Open 3-step local anesthesia technique is a more applicable method as compared with spinal anesthesia in inguinofemoral hernia repair

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ABSTRACT

الأهداف: عمل مقارنة بين الآثار المترتبة من اعتماد التخدير النخاعي وتلك المترتبة من التخدير الموضعي الذي يمر بثلاثة مراحل وذلك في عملية إصلاح الفتق الإربي.

الطريقة: أُجريت هذه الدراسة الاسترجاعية في وحدة الجراحة العامة بمستشفى أرداهان العسكري، أرداهان، تركيا وذلك خلال الفترة من يناير 2005م إلى أغسطس 2006م. شملت الدراسة 55 مريضاً كان سيخضع لعملية إصلاح الفتق الإربي، وقد تم تقسيم المرضى إلى مجموعتين وهما: مجموعة التخدير الموضعي الذي يمر بثلاثة مراحل، ومجموعة التخدير النخاعي. ومن ثم قمنا بجمع البيانات التالية: صفات المرضى، والاختبارات التي أجريت على المرضى قبل وبعد العملية الجراحية، ومتوسط الألم والغثيان بعد إجراء العملية الجراحية.

النتائج: أشارت النتائج إلى أن متوسط الوقت التحضيري قبل إجراء العملية الجراحية قد وصل إلى 24.56±8.85 دقيقة وذلك لتحفيز التخدير في عملية التخدير النخاعي، فيما لم تستدعي العملية الجراحية بالتخدير الموضعي وقتاً تحضيرياً. لم تظهر نتائج المقياس التماثلي النظري لكلي المجموعتين أي فروقاً واضحة بين الساعات الثمانية والأربعة والعشرين بعد إجراء العملية الجراحية. وعند النظر إلى مضاعفات العملية الجراحية في المجموعتين فقد تبين إصابة 3 مرضى بالصداع، ومريضين بالغثيان، و5 مرضى بالاحتباس البولي وذلك في مجموعة التخدير النخاعي.

خاتمة: أثبتت الدراسة مدى فعالية وأمان التخدير الموضعي الذي يمر بثلاثة مراحل، كما أنها تعد تقنية مناسبة للمرضى البالغين، وهذا بغض النظر عن العوامل السلبية التي تستثني بعض المرضى من إجراء هذا النوع من التخدير وهي كالتالي: رفض المريض لهذا التخدير، أو الإصابة بالحساسية من هذا التخدير فيما سبق، أو إغماءات وعائية مبهمية سابقة خلال التخدير الموضعي، بالإضافة إلى عدم تعاون المريض من جراء الإصابة باضطراب نفسي أو وجود عائق اللغة.

Objectives: To compare the effects of spinal anesthesia with those of the open 3-step local anesthesia (TSLA) technique under visual control.

Methods: Between January 2005 and August 2006, the data of 55 patients undergoing groin hernia repair with either the TSLA technique or spinal anesthesia (SA) were collected via retrospective case note review at the General Surgical Unit of the Ardahan Military Hospital, Ardahan, Turkey. Patient characteristics, preoperative and postoperative measurements prior to discharge, average pain, and nausea during the postoperative hospital stay were recorded.

Results: While there was no preoperative preparation time for the induction of anesthesia in the TSLA method, it was found that a preparation time of 24.56±8.85 minutes was required for the SA preoperatively. The evaluation of the visual analogue scores of both groups yielded no significant differences between the eighth and twenty-fourth hours. When the postoperative complications in both groups were considered, 3 patients had headache whereas 2 had nausea, and 5 had complications of urinary retention in the SA group.

Conclusion: Except for the negative factors such as patient refusal, allergic reaction history, previous vaso-vagal episode, or fainting during local anesthesia, incooperability caused by psychiatric disorder or language barriers, the results of the present study indicate that the TSLA is a safe, effective, and appropriate anesthetic technique in the adult age group.

