Histopathological features of failed prosthetic Leeds-Keio anterior cruciate ligaments

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Abstract

Artificial ligaments such as the Leeds-Keio ligament are inserted into knee joints to treat cruciate ligament trauma. Three cases of prosthetic ligament failure are reported, showing foreign body granulomatous inflammation around implanted fibres, together with abundant fibre particles within giant cells. It is suggested that intra-operative fibre fragmentation can produce a sufficient quantity of detritic particles to elicit a granulomatous reaction, which can ultimately lead to ligament instability and failure.

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The Leeds-Keio ligament is a loose woven Dacron mesh employed as an artificial ligament in the treatment of ruptured anterior cruciate ligaments of the knee. It is surgically

implanted and anchored through the femoral and tibial condyles by bone plugs.¹

The advantage of using this technique is that the mesh acts as a scaffold upon which there is ingrowth of fibrous and elastic tissue over a period of six to 18 months. At first the orientation of collagen fibres is haphazard, but over six to 12 months they realign in the direction of stress along the line of the ligament.² The neoligament develops a scanty blood supply and a synovial covering.³

Case report

All three cases occurred in fit men (aged 22, 25, and 28 years) who sustained a sudden loss of knee joint stability whilst playing sports. Arthroscopy confirmed anterior cruciate ligament (ACL) instability and each had ACL reconstruction using the Leeds-Keio technique. Eight to 20 months postoperatively, each patient noticed a sudden loss of stability following trivial injury. Each ligament was subsequently replaced. In two cases the ligament was loose but in continuity, and in the third case the ligament was discontinuous. Ligament failure appeared to occur in the substance of the ligament rather than at the edges of the bony canals.

Pathology

All of the cases examined showed similar histological features. The neoligamentous process of fibroblast ingrowth, with collagen deposition around and in the line of the Dacron fibres, was seen together with small amounts of elastic tissue as demonstrated by an elastic Van Gieson stain. However, sections taken through the centre of the ligament showed gaps in the matrix. Within these gaps there was a substantial foreign body granulomatous and chronic inflammatory cell response, immediately adjacent to the Dacron fibres (fig 1). Furthermore, when viewed under cross-polarised light, tiny refractile fibre particles were seen within some of the foreign body giant cells (fig 2). Some cases showed focal fibrin deposition in the vicinity of the inflammatory reaction and in the peripherally situated synovial tissue which otherwise looked normal.

Discussion

The presence of a florid granulomatous reaction around implanted Dacron fibres may be important in the pathogenesis of ligament

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Figure 1 A foreign body giant cell reaction is seen adjacent to the Dacron fibres.

Figure 2 Refractile fibre particles are seen within the giant cells.

failure. Although foreign body granulomatous reactions have been previously described in failed ligaments,⁴ the presence of numerous small fibre particles within foreign body giant

cells has not been reported. These particles could be the result of fibre fragmentation at the time of insertion of the ligament, as Dacron mesh is a friable material and the bony canals through which it is inserted have rough surfaces.

The particles, once released into the surrounding tissues, could elicit a florid foreign body granulomatous reaction. This would prevent the orderly collagen deposition by fibroblasts which is vital in the process of neoligamentisation and hence ligament stability. The implant could, therefore, fail by fatigue wear, just as if no new ligament had grown into it. In addition, the creation of structural gaps between the Dacron fibres and collagen already deposited would lead to prolonged mechanical instability, with an increased risk of ligament rupture by minor trauma.

As the use of such knee implants is likely to increase in the future, both pathologists and surgeons should be aware of the pathological findings of failed ligaments in order to discover means of preventing implant failure.

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