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RESEARCH ARTICLE

TESTICULAR ARTERIAL BLOOD FLOW AND SEXUAL DYSFUNCTION?

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ABSTRACT

Objective: In this prospective, secuentially randomized study, acute and chronic pain, testiculer arterial flow measurements and sexual functions were compared between Kugel and Lichtenstein hernia repair which are tension free, with Shouldice repair technic which is tensioned classical repair technic. **Patients and methods:** A prospective series of 92 inguinal hernia repairs performed in 66 patients. Shouldice repair performed to 19, Lichtenstein repair performed to 24 patients and Kugel repair performed to 23 patients. **Results:** No recurrence was seen in the 66 patients for all three groups. Postoperative 2nd hour ($p< 0.001$) and 24th hour ($p< 0.05$) VAS scores were significantly lower in the group K. For the evaluating of the chronic pain in the first year, incidence and limited activity were not significantly different between groups, but we found lesser pain intensity in the group K ($p<0.01$). There were not any erectile dysfunction in all patients. Erectile function results were also better in the Kugel group first year postoperatively, but these differences between groups were not significant. ($p> 0.05$) In the Doppler ultrasound measurements, testicular artery volumes were not different in all groups, but decrease of the flow measurements in Shouldice and Lichtenstein groups were significant. Testicular artery flow decreased in all groups at the postoperative period. **Conclusion:** The technic of preperitoneal Kugel patch repair, is new repair technic which has more satisfied results with less acute and chronic pain, less hospitalisation time, and less time to return to normal daily activity. It is interesting that the three different technics of hernia repairs cause decrease in the testiculer artery flow and volume, and it is significant in Shouldice and Lichtenstein groups, whereas it is not significant in the Kugel group. All repair technics in this study were not effected the erectile function, and there were no differences between groups. It is also interesting that, Kugel patch repair has more advantages on the patient comfort compare to the Lichtenstein repair technic which was accepted a new challenge in the inguinal hernia surgery.

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INTRODUCTION

In the development of the hernia surgery, all new approaches tend to be tension-free repairs aimed to provide better patient comfort, which is one of the main outcome and success of the inguinal hernia repair (Liem, 1997; Zieren et al., 2001). Sexual function and postoperative pain are also important indicators for patients comfort in sexually active patients. Although chronic pain and testicular atrophy following inguinal hernia repair are well known complications, consecutive prospective and comperative studies are rare. Several factors having an influence on the quality of life following to an inguinal hernia repair have been studied, yet little has been reported on sexual function prior and following to operation (Zieren, 2005). The aim of this study was to state expressly the frequency of acute and chronic pain, sexual dysfunctions and testicular artery flow velocity and testicular volume changings related to inguinal hernioraphy and compare anterior classical hernia repair with and without tension and preperitoneal tension-free hernia repair techniques.

MATERIALS AND METHODS

This prospective study was obtained upon an approval Local Ethic Committee. Patients with pain and bulging complaints at the groin and diagnosed as inguinal hernia, between February 2002 and July 2004 were taken into the study. Ninety-three hernia repairs were performed in 66 patients at the General Surgery Department of Firat (Euphrates) University, Elazig, TURKEY. All patients were male. Patients were divided into 3 groups, each contained 25 patients. Kugel patch repair group referred as Group K, Lichtenstein group referred as Group L and Shouldice repair group referred as Group S. The patients with recurrent or incarcerated hernia, scrotal diseases such as tumor or orchitis, previous known sexual disorders, patients were under the age of 18 were excluded from the study.

