Meniscal allograft transplantation: Magnetic resonance imaging using direct arthrography with clinical correlations

Poster No.: C-2282  
Congress: ECR 2010  
Type: Educational Exhibit  
Topic: Musculoskeletal  
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Keywords: Knee, meniscal transplantation, athro-MRI  
DOI: 10.1594/ecr2010/C-2282

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Learning objectives

Magnetic resonance imaging of postoperative knee is nowadays more frequently performed than in the past because of the increased number of arthroscopic surgical procedures performed in our hospitals.

Aim of our work is to illustrate the role of arthro-MRI with direct articular injection of contrast medium, in clinical protocol for monitoring patients which underwent meniscal replacement with allograft and to compare MRI findings with clinical data of examined patients.

Background

A review of the literature of recent years leads us to affirm that, as in preoperative patients, magnetic resonance (MR) imaging is the most valuable imaging method for postoperative evaluation of the knee. MR arthrography with direct intraarticular injection of contrast material can help to improve evaluation of postoperative meniscus; in post-surgical knee it is superior to MR without contrast in assessment of articular status both in symptomatic patients, in search for recurrent lesions previously repaired or new lesions to different structures, or in asymptomatic patient in assessing outcome of the surgical procedure.

In order to assess performance of this technique in outcome of meniscal replacement with allograft, we have studied 4 patients, manual workers, mean age of 30 aa at the time of follow up, with an history of meniscal replacement from 12 to 16 months before. In one case medial meniscus has been transplanted, in the other 3 cases the lateral meniscus.

In all cases we used arthroscopic replacement techniques: after preoperative measurement by CT, fresh-frozen allografts were implanted, making two tibial tunnels at the anterior and posterior horn of the meniscus, anchoring allograft with Bone Plug, using out-in and all-in sutures. At the time of examination two patients were asymptomatic, one patient, a professional football player, reported pain and functional limitation, while the fourth subject had suffered an injury a week before and he reported generalized pain and significant functional limitation.
All patients in our study have been previously clinically evaluated by Knee Injury and Osteoarthritis Outcome Score (KOOS) and by WOMAC (index of osteoarthritis). The values have been linked to their pre-operative values.

Two patients underwent second-look arthroscopy, the profession footballer for recurrent pain and functional limitation during his activity, the second for the new trauma.

**Imaging findings OR Procedure details**

Our study was conducted using high field (1.5 Tesla) MRI equipment in two stages. The first step was a basic study of the knee (Fig.1) according to the protocol used in our department which is illustrated in Table 1.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Fat Sat</th>
<th>Plane</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSE T2</td>
<td>FAT SAT</td>
<td>AXIAL</td>
<td>3 MM</td>
</tr>
<tr>
<td>SE T1</td>
<td>FAT SAT</td>
<td>SAGITTAL</td>
<td>3 MM</td>
</tr>
<tr>
<td>SE DP</td>
<td>FAT SAT</td>
<td>SAGITTAL</td>
<td>3MM</td>
</tr>
<tr>
<td>STIR</td>
<td></td>
<td>CORONAL</td>
<td>3MM</td>
</tr>
</tbody>
</table>

Tab. 1

Keeping the patient supine on the MRI table, after local disinfection, a needle was placed into the upper recess of the knee joint using external approach in para-patellar space; 30-40 cc of paramagnetic contrast agent, dilution 1:200 in saline, are then injected.

After mild joint mobilization we performed three sequences SET1 fat sat on the three planes (axial, sagittal and coronal), with a thickness of section of 3 mm.

Overall, the time of examination is equal to 35-40 '.

All patients referred minimal discomfort, that is minimal pain, absolutely tolerable in all cases.

In no case we observed complications or adverse reactions to the injection.
We always were able to see meniscal allograft, with good detail on meniscal margin, meniscal omogeneity, meniscal/bone relationship. Intra-articular contrast allows us, compared to baseline MRI, more detailed imaging of changes in transplant and relationship between graft and recipient, in addition to more detail on remaining articular components, in particular cartilaginous lesions.

Imaging findings of our four patients are reported in TABLE 2.

<table>
<thead>
<tr>
<th>MENISCUS</th>
<th>BONE</th>
<th>CONDRA</th>
<th>MENISCUS</th>
<th>MENISCUS</th>
<th>INTEGRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDEMA</td>
<td>LESION</td>
<td>SIGNAL</td>
<td>POSITION</td>
<td>TEAR</td>
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</tr>
<tr>
<td>1</td>
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<td>NO</td>
<td>condilar</td>
<td>mild</td>
<td>normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>inhomogeneuos</td>
</tr>
<tr>
<td>2</td>
<td>lateral</td>
<td>NO</td>
<td>patellar</td>
<td>inhomogeneous</td>
<td>extrusion</td>
</tr>
<tr>
<td>3</td>
<td>lateral</td>
<td>YES</td>
<td>condilar</td>
<td>inhomogeneous</td>
<td>extrusion</td>
</tr>
<tr>
<td>4</td>
<td>lateral</td>
<td>NO</td>
<td>NO</td>
<td>inhomogeneous</td>
<td>normal</td>
</tr>
</tbody>
</table>

**TAB. 2**

Imaging reported good integration of the allograft in two cases even if in patient N°4 MR showed meniscal tear. In two patients we observed meniscal extrusion that can be interpreted, in agreement with the literature, as a sign of failure of the transplant, even if we never saw contrast between allograft and bone, other sign reported as indicative of failure. Bone edema was see only in a patient, but it was interpreted as sign of impingement because diffuse in all compartments of the knee, in a professional footballer.

