COMPLICATIONS OF THE SCREW/WASHER TIBIAL FIXATION TECHNIQUE FOR KNEE LIGAMENT RECONSTRUCTION

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ABSTRACT

Objective: To evaluate the presence of pain at the site of the surgical incision and the need to remove the tibial fixation screw in anterior cruciate ligament (ACL) reconstruction, in relation to sex and body mass index (BMI). Methods: A group of 265 patients who underwent ACL reconstruction with ipsilateral flexor tendon grafts from the thigh in which the tibial fixation technique consisted of using a cortical screw and metal washer, between July 2000 and November 2007, were evaluated. Results: 176 patients were evaluated for an average of 33.3 ± 19.5 months; median of 29.5 months; IIQ: 17-45 months; minimum of 8 and maximum of 87 months. There was no statistical difference regarding complaints of pain at the site of the screw ($p = 0.272$) and the need to remove the tibial screw ($p = 0.633$) between sexes. There was no statistical difference regarding complaints of pain at the site of the screw ($p = 0.08$) and the need to remove the tibial screw ($p = 0.379$) according to BMI. Conclusion: The pain complaint rate at the screw site from the screw and metal washer method used for tibial fixation in ACL reconstruction was of the order of 25%, and the screw had to be removed in 10.8% of the cases. There was no predominance of pain complaints at the surgical wound between the sexes. There was a greater tendency to complain about pain among patients with BMI < 25. There was no predominance of screw and washer removal between the sexes or between individuals with different BMIs.

Keywords – Anterior Cruciate Ligament; Arthroscopy; Pain; Body mass index

INTRODUCTION

Reconstruction of the anterior cruciate ligament (ACL) using an autograft from the flexor tendons of the thigh has been shown to be a safe technique with good results[1-4]. There has been a discussion in the literature regarding the ideal method for carrying out this procedure, in terms of the choice of surgical technique (intra-articular alone, extra-articular or intra-articular with extra-articular reinforcement), choice of graft material, choice of fixation method and final result(1,2,5,6).

The preferences for graft material are divided between the flexor tendons of the thigh and the patellar tendon. Several studies have shown similar results between these two graft materials with regard to stability, although there is a tendency towards using flexor tendons because patients undergoing this technique present fewer postoperative complaints of anterior knee pain[2-4,7-9]. In meta-analyses published since the year 2000, it has been demonstrated that techniques that involve the patellar tendon seem to have better capacity for achieving a stable knee than do reconstruction techniques with flexor tendons of the thigh. However, this is at the cost

of a greater number of complications and, once again, anterior knee pain[3,4].

The fixation methods vary greatly. Kurosaka et al[10] observed that the fixation site is, mechanically, the weakest link of the reconstructed ligament. There is much controversy in the literature regarding the best implant to use for tibial fixation. Magen et al[11] studied six types of fixation for free tendinous grafts in the tibia and concluded that a double loop on a screw and washer was the best method with regard to stiffness and traction resistance.

The anteromedial anatomical region of the tibia has sparse subcutaneous cellular tissue. The hypothesis that stimulated the present study was that slim and female patients would have greater complaints at the level of the tibial fixation and consequently would need surgery to remove the synthesis. The aim of this investigation was thus to evaluate the presence of pain at the level of the surgical wound and the need to remove the synthesis material, among patients who underwent tibial fixation using a screw and washer, and to correlate the findings with sex and body mass index (BMI).

METHODS

A cross-sectional analysis was conducted on a group of 265 patients who had undergone knee arthroscopy for the purposes of ACL reconstruction using an ipsilateral graft from the flexor tendons of the thigh between July 6, 2000, and November 19, 2007.

The patients who had been selected for ligament reconstruction had presented complaints of knee instability, difficulties in practicing sports or difficulties in accomplishing professional tasks.

The procedure was always carried out by the same surgeon.

Technique: After subarachnoid block using heavy bupivacaine and additional morphine had been implemented, the patients were positioned in dorsal decubitus and the leg was placed under a pneumatic tourniquet. An incision of 3 to 4 cm was made at the level of the tibial insertion of the ipsilateral gracilis and semitendinosus tendons, and autografts were harvested from them and pretensioned on a special table. The bone tunnels required for the ACL reconstruction were constructed under arthroscopic viewing. Femoral fixation was performed using an Endobutton, and tibial fixation was performed by means of a double loop with non-absorbable Ethibond® 5.0 thread that had previously been fixed to

the four free extremities of the grafts, on a metal 4.5 mm cortical screw with a metal AO washer of diameter 8 mm and thickness 2 mm (Figure 1).

Figure 1 – Tibial fixation to post.

The operative would was closed in layers. No suction drain was used. A compressive dressing was applied after concluding the surgical procedure, and the patient, members of the family and nursing team were instructed to keep the leg completely extended[12] (Figures 2 and 3). Cryotherapy was used as an adjuvant method in all the cases[13].