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The type of anesthesia for all patients was set and confirmed by the consultant staff anesthesiologist, regardless of to know type of operation planning to perform. Classical repair technique was performed as Shouldice repair (Kurzer, 1998), tension-free anterior repair as Lichtenstein repair (Lichtenstein et al., 1989; Page, 2002), or preperitoneal Kugel repair (Kugel, 1999). The duration of operation, hospitalization time and time to return to normal daily activity were recorded. Visual analogue scale (VAS) has been used for the intensity of the acute pain in patients operated under general anesthesia preoperatively, postoperative hour #2 and hour #24, whereas for patients operated under regional anesthesia, VAS was obtained 2 hours following feeling the first pain at the operative site (Rosen, 1997). The chronic pain was evaluated by a modified questionnaire (Table 1) which was presented by Bay-Nielsen et al. (2001) for testing the incidence of the chronic pain (Questionnaire a), evaluating the effect of the pain on the functions, characterizing the pain (Questionnaire b), and constituting the intensity (Questionnaire c) of the chronic pain. For questionnaires a and b; response "yes" referred as 1 point, "no" referred as 2 points. For questionnaire c, "no pain" referred as 1 point, "not important pain" referred as 2 points, "mild pain" referred as 3 points and "severe pain" referred as 4 points. These achieved scores had been used in statistical analyses.

Also for evaluating the erectile function, form of International Index of Erectile Function (IIEF) was performed preoperatively and one year following to operation (8). In according to this index; categorization of patients has been made based on this questionnaire, between 0-5 point was given for each question. 1-10 points referred as the worst dysfunction, 11-16 points referred as moderate dysfunction, 17-21 points referred as slight dysfunction and finally 22-25 points referred as no erectile dysfunction. The testicular arterial flow velocity either inguinal region or scrotal region (Vmax (cm/sec)) and volume changings (cm^3) were recorded by the Doppler ultrasound measurements preoperatively, postoperative month #3, month #6, and month #12. Doppler ultrasonographic measurements had been performed by blind ultrasonographist who did not know operative procedure. The preoperative measurements for patients with bilateral hernia and non-operative site results for patients with unilateral hernia, served as controls. The statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) for Windows, version 9.01 (SPSS®, Chicago, Illinois, USA). The comparison of the groups was performed using the Variance analyze and Duncan Multiple Range tests, and paired t test was performed to compare preoperative and postoperative measures; $p< 0.05$ was considered as significant.

RESULTS

Since patients which disclaimed to continue the study, or did not continue to controls were excluded from the study (2 patients from Group K, 1 patient from Group L, and 6 patients from Group S). Thus, 35 Kugel repair, 33 Lichtenstein repair, and 25 Shouldice repairs, in total number of 93 repairs were performed to 66 patients. The operations were carried out under general anaesthesia in 48 cases (72%), epidural an aesthesia in 15 cases (22%), and spinal anaesthesia in 3 cases (4%) of total 66 cases in order to staff anestesiologists preferences. The characteristics of the treated patients are presented in Table 2. The mean age was 43,35±2.13 years in Group K, 50,58±2.18 years in Group L, and 40,95±3.32 years in Group S. Group L had an older mean age ($p<0.05$). The body mass index (BMI), and follow-up period were same in each groups. The average hospitalization time was 1.17 days in Group K, 1.92 days in Group L, 2.68 days in Group S ($p<0.001$). Time to return to normal daily activity was 5.4 days in Group K, 7.1 days in Group L, and 8.4 days in Group S ($p<0.001$).

Acute pain: No differences were noticed for preoperative VAS scores between groups ($p>0.05$), but the scores in the Group K were significantly lower 2 hours and 24 hours following onset of pain and following operation ($p<0.05$). In addition, when the preoperative results served as control and postoperative hour #24 scores compared between groups, only Group K did have lower VAS scores ($p<0.05$). These scores were higher in other two groups. VAS scores with statistical evaluations are presented in Table 3. Bilaterality of groin hernia was considered, postoperative hour #24 scores interestingly were lower in patients with bilateral inguinal hernia (3.11±1.52 vs 2.1±1.63, $p=0.023$). While distinction about operation type was made, there were no differences between groups ($p>0.05$).

Chronic Pain Questionnaire Results: The Questionnaire-a was evaluating the incidence of chronic pain. 4 patients (17%) in Group K, 4 patients (16%) in Group L, and 5 patients (26%) in Group S including total 13 patiens (20%) reported having a pain in the area of the hernia within the last month one year following to operation. The differences for presence of chronic groin pain between three groups were not significant. The evaluating of the questionnaire-b showed that, impairment of daily activities due to pain was fewer one year following to all kind of operations; but there were no significantly differences between groups. Questionnaire-c was aimed to determine the level of chronic pain. The avarage intensity of the pain in total number of patients and also in each groups one year following to herniorraphy was changed moderate to slight pain significantly when was compared with the pain prior to operation ($p<0.001$). The comparison between three groups showed that, this diminish of the intensity of chronic pain was significantly less after Kugel repair ($p<0.01$) Results of Questionnaires a, b, c are shown in the Table 4. The most frequent pain identifier used prior to operation in all groups was 'constricting' (39.4 %); 'tender' (24.2 %) and 'slight' (21.2 %) were the most used identifier one year following to operation.