Inguinal hernia repair is one of the most commonly performed operations worldwide. In 1996, 756,000 groin hernias (730,000 inguinal and 26,000 femoral) were repaired in America, and every year, approximately 80,000 inguinal hernia repairs are performed in the United Kingdom.[1,2] Overall, general, local, spinal, epidural, and, less than these techniques, paravertebral nerve blocks are utilized in hernia repair.[1,3] However, there is no common consensus among surgeons regarding the best choice of anesthesia for this sort of operation. Several retrospective and randomized controlled trials have shown that local anesthesia (LA) provides the best clinical and economical benefits to patients.[2,4] The spinal anesthesia technique (SA) has also been one of the choices for inguinal hernia repair. The common complications of SA are postural puncture headache, urinary retention, transient neurologic syndrome, bradycardia, and cardiac arrest.[2] The achievement of any operation under LA requires a surgeon being aware of the anatomy of the region where the anesthesia is applied. Although the deep inguinal ring is an important landmark regarding anatomy of the inguinal canal, there is no uniformity on its exact surface marking in the standard textbooks of anatomy or surgery.[5,6] This may be explained by anatomical diversities. Therefore, precise knowledge of the regional anatomy is essential for accurate clinical diagnosis and correct technical management of surgical disorders. In inguinal hernia repair, there is a possibility of failure to induce anesthesia even if the anesthetic agent is administered through the same locations several times. The aim of this study was to compare the effects of SA with those of the open 3-step local anesthesia technique (TSLA) under visual control.

Methods. Between January 2005 and August 2006, 55 patients undergoing groin hernia repair with either TSLA or SA in the General Surgical Unit of Ardahan Military Hospital, Ardahan, Turkey were screened. All patients received written information on the operations and gave verbal consent to participate. This retrospective study was ethically approved by the local ethics committee. Exclusion criteria were set as hernia recurrence, patient refusal, allergic reaction history, previous vaso-vagal episode, or fainting during LA, incooperability caused by psychiatric disorder or language barriers. The data collection was performed via retrospective case note review. Patient characteristics in addition to preoperative and postoperative measurements (age, body mass index, Nyhus classification, American Society of Anesthesiologists classification, operation type, operation time, complications) were recorded. Prior to discharge, average pain, and nausea during the postoperative hospital stay was evaluated with the visual analogue scale (VAS), and scored as 1=no pain or nausea to 10=most severe. Rest pain scores (patients at rest) at the eighth and twenty-fourth hours were recorded, and intraoperative and postoperative complications were also documented.

Open three-step local anesthesia method. Following preoperative preparation of the surgical area, local anesthesia was applied by the surgeon with a 50:50 mixture of prilocaine and 0.5% bupivacaine in accordance with the local infiltration technique described by Amid and colleagues.[7] The stages of the TSLA technique involves (1) skin anesthesia in the line of the incision, (2) blockage of the nerve supplies to the deeper tissues, and (3) anesthesia of the parietal peritoneum of the hernia. *Step 1: Skin anesthesia in the line of the incision.* After skin disinfection with the antiseptic solution, a skin wheal was raised longer than the intended incision under LA. Then, a skin incision was made 2 to 3 cm above and parallel to Poupart's ligament[8] (**Figure 1**). *Step 2: Blockage of the nerve supply to the deeper tissues.*
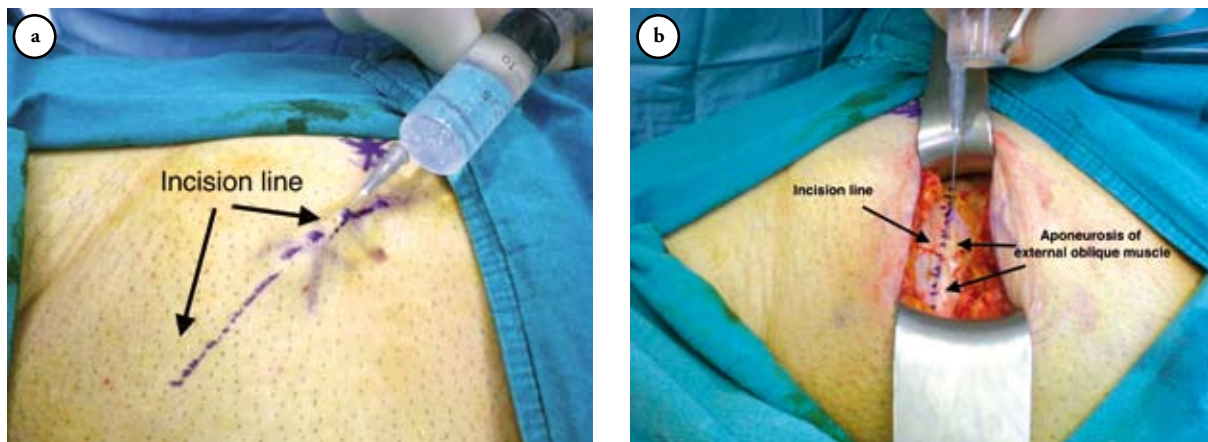

