How reliable is the Genovese grading for evaluation of collagen meniscus implants?

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Background

The Genovese grading (1) is one of the most commonly used scores for the evaluation of radiological outcome after partial meniscus substitution using collagen meniscus.

This score includes direct and indirect criteria. The direct criteria describe the size and morphology as well as the signal intensity of the collagen meniscus implant complex.

The indirect criteria describe if there is a chondral lesion more than 50% or less, if there is a sign for a bone marrow edema and if there is a synovial reaction.

It was the purpose of our study to evaluate the intra- and inter-observer reliability of the Genovese grading on MRI in patients after collagen meniscus substitution.

Materials and methods

The MRI images of 84 consecutive patients who underwent partial meniscus substitution using the collagen meniscus (CMI, RegenBiologics, USA) were assessed. Magnetic resonance imaging (MRI) using a dedicated knee coil was performed preoperatively and at last follow-up. The MRI protocol included the use of axial and coronal GE T2*, and SE T1 and FatSat FSE DP/T2 sagittal and coronal sequences .
MRIs were analyzed according to the Genovese criteria using the PACS (Picture Archiving Communication System, Phillips Easy Vision, Netherlands) .
The Genovese criteria consisted of direct (implant morphology/size, signal intensity) and indirect criteria (state of the corresponding cartilage of the medial/lateral femur or tibia, size of the cartilage lesions more of less than 50%, signs of bone marrow edema, synoivial reaction) (1). The extrusion of the meniscus was graded as smaller and bigger than 3mm.

Characteristic	Type 1	Type 2	Type 3
Morphology and size	Totally resorbed	Small CMI with regular and/or irregular morphology	CMI with identical shape and size to the normal meniscus
Signal intensity	Markedly hyperintense	Slightly hyperintense	Isointense relative to the normal meniscus (no signal)

Table 1:
The direct Genovese criteria for evaluation of collagen meniscus implants in MRI.

The Genovese grading was assessed by one musculoskeletal radiologist and one orthopaedic registrar twice within two weeks interval. The observers were blinded to their previous results as well as to the results of eachother.

Characteristic		
Chondral pathology	>50%	<50%
Subchondral bone marrow edema	yes	no
Synovial reaction	yes	no

Table 2:
The indirect Genovese criteria for evaluation of collagen meniscus implants in MRI.

The inter- and intra-observer reliability of the direct criterias was assessed using intra-class correlation coefficients (ICCs, 1=highest, 0=lowest). The inter- and intraobserver reliability of the indirect criterias was assessed using the kappa value (1=highest, 0=lowest) Two observers performed the grading with two week interval twice independently. The sample size was calculated according to Walter et al. (2).

Results

The Genovese grading for the morphology/size of the implant showed an ICC intra-observer-reliability of 0.456-0.775 and an ICC inter-observer-reliability of 0.256 bis 0.614.
The Genovese grading for the signal intensity of the implant showed an ICC intra-observer-reliability of 0.469-0.651 and an ICC inter-observer-reliability of 0.287-0.485.
The Genovese grading for the chondral lesions <>50% has a kappa value for the inta-observer-reliability of 0.409-0.413 and a kappa value for the inter-observer-reliability of 0.091-0.529.
The bone marrow oedema of the implant showed a kappa value for the intra-observer-reliability of 0.702-0.780 and a kappa value for the inter-observer-reliability of 0.667-0.808.

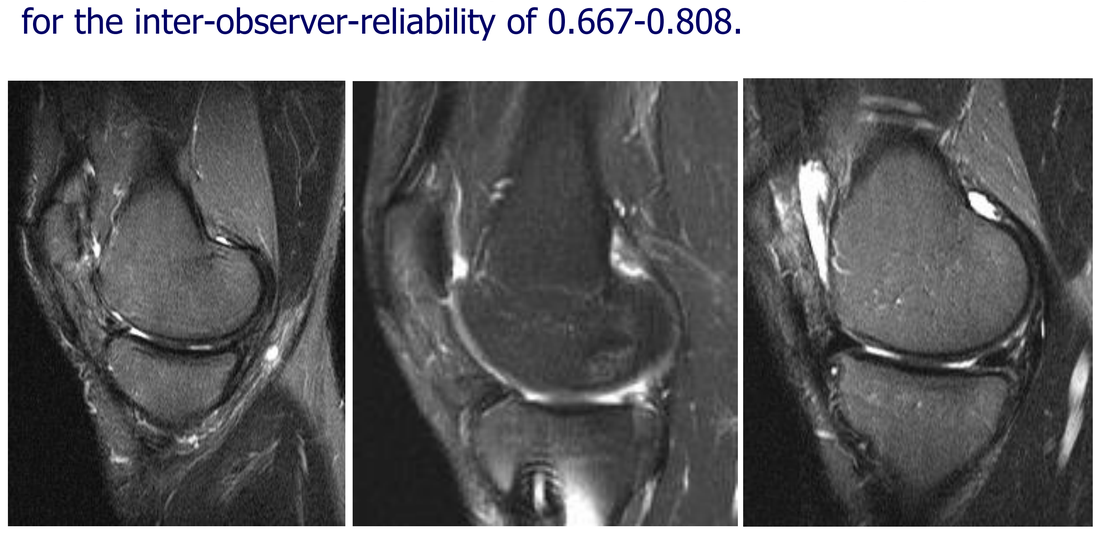

Figure 1:
Example of MRI after medial collagen meniscus implantation showing an entirely resorbed, partially resorbed and preserved CMI (from left to right).

Conclusion

In the clinical routine the Genovese classification shows only moderate inter- and intra-observer reliability for the evaluation of partial meniscus substitution using collagen meniscus implants.
This finding is particularly true for the evaluation of the implant size.
In their original paper Genovese et al. also performed a MR arthrography with acquisition of axial and sagittal SE T1 sequences and volumetric FSE FatSat T1 sequences in the coronal or sagittal plane. This could explain the problems defining the size and morphology of the implant in our series.
However, MR arthrography in asymptomatic patients is hardly feasible due to ethical reasons.
In summary, although the Genovese grading is the best available method, it should be used with all due caution. We also need to better define the subcriteria and which MR image should be used.

References

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