Assignemt

Part The ACL ligament has a complex anatomy which supports its role in providing the knee joint with both rotational and sagittal stabilization. This ligament is structurally significant and experiences regular injuries. To assess such injuries accurately, imaging technology, and specifically MRI, has been used. This technology has also enabled the assessment of other conditions that affect the ACL ligament together with any associated injuries. To obtain meaningful diagnostic performance, any direct or indirect tears that affect the ACL should be identified through MRI. The major challenge affecting prognosis, however, has been on the imaging of partial tears. Therefore, I provide the following recommendations for improvement of this protocol:

Oblique imaging planes, including oblique axial, oblique coronal and oblique sagittal, would improve on the accuracy of diagnosis and detection of any partial tears in the ACL. It would also aid in assessing individual bundle tears. This approach has been noted to be more useful than the standard MRI in cases where ACL tear is anticipated.

The protocol could also benefit from 3D sequences such as the 3D-DESS, known to be isotropic acquisition having the potential of reducing partial volume averaging through acquisition of thin and continuous slices from the joints. Additionally, this could be used to come up with multiplanar reformat images, MPR, which would make the evaluation of ACL possible from any orientation or oblique planes through a single acquisition. This creation of the MPR could be sourced as part of PACS system or through dependent workstations. The MPR images in this context would be useful for acquisition of the oblique planes, including the oblique axial, coronal and sagittal, to

better assess the ACL tears.

Finally, the 3D-DEES sequences play a crucial role of enhancing the image's T2* weighting and also increases synovial fluid and cartilage signal intensities. This 3D-DEES technique is beneficial in the sense that it provides moderate accuracy with regards to early cartilage delineation and high accuracy when detecting advanced cartilage lesions. As such, this sequence can only be employed when dealing with cartilage structures. Replacing this ACL imaging sequence with subtraction-DESS technique would result in its optimisation.

Part 2:

The MRI technology has been beneficial in supporting chronic and acute ligament injuries diagnosis and, even more importantly, in assessing problems that arise after the reconstruction of ligament. Even so, the short T2-relaxation time associated with tendon tissue (4), the standard MRI having echo times, TE, greater than a few milliseconds senses low signal from the tendon graft. This makes the visualisation of the graft occur through negative contrast with reference to the surrounding tissues. Moreover, those elements employed during graft fixing often have susceptibility effects that cause the local signal to be lost at the usually achievable echo times.

To visualise short-T2 components when dealing with highly ordered tissues like ligaments, menisci, tendons or periosteum (5 – 7), ultrashort echo-time, UTE techniques would be employed. As such, after cruciate ligament repairs, such techniques could offer a direct and positive contrast graft visualisation in addition to promising perfect contrast between fixation elements and

graft. Moreover, it has been noted that 3D UTE techniques produce isotropic spatial resolution (8. 9) which makes it possible for the easy data reformatting to stick to the graft course through the anatomy of the knee. This makes it possible for UTE imaging to provide additional information on the tendon graft's condition and its fixation.

The arrows show the metal implants at the low artifact level acquired in UTE images.

The arrow shows the section of the femoral cross pin that is broken as visualised from UTE images.

Conclusion

UTE imaging has the ability to allow for the direct visualisation of short-T2 components in ligaments, tendons and tendon grafts. Therefore, it provides additional information that could not be obtained using conventional sequences.