body weight <60 Kg, or 3mg morphine I.V bolus if the body weight >60Kg with 10 minutes lock-out interval till the NRS value was <3 [9]. The first time when the patient needs rescue analgesic and, the total amount of morphine in the first

24 hours were recorded. Hemo-dynamic monitoring including heart rate and mean arterial blood pressure before induction (base-line value), 30 minutes after recovery, 2 nd, 4th, 8th, 12th, 18th and 24th hours postoperatively. Any complications associated with the technique or to morphine e.g. respiratory depression, nausea, vomiting was recorded.

The sample size was calculated using epi-info software computer program created by center of disease prevention and control Atlanta, USA, WHO, Geneva, version 2002. The primary outcome was NRS at rest and movement. It was found that at least.

35 patients in each group were necessary to find significant difference of 30% in the NRS between the two groups. Group to group ratio 1: 1, with 80% power of the study and cut off statistical significance of 0.05%.

Results

There was no statistical significant difference between the two groups as regard to the demographic data; age, ASA and weight, (p-values >0.05) (Table 1).

There was statistically significant increase in NRS at rest and movement in group I compared to group II at 2 and 4 hrs postoperatively respectively with (p<0.001) indicating adequate analgesia in group II (p>0.05) (Figs. 1,2).

Morphine consumption during the first 24 hours ranged from 6-10mg and 3-9mg with median values of 9 and 6mg in group I and II respectively. There was statistically significant decrease in morphine consumption in group II in comparison with group I (p<0.05) (Table 2).

The median value of first time of analgesic request was 4 hours and ranged from 2-8 hours in group I which was statistically lower than the other group with the median of 8 hours and ranged from 4 to 8 hours with p-value <0.05 (Table 3).

There was statistically significant increase of mean arterial blood pressure (MAP) and heart rate (HR) in group I at 2 and 4 hours at the postoperative period in comparison with group II (Figs. 3,4).

There was no significant difference in the incidence of complications (nausea, vomiting, respiratory depression, hematoma and local anesthetic toxicity) in group I compared with group II.

Table (1): Demographic data of the patients in the two studied groups.

	Group I (n=35) (IL/IH)	Group II (n=35) (TAP)	*p*-value
Age (years):			
Range	25-46	24-47	0.084
Mean ± SD	35±6.94	33±6.11	
Weight (Kg):			
Range	75-95	78-91	0.86
Mean ± SD	87±5.74	84±6.31	
ASA :			
I	27 (77%)	28 (80%)	0.77
II	8 (23%)	7 (20%)	

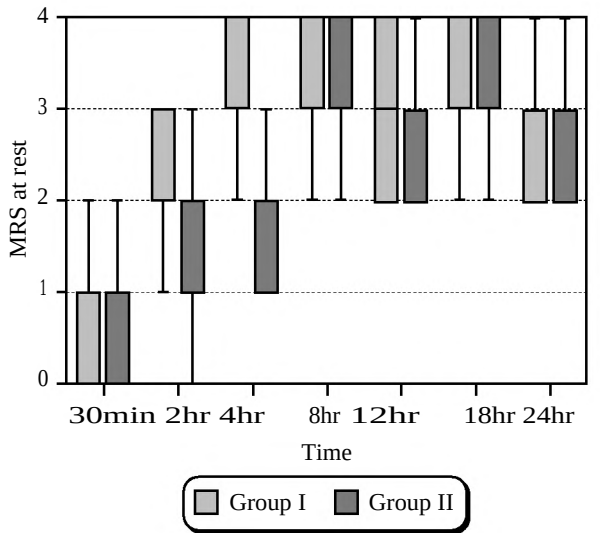

Fig. (1): Comparison of NRS change s at rest in two groups.

