**Conclusion of the concensus conference concerning multiple ligamentous injuries of the knee and allograft in knee surgery, Aarhus Denmark September 11 1999.**

Participants: Henrik Aagaard MD PhD, Svend Erik Christiansen MD, Lars Engebretsen MD professor, Peter Faunø MD, Mogens Strange Hansen MD, Michael Kjær MD professor, Michael Krogsgaard MD, Robert LaPrade MD, Martin Søe Steinke, Jens Ole Storm MD, Fred Wentorf MS, Søren Winge MD, Bent Wulff Jakobsen MD.

Multiple ligamentous injuries of the knee.

Incidence:

Rough estimate of number of multiple ligament injuries per year in DK is 50-100.

It is important to perform cadaver dissections regularly to keep experience. It is difficult to recommend any minimum number of operations per surgeon, but surgeons involved in this surgery should be obligated to keep their skills high by regular dissections, courses etc.

Diagnosis:

All acute multiple ligament injured patients should have an x-ray performed (fractures, Segon-avulsions etc.) and a precise clinical evaluation.

MRI with at least a 1.5 Tesla magnet and a special protocol for knee ligament injuries is the most precise method to diagnose injuries of the posterolateral corner. It is important that the evaluation of the examination is done in close collaboration between the orthopaedic surgeon and the radiologist, as the interpretation of the pictures is difficult. MRI with smaller magnets are sufficient for other ligament lesions of the knee.

In chronic cases the clinical evaluation is probably the most important way to a precise diagnosis, as the MRI pictures are difficult to interpret.

Chondral and osteochondral lesions and popliteal avulsion are often difficult to see on the MRI, so arthroscopy is recommended for diagnostic purposes in all acute cases. In cases with greater capsular lesions, fluid from the arthroscope may extravasate into the subcutaneous tissue, and it may be an advantage to wait at least a week before arthroscopy is performed.

Quantitative measurements are difficult to perform in a reliable manner, in particular in the acute cases. In the acute cases clinical qualitative evaluation is possible with varus test (0 and 30 degrees), Lachman, drawer, reverse Pivot, recurvatum and rotation tests. The lack of an endpoint is a strong indicator of severe ligament damage. It has been suggested that stress radiographs should be performed but the indication is not yet established.

Treatment and timing of multiple ligament injury:

Primary lesion of the lateral collateral ligament and/or lesion of the posterolateral corner combined with ACL and/or PCL lesion.

There are no randomised studies regarding conservative versus operative treatment but one study showed bad long term results after conservative treatment of clinically lateral instable knees. In cases with MRI verified lateral lesions and clinical lateral instability, surgical, anatomical repair is probably the treatment of choice in acute cases. Repair should be done primary delayed 7-10 days after the injury. In cases with vascular injury ligamentous surgery should probably be delayed 2 weeks and be performed without tourniquet. Cartilage and meniscal injury does not change timing. The central pivot can be reconstructed primary or elective, but if done acutely allografts should be used to eliminate donor site morbidity (stiffness). In open injuries the lateral repair should be performed acutely, and the central pivot reconstructed later.

In cases with extensive tissue damage on the lateral side (f. i. midsubstance ruptures of LCL), it is recommended that the repair is augmented with a graft.

Biomechanical studies and clinical series indicate that if only some of the instabilities are repaired (f. i. if the lateral side is repaired and the central Pivot is not reconstructed), the repair will stretch and loosen with time. It is recommended that all instabilities are treated, but not necessarily in one operation. If a delayed operation is performed it should be done when swelling is down and ROM good.

There is no documentation to put an age-limit for surgical treatment. If surgery is not performed a cast in full extension for 3 weeks is recommended.

Because of the potential extent of tissue damage in knee dislocations – also of donor sites, the surgeon should be familiar with harvest of PTB, quadriceps and hamstrings grafts.

Acute lesion of ACL and PCL with or without lesion of MCL

There is no indication that surgical repair is superior to conservative treatment of grade I and II MCL lesions, but grade III lesions should probably be treated acutely with anatomical repair. In extensive tissue damage it can be necessary to augment the repair with a graft. The central Pivot should always be reconstructed.

Chronic instability due to lesion of the collateral ligaments and/or posterolateral/posteromedial instability combined ACL and/or PCL lesion.

In the combined lateral/posterolateral - central instability the alignment of the knee should be normal, and if not it should be corrected with an open wedge osteotomy. If the patient has instability problems 6 months after this procedure, the lateral side should be repaired or reconstructed and the central Pivot reconstructed. A cartilage lesion can be addresses either at the time of osteotomy or at the time of reconstruction.

In medial instability the medial side should be repaired anatomically after MRI evaluation and the central Pivot reconstructed. The repair can be augmented with a graft if necessary.

