Abdullah A. Al-Othman

Biodegradable arrows for arthroscopic repair of meniscal tears

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Abstract Thirty-two meniscal tears in 32 patients were repaired using biodegradable meniscus arrows. The tears were fixed arthroscopically using an all-inside technique. Ten patients had a simultaneous anterior cruciate ligament (ACL) reconstruction. The period of follow-up was an average of 25 (10–40) months. Twenty-six patients were clinically stable and asymptomatic at follow-up. Six patients were considered clinically unstable and all had associated ACL reconstruction and required a repeat arthroscopy. Two meniscal repairs failed to heal, and the broken meniscus arrow was retrieved arthroscopically 6 months after the primary operation. In four cases the meniscal tear healed completely (two cases) or partially. Otherwise, there were no objective signs of complications. The use of meniscus arrows is a simple, safe, and reliable method for repair of properly selected meniscal tears.

Résumé 32 déchirures méniscales chez 32 malades ont été réparées en utilisant des ancrs méniscales biodégradables. Les déchirures ont été réparées par arthroscopie utilisant une technique tout intérieure. 10 malades avaient une reconstruction simultanée du LCA. La période de suivi était en moyenne 25 (10–40) mois. 26 malades étaient cliniquement stables et sans symptôme au dernier examen. 6 malades ont été considérés cliniquement instables et tous avaient une reconstruction associée du LCA avec nécessité de plusieurs arthroscopies. 2 réparations ont échoué et l'ancre cassée a été enlevée 6 mois après l'opération initiale. Dans 4 cas la déchirure méniscale a complètement guéri (2 cas) ou partiellement. Il n'y a pas eu d'autre complication. L'usage des ancrs méniscales est une méthode simple, sûre et fiable pour la réparation des déchirures méniscales correctement sélectionnées.

Introduction

The meniscus plays an important role in protection of the articular cartilage of the knee joint, load transmission, and dynamic stabilization of the knee. While several studies have shown that repair of the meniscus is superior to meniscectomy [16], only a few studies have dealt with the outcome of the new method of using a biodegradable meniscus arrow in meniscal repair [3, 1, 11]. The arthroscopic meniscus repair techniques involve three methods: inside-out, outside-in, and all-inside. The first two methods are both difficult and have potential risk of injury to the neurovascular structures during repair of posterior horn tears [16]. The recently introduced biodegradable meniscus arrow uses the all-inside fixation method in posterior meniscal repairs. The aim of the present study was to assess the clinical outcome of arthroscopic meniscal repair using these arrows.

Material and methods

From March 1998 through September 2000 we studied 32 patients who had a total 32 meniscal tears repaired arthroscopically using the Bionex meniscus arrow. All cases were reviewed and had a postoperative follow-up ranging from 10 to 40 (mean 25) months. All patients were male, and their ages ranged from 11 to 42 years with a mean age of 29.4 years. The right knee was affected in 15 cases.

Most of the injuries were secondary to football trauma (26 cases). The medial meniscus was torn in 26 knees and the lateral in six. Eleven patients had a concomitant anterior cruciate-deficient knee, and ligament stabilization procedures were done simultaneously with meniscal repair in all of these patients except one, who was operated with anterior cruciate ligament (ACL) reconstruction 3 months after the meniscal repair. The time from injury to surgery ranged from 1 month (two patients) to 3 years. Sixteen patients had chronic tears (more than 6 months).

Operative technique

Arthroscopic fixation of the torn menisci was performed using Bionex meniscus arrows following the technique described by Albrecht-Olsen et al. [1]. This was done under general anesthesia

A.A. Al-Othman (✉)
King Fahd University Hospital, PO Box 2845, Al-Khobar 31952,
Saudi Arabia
e-mail: aboahmed10@yahoo.com
Tel.: +966-3-8823735, Fax: +966-3-8823735

Table 1 Patient characteristics

	Number
Side	
Right	15
Left	17
Site	
Medial	26
Lateral	6
Associated ACL injury	11
Tear zone	
Red	17
Red-white	15
Tear type	
Bucket-handle	13
Vertical	19

using a tourniquet. Two portals were used routinely for all cases – lateral and medial infrapatellar portals. A total of 103 arrows (average 3.25 arrows per meniscal tear) were used. Seventeen tears were in the red zone, and 15 were red-white zone tears. Thirteen menisci were bucket-handle tears, and 19 were unstable vertical tears (10 mm–40 mm long) (Table 1). Debriding the meniscal tear with a shaver before insertion of the meniscus arrow was done routinely in all cases.

