

DIAGNOSIS AND SURGICAL TREATMENT OF KNEE MENISCUS INJURIES

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Abstract: *Meniscus injuries are among the most common orthopedic conditions affecting the knee joint, especially in athletes and physically active individuals. The menisci are crescent-shaped fibrocartilaginous structures that play an essential role in load distribution, joint stability, shock absorption, and lubrication of the knee. Damage to the meniscus can lead to pain, swelling, reduced mobility, and long-term degenerative changes such as osteoarthritis. Accurate diagnosis and timely treatment are important to restore knee function and prevent complications. This article reviews the anatomy of the meniscus, mechanisms of injury, diagnostic approaches, and modern surgical treatment methods.*

Introduction

The human knee contains two menisci: the medial meniscus and the lateral meniscus. These structures are located between the femur and tibia and function as stabilizers and shock absorbers. Meniscal injuries may occur due to traumatic events or degenerative changes associated with aging.

Traumatic meniscal tears are commonly observed in athletes involved in sports such as football, basketball, and skiing, where sudden twisting movements occur. Degenerative tears are more common in older adults due to gradual wear and tear of the cartilage.

Untreated meniscus injuries may lead to chronic knee pain, instability, and progressive cartilage damage. Therefore, early diagnosis and proper treatment are essential.

Anatomy and Function of the Meniscus

Each knee joint contains:

- Medial meniscus (inner side)
- Lateral meniscus (outer side)

The menisci consist of fibrocartilage and are partially vascularized. The outer third, known as the “red zone,” has a good blood supply and better healing potential. The inner portion, called the “white zone,” has poor vascularization and limited healing capacity.

Main functions of the meniscus include:

1. Load transmission and shock absorption
2. Joint stabilization
3. Lubrication and nutrition of articular cartilage
4. Reduction of friction during movement
5. Protection of the knee cartilage

Causes and Mechanisms of Injury

Meniscal tears may occur through traumatic or degenerative mechanisms.

Traumatic Causes

- Sudden twisting of the knee while the foot is fixed
- Sports injuries
- Direct trauma to the knee
- Rapid deceleration movements

Degenerative Causes

- Aging-related cartilage degeneration
- Repetitive stress on the knee
- Osteoarthritis
- Obesity and chronic overloading

Classification of Meniscal Tears

Meniscal injuries are classified according to the tear pattern:

1. Longitudinal tear
2. Radial tear
3. Horizontal tear
4. Bucket-handle tear
5. Complex tear
6. Flap tear

The location and type of tear influence treatment selection and prognosis.

Clinical Symptoms

Patients with meniscus injuries commonly present with:

- Knee pain
- Swelling
- Locking or catching sensation
- Reduced range of motion
- Joint line tenderness
- Instability during walking
- Clicking sounds during movement

Symptoms may vary depending on the severity and location of the tear.

Diagnostic Methods

Accurate diagnosis requires a combination of patient history, physical examination, and imaging studies.

Medical History

The physician evaluates:

- Mechanism of injury
- Duration of symptoms
- Previous knee injuries
- Functional limitations

Physical Examination

Several clinical tests help diagnose meniscal tears.

McMurray Test

This test involves rotation of the tibia while flexing and extending the knee. Pain or a clicking sound may indicate a meniscal tear.

Apley Compression Test

Pain during compression and rotation of the knee suggests meniscal pathology.

Thessaly Test

The patient stands on one leg and rotates the knee. Joint line pain may indicate meniscus injury.

Imaging Studies

X-ray Examination

X-rays are useful to exclude fractures or degenerative joint disease but cannot directly visualize meniscal tears.

Magnetic Resonance Imaging (MRI)

MRI is considered the gold standard for diagnosing meniscal injuries because it provides detailed visualization of soft tissues.

MRI findings may include:

- Tear location
- Tear pattern
- Associated ligament injuries
- Cartilage damage
- Joint effusion

MRI has high sensitivity and specificity in detecting meniscal pathology.

Arthroscopy

Diagnostic arthroscopy allows direct visualization of intra-articular structures and may simultaneously provide treatment.

Conservative Treatment

Not all meniscal injuries require surgery. Conservative management may be appropriate for small, stable, or degenerative tears.

Conservative treatment includes:

- Rest
- Ice application
- Compression
- Elevation (RICE protocol)
- Nonsteroidal anti-inflammatory drugs (NSAIDs)
- Physiotherapy
- Muscle strengthening exercises

However, persistent symptoms or mechanical locking often require surgical intervention.

Surgical Treatment Methods

Modern orthopedic surgery aims to preserve as much meniscal tissue as possible because total meniscectomy increases the risk of osteoarthritis.

Arthroscopic Surgery

Arthroscopy is the preferred minimally invasive surgical technique for meniscal injuries.

Advantages include:

- Small incisions
- Less postoperative pain
- Faster recovery
- Reduced complication rates
- Early rehabilitation

Partial Meniscectomy

Partial meniscectomy involves removal of the damaged portion of the meniscus while preserving healthy tissue.

Indications

- Irreparable tears
- Complex degenerative tears
- Tears in the avascular white zone

Advantages

- Rapid symptom relief
- Quick return to activity

Disadvantages

- Increased risk of long-term cartilage degeneration
- Possible development of osteoarthritis

Meniscus Repair

Meniscal repair aims to preserve and restore native meniscal tissue.

Indications

- Young patients
- Acute traumatic tears
- Tears in the vascular red zone
- Longitudinal vertical tears

Surgical Techniques

1. Inside-out repair
2. Outside-in repair
3. All-inside repair

Advantages

- Preservation of knee biomechanics
- Reduced risk of osteoarthritis
- Better long-term outcomes

Disadvantages

- Longer rehabilitation period
- Risk of re-tear

Meniscus Transplantation

Meniscus allograft transplantation may be considered in patients with previous total meniscectomy and persistent symptoms.

Indications

- Young active patients
- Meniscus deficiency

- Chronic knee pain after meniscectomy

Goals

- Pain reduction
- Joint preservation
- Delay of osteoarthritis progression

Postoperative Rehabilitation

Rehabilitation is essential for successful recovery after surgery.

Early Phase

- Pain and swelling control
- Range-of-motion exercises
- Protected weight-bearing

Intermediate Phase

- Muscle strengthening
- Balance training
- Progressive mobility exercises

Late Phase

- Functional exercises
- Sport-specific training
- Return-to-activity programs

Recovery duration depends on the surgical method used.

- Partial meniscectomy: 4–6 weeks
- Meniscus repair: 3–6 months
- Meniscus transplantation: up to 6–12 months

Complications

Possible complications include:

- Infection
- Deep vein thrombosis
- Joint stiffness
- Persistent pain

- Recurrent tears
- Osteoarthritis progression

Careful surgical technique and rehabilitation reduce complication risks.

Prevention

Preventive strategies include:

- Proper warm-up before sports
- Strengthening of quadriceps and hamstring muscles
- Maintaining healthy body weight
- Avoiding excessive knee stress
- Using proper sports techniques

Conclusion

Meniscal injuries are common orthopedic conditions that significantly affect knee function and quality of life. Early diagnosis through clinical examination and MRI is essential for selecting appropriate treatment. Modern arthroscopic techniques allow minimally invasive and effective surgical management. Whenever possible, meniscus-preserving procedures such as meniscal repair are preferred over meniscectomy to maintain long-term knee health. Comprehensive rehabilitation plays a vital role in restoring joint function and enabling patients to return to normal activities.

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