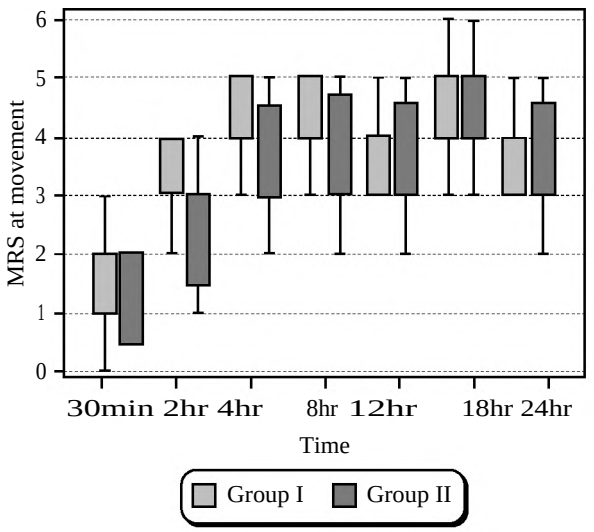

Fig. (2): Comparison of NRS changes at movement in two groups.

Table (2): Total rescue analgesic consumption (mg).

	Group I (n=35)	Group II (n=35)
Median: IQR	8 (9, 10)	6 (6, 9)
p-value	0.01 *	

* Denote significant change (p<0.05).

Table (3): Time of first analgesic requirement (hour).

	Group I (n=35)	Group II (n=35)
Median: IQR	4 (2, 8)	8 (4, 8)
p-value	0.01 *	

* Denote significant change (p<0.05).

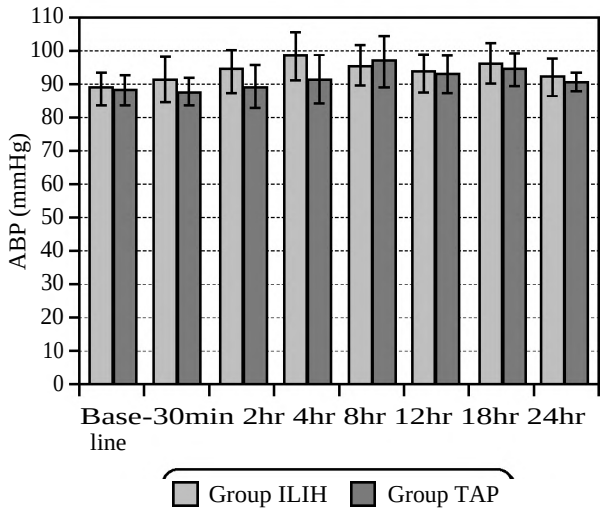

Fig. (3): Comparison of mean blood pressure changes between two groups.

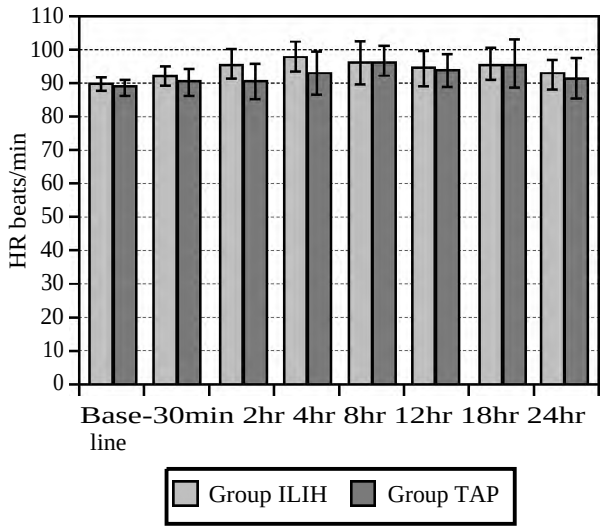

Fig. (4): Comparison of heart rate changes in two groups.

Discussion

Inguinal hernia repair induces parital pain depending on IL/IH distribution, [8] which differs in place with many branches of the nerves at the level of the iliac crest [10]. The site of penetration of the two nerves toward the abdominal wall muscles also varies, so that the more proximal the nerves are blocked, the more effective the block could be [11].

As regard the post-operative pain; comparison between the two groups showed that there was a significant difference in the Numerical Rating Score with pain began earlier and there were significant increases in its value in group IL/IH compared to TAP group. In agreement with our study: Carney et al., [12] conducted a study on patients undergoing total abdominal hysterectomy and compared blind TAP with control group and found that, the VAS was low in TAP group than in the control group at 4, 6, 12, 24, and 36hr postoperatively. However in their study the median values of the VAS score were low for a longer time than in the present study and this can be attributed to the use of different local anesthetic in the form of ropivacaine.