There are no controlled or randomised studies comparing conservative and operative treatments of multiple ligament instability. Conservative treatment of knee dislocations (plaster, immobilization and non-weight bearing) was used in the first part of our century, and the main goal was to prevent amputation. These patients turned out with a bad range of motion and severe instability. Reports of postoperative results show that patients with low-velocity injuries do better that patients with high-velocity injuries. There is persistent loss in range of motion in half of the patients. Up to 50 % are classified as only fair, and generally it is difficult for the patients to get back to physically hard work. Patients with low-velocity injury has a higher probability of getting back to activity, including sports (75 % in one report). The rehabilitation period is long, 12 months.

The prognosis is dependent on additional vascular and nerve injury. The prognosis is better after reconstruction in acute cases than in chronic cases..

Whether there is any difference in outcome comparing primary (acute or delayed acute) treatment and elective reconstruction in different catagories of ligamentous lesions, only few studies address this question and at present no clear answer can be provided. The clinical experience favour treatment of multiple ligament injury of the knee within 7-10 days postoperatively, allowing for optimal planning of the procedure based on MRI and clinical tests. Taking into account that these injuries are treated timewise somewhat different throughout Denmark, a prolonged prospective study on outcome could and should be performed before guidelines can be provided.

Repair of the lateral side is surgically easiest to perform in the acute phase, and because of this, acute repair may be superior to chronic repair.

Grafts in multiple ligament surgery:

Concerning strength of the grafts thick grafts (Achilles tendon allografts or quadriceps tendon allo- or autografts) are preferable in revision cases with tunnel enlargement and in cases with loss of large amounts of ligament tissue, f. i. complete absence of PCL or LCL. These grafts are stronger than PTB and hamstrings but they have only one bony fixation.

Generally PTB grafts are the gold standard because they have a good strength, a good dimension for most repairs and good, bony fixation. The donor site morbidity (anterior knee pain) does not seem to be related solely to graft harvesting, but also to the reconstructive procedure itself. Therefore PTB autografts is first choice in many cases.

The choice of grafts in the individual cases is dependent on the instability, the loss of tissue and the availability of autografts.

Autografts seem to heal and incorporate themselves quicker than allografts, and some clinics use prolonged rehabilitation protocols after allograft procedures (9 months instead of 6 months). Loss of strength is quicker in allografts and the regain of strength less complete in allografts compared to autografts.

There are no randomised studies comparing allo- and autograft reconstructions, and because of the inferior properties of allografts, patients with high demands to knee stability are probably preferably operated with autografts. In series of patients there does not seem to be any great difference in long term stability between allo- and autograft operated knees.

There does not seem to be a cumulated morbidity when several grafts are harvested from the affected knee, but there are reports of higher donor site morbidity if the contralateral knee is used for harvesting.

In acute cases harvesting from the injured knee may lead to increased arthrofibrosis, and in addition the graft may have unrecognized injuries.

Rehabilitation after multiple ligament reconstruction/repair:

At present only general guidelines can be suggested, as different rehabilitation protocols have not been compared.

The general experience speaks in favour of individualized programs where progression depends on recovery speed and improvement in function of the individual patient.

Three phases for rehabilitation,

1. PRIMARY HEALING PHASE (0-4 weeks) where the goal is both to maintain knee joint movement (ROM) suggested by the use of CPM (10 h/day), and to counteract swelling.
2. REGAINING FUNCTION (4-12 weeks) with focus on ROM and loaded activity on the knee (e.g. cycling) and moderate strength training with fixed foot position.
3. BACK TO NORMAL ACTIVITY (3-12 months) where further increase in intensity of the training with regards to strength and training of functional movements is done. With regards to the knowledge on healing and strengthening of structures together with recovery of neuromuscular function it takes 12 months from injury before full sports activity on a high level can be expected.

When injury of the PLC is present theoretical knowledge and clinical experience suggests that aggressive training of hamstring function should be avoided for 3-4 months post injury.

Braces may be used with the goal to reduce loading on specific ligaments allowing for maintenance or improvements of ROM. Scientific bases for this are weak.

In the case of complications such as development of heterotrophic ossification with risk of arthrofibrosis, rehabilitation with regards to ROM should be intensified.

Bearing in mind the lack of scientific evidence for choosing one rehabilitation protocol in favour of the other, demands prospective randomized trials comparing different regimes. A too strict standardized treatment in such a study will be difficult given the individual differences in improvement of knee tissues found within these patients. However, the fact that different clinical views and experiences exists especially regarding the degree of aggressiveness and allowing e.g. early weight bearing in the rehabilitation, should provide a good basis for designing a multicenter study where different degrees of aggressiveness in rehabilitation protocols can be compared.

(Special emphasize on acute versus chronic patients (chronic should have full ROM before operation)).

Most surgeons use braces in acute cases for 8-12 weeks, mainly to avoid hyperextension and varus stress. In chronic cases braces are used after individual judgement.

Quality control:

It is important to monitor this treatment, as the literature is very sparse with short follow up and few patients. Long follow up is recommended with clinical parameters.

IKDC is scoring very low, because of the extensive nature of these injuries, and is too strict to evaluate these patients. There is no really good evaluation system for these patients.