Exercises consisting of active elevation of the leg were started as soon as the patient recovered control over leg movements. Protected support was maintained for three weeks, and then closed kinetic chain exercises were started. Open kinetic chain exercises were allowed four months after the operation. The return to sports movements was started six months after the operation, and full recovery of activities was achieved eight months after the operation.

All patients who presented other synthesis materials (such as tibial nails with proximal locking screws, Puddu plates and others) at the level of the proximal metaphysis of the tibia that might compromise the

Figure 2 – AP radiograph after the operation.

Figure 3 – Lateral radiograph after the operation.

evaluation were excluded from this study. In addition, any patients with any preexisting condition that might compromise the results (such as muscle loss as a sequela of burns) and patients who had been operated less than eight months earlier were excluded.

The patients' heights and weights were measured immediately before the operation, in order to calculate their BMI, in accordance with the routine of the institution where the procedure was carried out. The measurements were made using the same equipment, with the patient only wearing the surgical center gown.

The BMI (kg/m2) was used to classify the patients according to their degree of obesity[14], as shown in Table 1.

Table 1 – Degrees of obesity.

Obesity classification	
BMI (kg/m2)	
18 - 24.9	Normal
25 - 29.9	Overweight
30 - 34.9	Obese G1
35 - 39.9	Obese G2
>= 40.0	Morbidly obese

Legenda: IMC – índice de massa corporal; kg/m2 – unidade de medida do índice de massa corporal.

The variables studied were sex, BMI, pain at the level of the surgical wound and need for additional procedures to remove the fixation screw.

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 12.0 (SPSS Inc. 1989-2003). The statistical analysis consisted of calculating means, standard deviations, medians and percentages. Student's t test and one-way ANOVA were used to compare the means of symmetrical variables. The nonparametric Mann-Whitney and Kruskal-Wallis tests were used to analyze asymmetrical variables and the chi-square (X^2) test was used to compare frequencies. Differences of $p \le 0.05$ were taken to be significant for a confidence interval of 95%.

RESULTS

This study evaluated 265 patients, of whom 78 were excluded in accordance with the exclusion criteria. Thus, the final sample totaled 187 patients. Among these, there was a sample loss of 11 patients (5.88%), due to two deaths and nine failures to maintain follow-up.

Hence, a total of 176 patients were evaluated for a mean period of 33.3 ± 19.5 months (median of 29.5 months; IIQ: 17-45 months). The minimum duration

of the evaluation was eight months, and the maximum was 87 months.

The mean age was 32.2 ± 9.8 years.

In this sample, 131 patients were male (74.4%) and 45 were female (25.6%). The mean age among the males was 32.2 ± 9.4 years and among the females, it was 32.3 ± 11.2 years. The number of right knees operated was 80 (45.5%) and left knees, 96 (54.5%).

There were complaints of pain at the level of the operative wound, where the fixation screw and metal washer were located, among 44 patients (25%). The number of male patients with complaints regarding the operative wound was 30/131 (22.9%) and the number of females was 14/45 (31.1%).

Analysis on the complaints of pain at the site of the tibial fixation screw and metal washer, comparing between the sexes, did not show any statistically significant difference (p = 0.272).

It was necessary to remove the tibial fixation screw and washer in the cases of 19 patients (10.8%), of whom 15 (78.9%) were male and four (21.1%) were female. The time of removing the synthesis material ranged from four to 54 months after the operation, with a mean of 14.5 ± 10.8 months (median of 11 months; IIQ: 8-18 months).

Analysis on the need to remove the tibial fixation screw and washer, comparing between the sexes, did not show any statistically significant difference (p = 0.633).

With regard to the degree of obesity, 76 patients (43.2%) presented weights that were considered normal, while 69 (39.2%) were classified as overweight, 27 (15.3%) as obese grade I and four (2.3%) as obese grade II. There were no patients with morbid obesity in this sample.

Pain at the level of the operative wound was found to be present in 24/76 patients (31.57%) with normal BMI (BMI < 25). By grouping the patients with BMI > 25 (overweight, obese grade I and obese grade II), it was found that pain was present in the operative wound in 20/100 patients (20%). Comparison between these two groups showed that there was no statistically significant difference in relation to the presence of pain at the level of the operative wound (p = 0.08).

It was found to be necessary to remove the tibial fixation screw and washer in 10/76 patients (13.2%) with normal BMI (BMI < 25). By grouping the patients with BMI > 25 (overweight, obese grade I and obese grade II), it was found to be necessary to remove the tibial

fixation screw and washer in 9/100 patients (9%). Comparison between these two groups showed that there was no significant difference in relation to the need to remove the tibial fixation screw and washer (p = 0.379).

DISCUSSION

Many studies in the literature have had the aim of investigating what would be the ideal replacement for the complex structure of the ACL(1,2,5-7,15-19).