0.75% also they used basic analgesia in the form of paracetamol 1gm/6 hours and rectal diclofenac 100mg/16 hours on admission to PACU. Also, Aveline et al., [8] compared ultrasound-guided transverses abdominis plane block with blind II/IH nerve blocks for day care inguinal hernia repair on 273 patients, and reported that the TAP block patients expressed significantly less pain at rest on VAS scores at 4, 12, and 24h postoperatively. however, the longer duration of analgesia compared to the present study may be related to the basic analgesia given to all patients in the form of combination of paracetamol 1gm/6 hours and ketoprofen 150mg/12 hours postoperatively. Moreover, Bhattacharjee et al., [13] compared bilateral pre incisional TAP block with bupivacaine, 0.25% (0.5ml/kg body weight on each side) with TAP block with normal saline only (control group) on 90 adult female patients ASA I or II, and revealed that immediate postoperative VAS (rest and movement) was lower in TAP group than the control group. Also, Venkatraman et al., [6] carried out a study comparing ultra sound guided TAP with ropivacaine (group TAP) versus TAP with normal saline (control group) in patients undergoing inguinal hernia repair under spinal anesthesia and found that the VAS score was significantly less in TAP group at 4, 6, and 12 hours postoperatively compared to control group. Conflicting with our results is the study of Petersen et al., [7] who studied the analgesic effect of ultrasound guided TAP block versus IL/IH block plus wound infiltration in inguinal hernia repair. They demonstrated that their patients didn't benefit from the procedures in either group which didn't reduce the post-operative pain compared to placebo. This may be attributed to the use of basic analgesic regimen in the form of paracetamol 1 gm and ibuprofen 400mg every 6 hours , initiated 30min before surgery which may mask the analgesic outcome of the blocks. Also they didn't asses the pain from 8 to 9 hours postoperatively and so there is a limited information on any differences among the groups during this period.

Also, Mohamed et al., [14] compared ultrasound-guided ilioinguinal/iliohypogastric (IL/IH) nerve block versus ultrasound guided TAP block for pediatric inguinal hernia repair on 50 pediatric patients and reported that pain score in IL/IH group was less than pain score in TAP group. The discrepancy between their study and our findings may be due to the fact that pediatric herniotomy procedures are done with minimal incision without placing a mesh whereas adult patients require extensive dissection and tissue trauma along with mesh placement.

Moreover, Kamal et al., [15] compared ultra sound guided TAP with ultra sound guided IL/IH in inguinal hernia repair using ropivacaine 0.75% on 60 adult patients and found that IL/IH group is superior to TAP group in postoperative pain as VAS score was higher in group TAP at 2hr, 4hr, 6hr, 8hr. The discrepancy between our findings and this study may be related to the technique of the block of ilioinguinal and iliohypogastric as they didn't visualize the nerve he only visualize the plane between internal oblique and transversus abdominis which is considered one of the types of TAP.

As regard total dose of analgesic requirement; our results showed that the median value of total dose of analgesic consumption (morphine) in TAP group was significantly reduced compared with IL/IH group. Our findings were in accordance with the results of Carney J. [12] and Venkatraman et al,(6) who reported that the total dose of analgesic requirements was reduced in TAP group than control group. Also Aveline et al., [8] found that I.V morphine titration doses in the PACU were low and comparable in the IL/IH and TAP groups, respectively. However, patients in the TAP group required less oral morphine tablets during the first two post-operative days. Similarly Pratheeba et

al., [16] concluded that the total dose of rescue analgesia were significantly lower in TAP group compared with wound site infiltration. On the contrary, Mohamed et al., [14] concluded that the number of patients who required rescue analgesia was lower in IL/IH group compared with TAP group and this can be explained by the difference in age and in the technique of operation. Also Bhatia et al., [17] in their study found that the median of the total consumption of rescue analgesia in the first 24 hours were comparable between the medial TAP and IH/IH groups. This may be due to the difference approach of the TAP block; also their patients received basic analgesic in the form of paracetamol 1gm/6 hours with the first dose given at the end of the surgery.