Postoperatively, a light knee brace was used for few days. Patients were instructed in isometric quadricep and hamstring strengthening exercises. Partial weight bearing and knee flexion-extension exercises were permitted after 3 weeks, and a full range of motion was regained usually after 4 weeks. Cases with associated ACL reconstruction had early mobilization using the continuous passive motion machine, but return to sport activity was not permitted before 5–6 months.

Clinical evaluation of the operated knees was performed according to the rating system described by Scott et al. [17]. Patients were questioned postoperatively as to pain in order to quantify its category (none, slight, moderate, or severe) [15]. In addition, they were asked for effusion, catching, giving way, and locking, to determine clinically healing of the repaired menisci. To be scored as having a clinically stable knee the patient had to have a pain grade of no more than three; no postoperative history of locking, giving way, or catching; a painless and negative McMurray's maneuver [7]; and no subsequent surgical procedure. If the examined knee failed to satisfy all of these criteria it was categorized as being clinically unstable [17].

Results

The follow-up period ranged from 10 to 40 (mean 25) months. The operated knees were asymptomatic and clinically stable in 26 patients at the final follow-up examination. Residual mild pain was encountered in six patients; four of these had mild effusion that settled down with conservative treatment. The 21 patients with isolated meniscus repairs all regained full range of motion and were clinically stable. Six cases were considered clinically unstable, all of which had associated ACL reconstruction and required a second-look arthroscopy for different reasons. In four of these six cases the meniscal tears were found completely (two cases) or partially healed and required no further treatment. The remaining two cases

failed to heal and, in both, the menisci were subsequently excised arthroscopically. In one, the meniscus arrow was found broken and loose within the knee joint.

Discussion

Experimental studies on the use of a biodegradable fixation device (meniscus arrow) for repair of meniscal tears was first reported by Miller in 1988 [14]. Clinical use of these arrows was introduced by Albrecht-Olsen et al. in 1993 [1]. Although this new technique for arthroscopic repair of meniscal tears is becoming increasingly popular [4], few studies reported the clinical outcome of this method [3, 11]. Other studies tested the mechanical properties of the meniscus arrow [2, 5] or published case reports on complications [6, 9, 10, 12, 13].

Eighty-one percent of patients in this study were categorized as clinically stable on follow-up. Magnetic resonance imaging was not used to evaluate healing because of its doubtful value [8], and second-look arthroscopy was done only when required (six cases). These results are comparable to the North American figures pertaining to meniscal healing after arthroscopic sutures.

Few studies reported clinical outcomes of meniscal repair using meniscus arrows. Albrecht-Olsen et al. [3] performed a randomized prospective study comparing this method to inside-out repair with horizontal meniscal sutures. A healed meniscus was observed in 91% of the arrow repair group but in only 75% of the suture group at repeat arthroscopy. Hurel et al. [11] reported outcomes in 25 patients at 1 year. His results were excellent or good in 88% of cases, which is comparable to results in the present study. He concluded that the meniscus arrow fixation technique allows safe fixation of meniscal tears, specifically of posterior horn lesions, where injury of the neurovascular structures is not uncommon.

Biomechanical data regarding the pull-out strength of the meniscus arrow compared to meniscus sutures in bovine menisci are inconsistent. Albrecht-Olsen et al. [2] demonstrated lower failure strength of meniscus arrows compared to the suture groups. Boenisch [5] believed that, although weaker than sutures, arrows should provide sufficient strength for meniscal healing. However, technical considerations of insertion, such as keeping the arrow parallel to the joint surface and improving the mechanical properties of the arrows, should enhance integrity of the repair.

Complications associated with meniscus arrows have been published as case reports. These include foreign-body reaction [13], hematoma formation [10], and subcutaneous migration [9]. Late-onset aseptic synovitis has been recently reported [18].

Advantages of using meniscus arrows are many. The procedure is simple and easy compared to the technical difficulty of meniscal suture, operative time is reduced [3], and there is a reduced risk of complications, including neurovascular injury. However, attention to technical details in terms of placement, choice of arrow length,

and orientation, is required to ensure optimal fixation and better outcomes.

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