For a long time, use of the patellar tendon for reconstructing the ACL was considered to be the gold standard, although this technique is not free from complications. Among the complications that have been attributed to this are: postoperative pain in the graft donor area[7], anterior knee pain[20,21], pain when kneeling down[20], cutaneous anesthesia in the operative wound[21], diminished strength of the knee extensor mechanism[20,21], tearing of the patellar tendon[20], fracturing of the patella[20] and patellar tendinitis[20,21].

Pain in the donor area of the patellar tendon (anterior face of the knee) has been reported in the literature in up to 40% of the cases[20,21]. Deehan et al[22] found that 8% of their sample presented symptomatic crepitation in the femoropatellar joint.

One variation of the technique for seeking the graft from the knee extensor mechanism is to harvest the graft from the quadricipital tendon. Fulkerson and Langeland[23] reported that the incidence of anterior knee pain with quadricipital tendon grafts was 45%. Cortelazo et al[24] found discomfort upon kneeling down among 44% of their patients, five years after ACL reconstruction surgery using quadricipital tendon grafts.

In searching for a less aggressive graft, the trend towards ACL reconstruction using the flexor tendons of the thigh emerged. This technique significantly reduced the pain complaints relating to the use of the patellar tendon and quadricipital tendon that had previously been mentioned, by means of diminishing the morbidity of the procedure[25-27].

We have used the ACL reconstruction technique involving autologous grafts from the gracilis and semitendinosus tendons since the year 2000. The main reason for definitively migrating away from the patellar tendon technique was the lower levels of postoperative pain thus achieved[25].

The distal fixation of grafts from the flexor tendons at the level of the tibial metaphysis is considered to be the weak link in ACL reconstruction, and this has be-

come a challenge for biomechanics specialists because of the lower bone density at this site[28,29]. Today, the various types of implants available on the market can be categorized as providing either intratunnel fixation or cortical fixation. This wide-ranging therapeutic arsenal makes it possible to significantly modify the cost of the surgical procedure.

Intratunnel fixation is used because of its practicality and because of the low rate of local complaints[30]. Its traction resistance is dependent on the quality of the metaphyseal bone, and some studies have suggested that some additional fixation should be used in order to achieve successful ligament reconstruction[31]. Hill et al[31] proposed that cortical staples should be used, while other authors have suggested using intratunnel bone grafts[32,33] and additional care with the technique at the time of inserting the screw, so that the graft tension is not lost, as put forward by Grover et al[34].

Cortical fixation of the flexor tendons is recognized as providing great stiffness to the system, but with the inconvenience of causing complaints of subcutaneous irritation in some cases[29]. Hill et al[31] used cortical staples to increase the stiffness of the fixation system and found that 29% of their patients experienced pain when kneeling down.

Another cortical fixation method is the use of double loops of non-absorbable threads onto a cortical screw with a metal washer. This fixation method, also known as "fixation on a post", was considered to be the best type of ACL fixation among six different methods tested by Magen et al[11], with regard to fixation stiffness. Although this is a safe, cheap and adequate method for fixation of free grafts from the flexor tendons, it increases the relief of the anteromedial cortical bone of the tibia. This makes it fairly easy for patients to see the prominence of the screw head, and is particularly important when patients are slim and female. It may give rise to complaints of pain and in relation to esthetics, with the need to remove the screw in some cases[11,35,36]. Our sample did not demonstrate significantly that women would present greater risk of local complaints (p = 0.272) or greater need for synthesis removal (p = 0.633).

In a study investigating the evolution of chondral lesions after ACL reconstruction procedures, Asano et al[37] took advantage of the procedure of screw and washer removal from the anterior cortical bone of the tibia to take a second look at their patients. They reported that the complaint of pain and the wish to remove the synthesis material were the factors that motivated the second procedure. Their rate of synthesis material removal was 66.3%.

In our study, we found that 25% of our patients had complaints of pain and discomfort in the knee relating to the synthesis material. We took care to analyze the profile of these patients, and we observed a tendency towards complaints of local pain among the slim patients (p = 0.08). However, evolution towards an additional surgical procedure in which the screw would be removed occurred only in 10.8% of the cases (p = 0.379).

There is unanimity in the literature that the choice of graft type and fixation technique should be individualized to each patient's condition and, especially, to surgeons' preferences. Surgeons need to take into consideration their knowledge and experience regarding each technique.

The variations in body weight found in some patients after the operation can be taken to be a form of bias in the study, given that patients could change BMI group over the months and years that followed the surgical procedure.

CONCLUSIONS

ACL reconstruction using grafts from the flexor tendons of the thigh, with tibial fixation using a screw and washer, showed a rate of pain complaints at the screw site of around 25%. There was a need to remove the tibial fixation screw and washer in 10.8% of the cases.

There was no predominance of pain complaints regarding the operative wound between the sexes. There was a greater tendency towards pain complaints among individuals with BMI less than 25.

There was no predominance regarding screw and washer removal between the sexes or between individuals with different BMIs.

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