Figure 1 - Injection of the local anesthetic solution to the skin and subcutaneous tissues showing **a)** skin, and **b)** fascia.
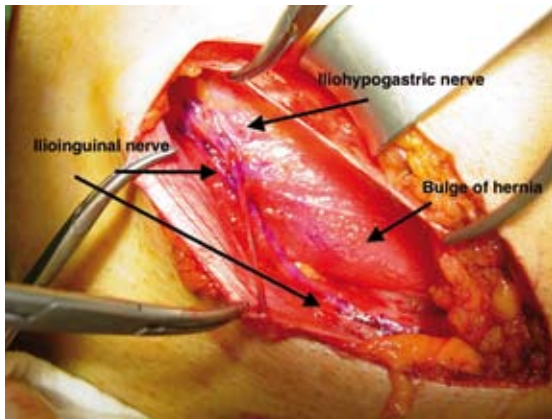
Figure 2 - Injection of the local anesthetic solution into the external oblique aponeurosis to anesthetize the ilioinguinal and iliohypogastric nerves.
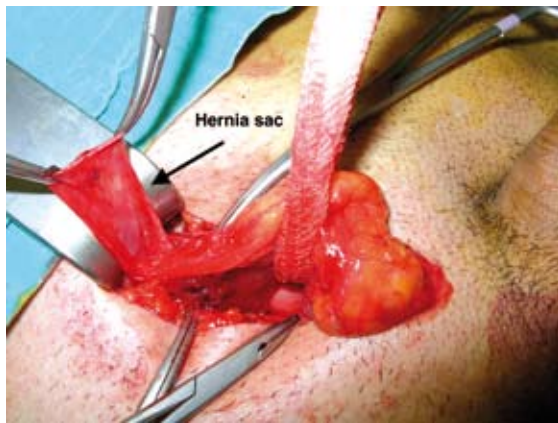

Figure 3 - Additional local anesthetic might be injected into the peritoneal area.

Iliohypogastric and ilioinguinal nerves (T12 and L1) innerve the lower abdomen. The LA solution was injected into the external oblique aponeurosis for blocking of the ilioinguinal and iliohypogastric nerves (**Figures 1 & 2**). In this region, iliohypogastric and ilioinguinal nerves lie under the external oblique fascia.[8,9] After a small incision was made through the external oblique fascia, the ilioinguinal nerve was elevated from the fibers of the cremaster muscle and sharply freed along its course. It extends into the medial side of the external inguinal ring. Then, the iliohypogastric nerve was seen in this step. The anesthetic solution might be injected near the root of this nerve if it is necessary. Catching or cutting the ilioinguinal and iliohypogastric nerve were avoided. The LA solution might also be injected into the base of the inguinal cord at the deep ring, since blocking these nerves decreases the sensitivity of the pubic tubercle and Cooper's ligament to painful stimuli. If deep sutures were placed in Cooper's ligament or pubic tubercle, injection of the anesthetic solution was crucial.[9] The

hernia sac was seen as a definite white membrane. *Step 3: Anesthesia of the parietal peritoneum of the hernia.* The sac was freed. In this step, the patient might be feeling pain and nausea. The parietal peritoneum is supplied by somatic nerves. The discomfort elicited was the visceral type of pain when undue traction was exerted upon the cord.[9] In this step, additional LA might be injected into this peritoneal area (**Figure 3**). Following that, hernia repair might be accomplished with any chosen technique.