As regard first time of analgesic request; our result reported extended time of first analgesic request in TAP group than in IL/IH group. In agreement with our results Carney J. [12] found that the first analgesic request was extended in TAP group than in control group. Also, Bhattacharjee S. [13] reported that the time of first analgesic request was longer in TAP group 290min (4.8 hrs.) than in control group 16min (0.26 hr). Moreover, Venkatraman et al., [6] reported that the time of the first analgesic request in TAP group was 439.5 min (about 7.3 hours) which was the same time as that of TAP group in the present study. Furthermore, Sujatha et al., [18] compared U-S guided TAP versus US-guided IL/IH plus wound infiltration in inguinal hernia repair and showed extended time of 1 st analgesic request in TAP group than IL/IH plus wound infiltration group. Also Pratheeba et al., [16] reported that patients who underwent TAP block took significantly longer time (6hr) to request for the first rescue analgesic compared with wound site infiltration (4hr). While, in the study of Bhatia et al., [17] the time of the first analgesic request was prolonged in medial TAP group compared to IL/IH group although not statistically significant. Differs from our study Mohamed et al., [14] concluded that the average time to first rescue analgesia was longer and the duration of analgesia was more stable in IL/IH group compared with TAP group. This difference can be explained by variation of age and technique of operation in their study.

As regard hemodynamics; in our study; comparison of the mean value of HR and MAP showed stable hemodynamics in both groups with significant decrease in TAP group compared with IL/IH group at 2hr and 4hr post operatively which was within the physiological range. In agreement with our results Bhattacharjee et al., [13] reported that there was a significant decrease in intraoperative hemodynamics in TAP group than in control group. In contrast to our results Sujatha et al., [18] found that there was no difference between TAP group and IL/IH group, this can be explained by addition of local wound infiltration with IL/IH block.

During our study, complications due to the technique as hematoma or local anesthetic toxicity did not occur. Also complication due to rescue analgesia as postoperative nausea and vomiting, sedation or respiratory depression did not occur. This was in accordance with the result of Aveline et al., [8], Petersen et al., [7], Bhattacharjee et al., [13], Htun et al., [19], Venkatraman et al., [6] and Bhatia et al., [17].

Conclusions:

Ultrasound guided transversus abdominis plane (TAP) block reduces the postoperative pain and analgesic consumption compared to ultrasound guided ilioinguinal and iliohypogastric nerve (IL/IH) block in patients undergoing inguinal hernia repair.

Conflicts of interest:

No conflicts of interest declared.

Authors' Contributions:

All authors had equal role in design, work, statistical analysis and manuscript writing.

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تسكين الألم الناتج عن إصلاح الفتق الاربى بواسطة التخدير الموضعى للعصب الحرقفى الإربى والعصب الحرقفى الغضروفى باستخدام جهاز الموجات فوق الصوتية
مقارنة بالتخدير الموضعى للعضلة البطنية المستعرضة باستخدام جهاز الموجات فوق الصوتية

المقدمة: تعتبر عمليات إصلاح الفتق الاربى من أكثر الجراحات شيو عاً فى العالم والألم الناتج عنها يتراوح بين المتوسط والشديد ويصاحبه تأخر عودة المريض للممارسة حياته الطبيعية وأيضاً استمرار الألم ما بعد الجراحة ويعتبر التخدير الموضعى للعضلة البطنية المستعرضة مجالاً رائداً وسريع التطور فى مجال التخدير الموضعى والذى يعطى تخديراً موضعياً للغشاء البريتونى الخارجى والجلد والعضلات فى الجدار الأمامى من البطن ما بعد جراحات البطن وقد نال هذه الشهرة لبساطته وفاعليته.

يعتبر التخدير الموضعى للعصب الحرقفى الأربى والعصب الحرقفى الغضروفى من طرق التخدير التى تم ابتكارها لعلاج الام ما بعد اصلاح الفتق بالإضافة لجراحات الخصية والولادات القيصرية والطهارة واستئصال التكيسات الدموية حول الخصية مع تخدير العصب الفخذى.

