Late Presentation and Revision for Failed Primary Management of Multiligament Injury:
Role of Osteotomy, Meniscal Allograft, and Cartilage Repair
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This talk will address factors that can have an adverse effect on the outcome of surgical management of multi-ligament knee injury. These are factors that should be evaluated in patients with failed surgical and conservative management.

I will address the following issues:
1. Malalignment
2. Meniscus loss
3. Cartilage injury
4. Post-traumatic arthritis

1. Malalignment
Axial malalignment (mechanical axis deviation) leads to increased tensile forces in the compartment, which can overload a ligament reconstruction.

Malalignment and lateral side injury
A lateral ligament reconstruction will experience excessive load in the varus knee, especially if there is a varus thrust.

A varus thrust may be exacerbated with combined ACL and lateral side injury.

Frank Noyes:
Single varus knee: varus mechanical axis due to bone alignment
Double varus knee: boney varus alignment + lateral ligament laxity
Triple varus knee: boney varus + lateral ligament laxity + posterior capsular injury (varus + recurvatum with weight bearing)

The clinician needs to determine if a complaint of "giving way" is due to buckling from ligament instability versus a varus thrust with gait.

A trial in a valgus-producing (unloader) brace may be helpful for both diagnostic and therapeutic purposes.

Revision lateral ligament reconstruction may require staged or concomitant valgus-producing osteotomy. A medial opening which technique would be preferred to a lateral
closing wedge tibial osteotomy, due to potential to induce further lateral collateral ligament laxity if the tibiofibular joint is released to allow closure of the osteotomy. A biplanar osteotomy to also change tibial slope to address ACL or PCL injury can be considered in this setting.

**Malalignment and medial side injury**
A clinically apparent valgus thrust is very uncommon

Valgus deformity is typically on the femoral side, and thus a distal femoral opening wedge varus-producing osteotomy is preferred.

**Malalignment and ACL/PCL injury**
Excessive posterior tibial slope can place increased stress on an ACL reconstruction graft. Conversely, decreased tibial slope may exacerbate PCL instability. A biplanar osteotomy can provide correction of both the mechanical axis as well as tibial slope.

2. **Meniscus Loss**
The menisci function in load sharing with the ACL. Both menisci act as secondary stabilizers in the ACL-deficient knee:

- **Medial** meniscus is dominant secondary stabilizer in ACL deficient knee during Lachman maneuver (*Levy et al, JBIS 1982*)
- **Lateral** meniscus is dominant secondary stabilizer in ACL deficient knee during pivot shift maneuver (*Musahl and Pearle, American J. Sports Medicine 2010*)

Meniscus transplantation may be considered in revision ACL reconstruction in order to protect the ACL graft, in addition to its possible role in chondroprotection.

Lateral compartment geometry (convex surfaces on both sides) makes it difficult to control tibiofemoral subluxation in the lateral compartment in the setting of absence of the lateral meniscus. Removal of lateral meniscus may increase the incongruity of an already incongruent lateral compartment, and facilitate the tibiofemoral subluxation that occurs with a pivoting maneuver.

In the unusual setting of sub-total loss of both menisci combined with collateral ligament laxity, meniscus replacement may aid stability by removing pseudo-laxity.

3. **Cartilage Injury/Post-Traumatic Arthritis**
Chondral injury is common in the multi-ligament injured knee. It is well-established that chondral injury has an important effect on clinical outcome following ACL reconstruction. Although there is much less data available regarding chondral injury in the setting of multi-ligament knee injury, it is likely that it has an adverse effect on outcome.

Cartilage repair techniques may be considered for treatment of a focal chondral defect
in the setting of ligament reconstruction. The author’s preferred technique is use of fresh osteochondral allograft.

Poor outcome after primary management of multi-ligament injury may be due to stiffness and post-traumatic arthritis. In that setting, conservative management is recommended initially. Manipulation under anesthesia and/or lysis of adhesions may be considered to restore motion. Ultimately, arthroplasty may need to be considered in knees with post-traumatic arthritis.