Spinal anesthesia method. In the SA group, the induction of anesthesia was performed by the administration of 3 ml of 0.5% bupivacaine using a pencil point 25 gauge spinal needle through the L3-L4 intervertebral space in the lateral decubitus position, while the patient was lying on the same side as the hernia.

Variables such as age, operation time, and VAS values were compared with the student t test. P-values less than 0.05 were judged to be significant. The Statistical Package for Social Sciences version 16 (SPSS Inc, Chicago, Illinois, USA) was used for statistical tests.

Results. Patient characteristics are shown in **Table 1**. There were no intraoperative complications. With respect to patient age, there was no significant difference between both groups ($p=0.806$). Patients' body mass indexes (BMI's) were evaluated and no significant difference was found between both groups. All patients were ASA I. Regarding hernia types based on the Nyhus classification, 13 patients were type 2,

Table 1 - Patient characteristics of the 2 groups.

Characteristics	TSLA group (n=16)	SA group (n=39)
Age (mean±SD)	21.31±1.74	21.15±2.78 ($p=0.806$)
Body mass index		
Normal (<25)	13	34
Overweight (25-30)	3	5
ASA		
I	16	39
II	0	0
III	0	0
Hernia type (Nyhus classification)		
I	0	0
II	13	32
IIIA	2	4
IIIB	1	3
IIIC	0	0
IV	0	0
Operation type (mesh/without mesh)	7/9	27/12
Operation time (min) (Mean±SD)	61+9	58+14 ($p=0.421$)
Preoperative preparation time (min) (mean±SD)	0	24.56+8.85

TSLA - 3-step local anesthesia, SA - spinal anesthesia,
ASA - American Society of Anesthesiologists

Table 2 - Visual pain scores of the 2 groups.

Pain scores	TSLA group (n=16)	SA group (n=39)	*P*-value
Pain score at rest (8 hours) (mean±SD)	2.93±0.77	2.55±0.68	0.096
Pain score at rest (24 hours) (mean±SD)	1.37±0.5	1.42±0.5	0.760

TSLA - 3-step local anesthesia, SA - spinal anesthesia

Table 3 - Operative and postoperative problems in the patients of the 2 groups.

Problems	TSLA group (n=16)	SA group (n=39)
Fatigue (8h/24h)	1/0	7/1
Headache	0	3
Nausea	0	2
Voiding problem	0	5
Bleeding	0	0

TSLA - 3-step local anesthesia, SA - spinal anesthesia

2 patients were type 3A, and one was type 3B in the LA group. Using TSLA, hernias of 7 patients were repaired applying mesh patches, and patchless repair was conducted in 9 patients. In the SA group, hernias of 27 patients were repaired using mesh patches and patchless repair was conducted in 12 patients. There was no significant difference between both groups in terms of operation time (*p*=0.421). While preoperative preparation time was not necessary for the induction of anesthesia in the TSLA method, a preparation time of 24.56±8.85 minutes was required for SA preoperatively (**Table 1**). The evaluation of the VAS scores of both groups yielded no significant differences between eighth and twenty-fourth hours (**Table 2**). The postoperative complications in both groups are shown in **Table 3**.

Discussion. Inguinal hernia repair is one of the most commonly performed operations all over the world. Various types of anesthesia such as general, local, or SA are utilized in this operation. In adults, LA for hernia repair has been widely used with or without sedation around the world for the past 50 years.[10-12] The choice of anesthesia is influenced by the patient preferences and needs.[4,13] In the present study, the patients undergoing inguinal hernia repair with either SA or TSLA techniques were evaluated and the latter described.