الهدف من البحث: الهدف من هذه الدراسة هو مقارنة التخدير الموضعى للعضلة البطنية المستعرضة باستخدام السونار بالتخدير الموضعى للعصب الحرقفى الأربى والعصب الحرقفى الغضروفى باستخدام السونار وذالك لتسكين الألم الناتج عن جراحات إصلاح الفتق الاربى.

المرضى وطرق القياس: تم إجراء هذه الدراسة فى أقسام الجراحة العامة بمستشفيات جا معة طنطا بعد موافقة لجنة أخلاقيات البحث الطبى بجامعة طنطا على سبعين مريضاً ذكراً خضعوا لإجراء جراحة إصلاح الفتق الاربى. تم تقسيم المرضى باستخدام جهاز الكمبيوتر إلى مجمو عتين كل مجموعة المجموعة الأولى (٣٠ مريض): تم تخدير العصب الحرقفى الغضروفى والعصب الحرقفى الأربى موضعية باستخدام جهاز الموجات الفوق صوتية وحقن ٢٠ مللى ليتر من عقار البريبفيكين بتركيزه ٠.٥٪.

فى كلا المجموعتين سوف يتم قياس كلا من:

تقييم الألم بعد الجراحة تم تقيم الألم بعد الجراحة باستخدام مقياس التناظرية البصرية ويتراوح من : إلى أحيت من (٠ إلى ٣) ألم بسيط ومن (٤ إلى ٦) ألم متوسط وأكثر من ٦ ألم شديد ويتم قياس الألم أثناء الراحة وأثناء الحركة بعد الجراحة بـ ٣٠ دقيقة وبعد ساعتين وأربع ساعات و ٨ ساعات و ١٢ ساعة و ١٨ ساعة و ٢٩ ساعة وعندما يكون مقياس الألم أكثر من ٣ يتم إعطاء المريض عقار المورفين كمسكن للألم.

- أول وقت يحتاج فيه المريض للمسكن.
- الجرعة الإجمالية لعقار المورفين فى خلال ساعة.
- لعلامات الحيوية للمريض مثل النبض والضغط قبل العملية وبعد العملية بنصف ساعة وساعتين و ٤ ساعات والساعات و ١٢ ساعة و ١٨ ساعة و ٢٤ ساعة.

وكانت النتائج كالآتى:

- أولاً لم يوجد فارقاً بين المجموعتين من تجاه البيانات الديموغرافية (الوزن والسن).
- مقياس الألم عن طريق مقياس التناظرية البصرية أثناء الحركة والسكون أوضح أن قياسات المجموعة الثانية أقل على مقياس التناظرية البصرية لقياس الألم من المجموعة الأولى عند الساعة الثانية والرابعة بعد التخدير الموضعى وكانت القياسات ذات دلالات إحصائية.
- متوسط الوقت الذى احتاج فيه المريض لمسكن المورفين كان أطول فى المجموعة الثانية من المجموعة الأولى وكان الفرق ذا دلالة إحصائية.
- متوسط جرعة المورفين فى المجموعة الثانية أقل من متوسط جرعة المورفين فى المجموعة الأولى وكان الفرق ذا دلالة إحصائية.
- المجموعة الثانية كان متوسط قياسات الضغط الدموى فيها أقل من المجموعة الأولى وذلك عند الساعة الثانية والساعة الرابعة بعد التخدير الموضعى وكذالك قياسات النبض وكانت القياسات ذات دلالات إحصائية.
- لم يكن هناك فرق فى حدوث المضاعفات بين المجموعتين سواء الخاصة بطريقة الحقن أو الخاصة بالمورفين.

نستخلص من هذا البحث: أن التخدير الموضعى للعضلة البطنية المستعرضة استرادا بجهاز الموجات فوق الصوتية أكثر فاعلية من التخدير الموضعى للعصب الحرقى الأربى والعصب الحرقفى الغضروفى باستخدام جهاز الموجات فوق الصوتية.