The imaging findings also showed how arthro-MRI is gold standard to highlight and distinguish between recurrent lesion and scar; this finding is in agreement with the literature and it is confirmed also in meniscal transplant where inhomogeneous signal of the transplanted meniscus is seen in all cases we have studied.

Arthro-MRI revealed 3 chondrites (two on femoral condilous and one on patellar articular external surface), two unrecognized on baseline MRI and confirmed at second-look arthroscopy when performed.

Meniscal transplantation has led to an improvement of the clinical picture as shown in Tables 3, where we report the average of the scores obtained in KOOS test and WOMAC index of osteoarthritis with comparison between pre-and post-surgical results.
### KOOS

<table>
<thead>
<tr>
<th></th>
<th>PRE-SURGICAL</th>
<th>POST-SURGICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAIN</td>
<td>55.5</td>
<td>78.25</td>
</tr>
<tr>
<td>SYMPTOMS</td>
<td>61</td>
<td>80.25</td>
</tr>
<tr>
<td>DAILY LIVING</td>
<td>57.5</td>
<td>74.75</td>
</tr>
<tr>
<td>SPORT ACTIVITIES</td>
<td>31.25</td>
<td>55</td>
</tr>
<tr>
<td>QUALITY OF LIFE</td>
<td>31.25</td>
<td>53.25</td>
</tr>
<tr>
<td>WOMAC</td>
<td>45</td>
<td>30.25</td>
</tr>
</tbody>
</table>

Tab. 3

Images for this section:
**Fig. 1:** SE T1 FS on sagittal plane after articular injection of contrast medium
Fig. 2: SE DP fs on sagittal plane (same patient of Fig.1): worst displaying of meniscal margins
Fig. 3: SE T1 FS on axial plane after articular injection of contrast medium
Fig. 4: SE T1 FS on coronal plane after articular injection of contrast medium
Conclusion

Our data, although preliminary, show that arthro-MRI allows us to evaluate, in knees which underwent meniscal transplant, the successful meniscal healing (integration of the meniscus to the meniscal wall) and the differential diagnosis between recurrent lesion and scarring process thanks to spreading in the lesion of contrast medium (Fig. 1-2). Moreover, if present, arthro-MRI can identify with greater precision, assessing extent and depth, chondral defects that may be unrecognized in no contrast sequences.

In all patients MRI didn't show contrast infiltration under allograft nor bone edema (present only in one patient and thought not to be in relationship with transplant), signs of good transplaction integration. In two case we saw meniscal extrusion (Fig. 3-4), the only sign of bad integration of the allograft, in one case confirmed arthroscopically. In many cases meniscus was irregular and disomogeneous (Fig. 5-6) sign best seen after contrast injection.

Arthro-MR showed in three patients cartilage erosions in all cases best studied on post-contrast imaging (Fig. 7-8-9). In the patient with recent trauma MR revealed posterior cruciate legament tear that was seen both in pre- or post-contrast imaging. When performed, arthroscopy confirmed cartilagineous and meniscal lesions and cruciate tear, but revealed incomplete integration of meniscal allograft. In one case this was in agreement with imaging but in the second patient there was disagreement because imaging showed no sign of failure; on the other side we can say that the patient, before recent trauma with posterior cruciate ligament tear, was free of pain.

So we can say that there is a good correlation between imaging findings and clinical second-look, even if the data analyzed and the results come from a small and heterogeneous group of patients.

Images for this section:
Fig. 1: Hyperintense linear image in meniscus posterior horn, without filling by contrast medium: not lesion.
Fig. 2: Hyperintense linear image in meniscus posterior horn, filled by contrast medium: meniscal tear.
Fig. 3: Meniscal extrusion
Fig. 4: Meniscal extrusion.
**Fig. 5:** DP fat sat sagittal image before contrast. We can see tibial tunnels for allograft fixation.
**Fig. 6:** Same patient of Fig. 5 after contrast injection. SET1 FS on sagittal plane: we can see irregularity of meniscus margins that we can not see in detail on basal sequence.
Fig. 7: Pre-contrast axial image: we can see only disomogeneity of cartilaginous signal.
**Fig. 8:** Same patient of Fig. 7: in post-contrast image we can see erosion in lateral portion of femoral condilous cartilage.
Fig. 9: Erosion of cartilage in lateral articular patellar surface.
Personal Information

References

1. PC Verdonk et al
"Meniscal allograft transplantation: long-term clinical results with radiological and magnetic resonance imaging correlation"

2. TR McCauley
"MR imaging evaluation of post-chirurgical knee"
Radiology 2005; 234: 53-61

3. PR Rencht
" MR imaging of the post-operative knee: a pictorial essay"
Radiographics 2002; 22765-774

4. HG Potter
" MR imaging of meniscal allografts: correlation with clinical and arthroscopic outcomes"
Radiology 1996; 198:509-514

5. ERA van Arkel
" Survival analysis of human meniscal transplantation"