All these anesthetic techniques aim to provide patient safety, good operating conditions, and timely discharge.[4] Most of the randomized and retrospective trials on inguinal hernia repair have shown the superiority of LA over GA in terms of reduced postoperative pain, earlier

mobilization, fewer urinary problems, higher day case rates, and greater patient satisfaction.[13,14] The LA was reported to provide the best clinical and economical benefits to patients.[4] Local anesthetic avoids the risks of GA,[14] and enables faster induction. Therefore, the interval between the operations in the operating theatre is shortened.[15,16] While there was no need for pre-op time for TSLA, the induction of SA required an additional 23 minutes on average in the present study. This represents an additional time loss for the surgeons during daily activities. Furthermore, shortening of operating theater occupation time could improve the overall performance of the healthcare facility.[4,17] The TSLA imposes a gentle technique because the patient is only interested in a painless operation at this stage. The idea of walking out of the operating theater boosts patient's morale preoperatively, and has a great impact on short hospital stay.[18,19] A conscious patient can be asked to cough to identify an evasive hernia or to test a repair in the operating room.[2,14] The cost of LA for inguinal hernia repair is cheaper than GA.[17,20] Immediate postoperative complications are fewer with the questionable exception of discomfort experienced in the first 24 hours.[14,18,19] In addition, cardiovascular instability, and urinary retention in the postoperative period occur at very low rates.[2,17,20] In a large multicenter randomized trial with 616 patients comparing LA with regional or GA in Sweden, LA was shown to be associated with less pain in the early postoperative period, less urinary retention, and shorter duration of hospital stay than those with regional or GA.[15] In accordance with the results from another large-scale study on LA, no case of urinary retention was reported.[16] More frequent rates of unrestricted fluid load after spinal and GA have been reported.[21] Troublesome clinical issues with neuraxial block include the possibility of postdural puncture headache, urinary retention, transient neurologic syndrome, and profound bradycardia or cardiac arrest.[2] In the present study, no statistical differences regarding the VAS scores were found between the 8 and 24-hour values parallel to the above-mentioned findings. Moreover, there were more postoperative complications among the SA group.

The location of the deep inguinal ring is of importance in the context of inguinal hernias, and it changes during the development of the inguinal canal. A preliminary survey of surgeons revealed confusion of the anatomy of the inguinal region.[2] Similarly, a review of the literature demonstrated conflicting opinions regarding the surface landmark of the deep inguinal ring.[22] The TSLA technique consists of iliohypogastric, ilioinguinal, and genito-femoral nerve blocks, and incision line anesthetic infiltration.[7,8] These nerves arise from the lumbar plexus and are situated above and

lateral to the cord.[23] A conversion rate from LA to GA anesthesia of around 2.5% has been reported, even in specialized hernia centers.[13,24] If these nerves are not seen or not found in the anatomical landmark-assisted method, anesthesia cannot be introduced every time, or it is assumed that it will produce an insufficient analgesic effect. Moreover, the possible overuse and toxicity of LA may lead to the reluctance of application of LA in hernia surgery.[2,6,9,25] Since the anatomic landmarks are used in the LA technique, identification of these locations and administration of anesthetic substance at the right spots are necessary. However, there is always a possibility of missing the exact locations of these nerves. In the TSLA technique, ilioinguinal and iliohypogastrical blocks minimized anesthetic reuse in particular. With this technique, all nerves are seen and blockage is provided under control. Particularly in growing adolescents and morbid obese patients, the location of the nerves may not be accurately found. When the administration of the anesthetic substance to the nerves is not possible, anesthesia cannot be induced.[10,22,23,26] In the employed TSLA technique, these problems are eliminated by ensuring open anesthesia, and this technique seems to be more useful than both LA and SA.

The limitations of this study were exclusion of the older age group, patients with additional systemic diseases, and limited number of patients.

In conclusion, except for the negative factors such as patient refusal, allergic reaction history, previous vaso-vagal episode, or fainting during LA, incooperability caused by psychiatric disorder or language barriers, the results of the present study seem to indicate that the open TSLA is a safe, effective, and appropriate anesthetic technique in the adult age group. Moreover, anterior mesh repair can be safely and effectively performed under TSLA. In the present study, the standard LA procedure was modified to establish a more applicable anesthesia technique for inguinal hernia repair. Its application and outcome were compared in a non-randomized retrospective evaluation based on case file data collection in a limited number of cases. However, there is a need for further prospective randomized studies that include a higher number of patients.

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