Doppler Ultrasound Measurements: The measurements of either operative site or non-operative site of the Doppler measurements in all groups were not statistically different ($p>0.05$). However, preoperative vs each postoperative Doppler measurements of testicular volume and blood flow velocity of the spermatic artery were less effected in Group K. It means inguinal blood flow changings in postoperative year #1, significantly less influenced in Group K compared to other herniorraphies, whereas in Group L; forementioned velocity of these flows were significantly lower in postoperative month #3 and year #1. Similarly, inguinal and testicular blood flow measurements were also significantly less in Group S in postoperative month #3, month #6 and year #1 ($p<0.05$). (Table 5). Testicular volume measurements of all groups were not different at the operating site in all patients ($p>0.05$)

Erectile Function: There was not any erectile dysfunction in all patients prior to and also following to operation. There were

no significantly differences of erectile function scoring results in total number of patients preoperative versus postoperative scoring ($p>0.05$). When the scoring of the erectile function considered for each group, the Group K did have a significantly higher points ($p<0.05$), Group L preoperative and postoperative scores were similar ($p>0.05$), and Group S had minimal lower points which are not significant ($p>0.05$) (Table 6).

DISCUSSION

One of the most important indicators conducting to success of inguinal hernia repair is recurrence rate. While almost perfect results have been reached on recurrence rate following the current hernia surgery, patient comfort has been became an important factor (Hawn, 2006). Therefore success of different techniques have been evaluated and compared with patient comfort. It is well known that acute and chronic pain can be seen following hernia surgery. But exact prevalance and reason of these phenomennon, duration and social results of this pain are not fully understood (Bay-Nielsen, 2001). As far as we know, the evaluation of acute and chronic pain status, daily activity restrictions which reflect patient comfort, testicular volume, erectile dysfunction and testicular artery volume changings which reflect sexually dysfunctions are not well studied in the English Literature yet. Therefore this prospective study was designed to compare forementioned functions following three different inguinal hernia repair techniques.

The best method to measure acute pain is generally performed "Visual Analog Scale" (VAS). In large series, early pain status has been evaluated by VAS following repairment. Lau and Lee (Lau, 2001) advocated that this pain was not related to technique, gender, hernia anatomy and postoperative morbidity, but only related to the age of patients. Similarly, in our study, Group S with less mean age did have higher pain scores. But in contrast to that study, Group L with higher mean age, did have higher pain scores than the Group K. Significant differences were noticed on acute pain scores between groups, and this was realised between different repair techniques and not within mean ages. Many of studies emphasized that tension-free techniques existed with less pain than the tensioned ones. Moreover, preperitoneal approaches carried with less pain than the anterior approaches (Zieren, 1998; Ducic et al., 2004). In the literature, it has been published that following laparoscopic repairment of inguinal hernia, patients did have less acute pain than the other different repairments i.e. Shouldice method (Zieren et al., 1998; Bessell et al., 1996; Wright et al., 1996; Tschudi et al., 1996). However, Paganini et al (20) compared laparoscopic repair with open anterior tension-free techniques, and they did not find any difference of the VAS scores at 6, 9, 24 hours and 7 days following to operation. In fact, they interestingly found higher pain scores in laparoscopic arm 48 hours following to operation. In according to hydrostatic pressure principles, mesh placement to the preperitoneal space represents more physiologic approaches in the inguinal hernia surgery (i.e. Stoppa and Fruchaud) (Klosterhalfen et al., 1998). This perspective has been an idea to Kugel for his original though, novel, tension free, sutureless preperitoneal hernia repairment technique and it has been more popular since first published (Kugel, 1999). In our study it has been stated that minimally invazive, tension-free, preperitoneal Kugel repair with small incision was found to have a lower acute pain scores compared to Lichtenstein and Shouldice repairs, as reported before (Reddy et al., 2005).

There is an increasing thought about the cause of chronic pain and why preperitoneal approaches i.e. Kugel repair, laparoscopic repair appear to be superior to anterior approaches (Ducic, 2004). The injury of the ilioinguinal, iliohypogastric or genitofemoral nerves is the main possibly responsible cause of chronic pain (Bay-Nielsen et al., 2001; Collaboration, 2009). Amid PK from Lichtenstein Hernia Institute, suggested triple cut off forementioned nerves at one-stage surgical procedure for prevention chronic pain following inguinal hernia repairment (Amid, 2004). In this study it was noticed that the incidence of chronic pain and daily activity limitations at one year following to surgery were similar in patients considered, while the intensity of pain considered, Group K was superior than others. In this study, the pain following surgery was evaluated with all subjective characteristics, not only with VAS. Chronic pain (presents, characteristics and related to fall behind to social activity) has been reviewed by Bay-Nielsen et al. in large numbered evaluation (Bay-Nielsen, 2001). But forenamed study was considered only Lichtenstein technique and not related to distinguish for different hernia repairment techniques. Therefore we strongly believe that presented study can cover demand about the gap of this work. Mc Cormack, one of the members of EU Hernia Trialists Collaboration, also stated in according to their meta-analysis, less persisting pain was noticed following prepreitoneal laparoscopic repair (22). Alfieri et al. emphasized in their multicenter study of 973 cases, that identification and preservation of ilioinguinal, iliohypogastric and genital branches of genitofemoral nerves during open inguinal hernia repair reduce chronic incapacitating groin pain. These findings can possibly support that preperitoneal approaches i.e. Kugel or laparoscopic interventions which have minimally risk of damage for forementioned nerves, are superior that other conventional techniques. Our results are compatible to previous studies that chronic pain was found to be significantly less in Group K, most probably due to this reason.

The quality of life (QOL) current criteria is to assess the success and the evaluation following surgical or medical treatment modalities. While wound healing and pain well studied following hernia surgery in previous articles, sexual dysfunction which is another parameter of QOL, was not taken into consideration adequately. During surgery; direct trauma to the spermatic cord and its components can cause either reversible (i.e. hematoma, seroma and orchitis), or irreversible (testicular atrophy and oligospermia etc.) damage. Zieren et al found no evidence for a significant impairment of the cord structures and the sexual function after inguinal hernia repair in the *"plug and patch technique"* (Zieren, 2001). Aasvang from Denmark recently reported that about 3% of younger male patients with a previous inguinal herniorraphy suffered from pain during sexual activity and subsequent sexual dysfunction. Author also emphasized that intraoperative nerve damage were most likely responsible factor (Aasvang, 2006). In this large numbered study, however, there was no distinction about operative techniques again. In our study different operative techniques have been evaluated and compared for to diminish on sexual functions. Therefore, our study can also cover this gap again since the similar questionnaires were performed in this study. In our study, no changings were noted about testicular volume. Although there were some differences on testicular arterial flow velocity, there was no sexual dysfunction among patients following groin hernia repair.

Significant differences could not be established between operative techniques and erectile dysfunction on postoperative scores ($p>0.05$). But, comparing to scores obtained from questionnaires a, b and c, Group K results were superior to other groups ($p<0.05$). Moreover, patients in Group K clarified that they have had better sexual condition following surgery. Similarly, whether testicular arterial flow velocity and testicular volume measurements considered, in patients in Group K have had better results ($p<0.05$). These results are most probably related to less dissection of inguinal region, to avoid diminishing the blood supply of spermatic cord and related structures and nerve damage. In conclusion, Kugel repairment for inguinal hernia has advantages on more less acute pain and also more less chronic pain than Lichtenstein and Shouldice repairment techniques. Moreover, reduced operative time, lower hospitalization period and faster to return to normal daily activity appear to have advantages of Kugel technique, in addition to able to cover up possible hernia points of inguinal region (i.e. internal ring, Hessebach triangle and femoral canal). This study should be warrented with large numbered randomized trials.

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