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## Surgical Approaches to the Knee

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## Surgical approaches to the knee

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### Introduction

The surgical approaches to the knee, to the distal femur and to the proximal tibia allow access to the knee and the periarticular structures. Even in times of arthroscopically assisted knee ligament and meniscal surgery, the open procedures and the correct surgical approaches respecting the anatomy of the largest joint of the human body are needed - not only for total knee arthroplasty! There is no single best approach. Often several approaches have to be used for treating one affection. The knee is very sensitive to disruption of its proprioception. Any skin and capsular incision will disrupt parts of it. Surgical approaches do not only have to allow easy access to the anatomical structures but have to respect functional anatomy. One of the most important questions is obviously the one about where to put the skin incision. Regardless of the place of skin incision, any incision of the underlined joint capsule may be performed either laterally, medially, as media split (as described by Insall) or as a medial subvastus ("Southern") approach (1, 12,13,14).

We describe some of the most common approaches to the knee. They have proven to be effective in the hands of the authors. Reference literature for in-depth study is cited along the text and is listed at the end of paragraph. A sound understanding of knee's anatomy is essential to obtain safe and reliable approaches to the knee.

### **1. Medial approach to the knee**

This approach allows good exposure of the medial side of the knee (2, 8, 9, 10, 20, 21). It is one of the most commonly used approaches to the knee worldwide. It can easily be extended both proximally and distally and allows therefore - after lateral dislocation and eversion of the patella - easy access to both the medial and lateral compartment. A medial release of the tight structures in varus knees is easily possible. There are only small skin flaps, if any. In addition there is only minimal skin contact with joint surfaces during surgery which may minimize the risk of contamination of the joint.

The single most disadvantage of this approach is the substantial risk to injury to branches of the saphenous nerve. This nerve should be protected if possible. It runs posterior to the sartorius muscle, goes through the fascia between the tendons of the sartorius and gracilis muscles and becomes then subcutaneous on the medial side. The infrapatellar branch supplies the skin of the medial side of the knee. Injury to this branch may lead to neuroma and to severe discomfort of the patient, which may compromise subjective and objective function of the joint, e.g. of even the most perfect aligned total knee arthroplasty. In elderly patients the blood supply to the central portion of the incision may be poor, which increases to risk of skin flap necrosis.

### **2. Median (midline) approach to the knee**

In general there are the same advantages as in the medial parapatellar approach. Extension proximally and/or distally is possible. In addition a medial or lateral arthrotomy may be performed. The skin incision may be kept quite small, which has been one of the reasons why this approach became so popular for total knee arthroplasty.

The major disadvantage of this approach lies in an increased risk of wound healing problems (27,31,34): The incision lies "on the ridge" of the bony underlying structures and will be under tension from medially as well as from laterally. This may compromise proper wound healing, especially in the obese patient. Injury to branches of the infrapatellar part of the saphenous nerve can not be completely avoided with this approach. The blood supply to the patella can be compromised.

### **3. Y-shaped approach to the knee ("Mercedes-Benz star" approach)**

This approach was claimed to give an excellent exposure to the anterior part of the knee (11). And this especially in complicated proximal tibial fractures. With the osteotomy of the tibial tubercle and retracting the extensor/flexor apparatus one obtains an excellent view over the anterior compartment.

The single most important aspect is the fact, that an extremely high amount of wound healing problems had been noted over the years in this approach. And in view of these potential complications, some authors do not really see an advantage over other approaches in terms of exposure and soft tissue handling.

### **4. Lateral parapatellar approach**

The approach preserves the medial vascularity of the patella and does not interfere with the infrapatellar branch of the saphenous nerve (3, 8, 16, 18,19,20, 23, 25, 26, 27, 28, 31, 32, 37, 38). In combination with a tubercle osteotomy an excellent exposure of the knee can be obtained without causing any harm to the patellar tendon itself. The exposure to the lateral as well as to the medial side is excellent. Any extension in proximal as well as in distal direction is easily possible. Most compartments, event in difficult knee reconstruction can be reached with one incision. A so-called "lateral retinacular release" is included in the approach, which is helpful when addressing the tight valgus fixed knee in Total Knee Arthroplasty.

One of the major disadvantages of this approach is the fact, that usually a longer skin incision is necessary. Especially when compared with the straight midline approach. In order to avoid any complications with skin flaps care has to be taken to do subfacial and not only subcutaneous dissections. An osteotomy of the tibial tuberosity may be required. This osteotomy by itself however allows again for an excellent overview.

## **5. Medial approach**

When reaching for the medial collateral ligament or posterior capsule only this approach shows an excellent wound healing potential. It has proven to be very valuable in treating osteochondral defects with the osteochondral transfer technique (Mosaicplasty). With one relatively small incision both recipient site at the medial femoral condyle (reached in knee flexion) as well as the donor site proximally (in knee extension) can be reached, thus keeping soft tissue dissection minimal.

Extensions of the approach in proximal as well as distal direction are difficult or not possible. Once again, the infrapatellar branches of the saphenous nerve may be in jeopardy.

## **6. Posteromedial approach**

Easy access to the posterior capsule and the posterior aspects of the medial collateral ligament (35). Visualization of the posterior cruciate ligament and the most posterior aspects of the knee can be hampered by the thick synovium. Too much dissection may lead to vascular compromise, soft tissue and skin healing problems.

## **7. Posterior approach**

Especially when utilizing the simplified approach as described by Burks et al (7) it allows easy access to the tibial attachment of the posterior cruciate ligament and facilitates the so-called "on-lay" technique of PCL-reconstruction with auto- or allografts and which has shown in biomechanical testing to be superior to arthroscopically assisted techniques. Baker's cysts can very easily be reached and excised. Very rarely the medial head of the gastrocnemius muscle needs to be freed.

The patient has to be positioned prone, which not all of the patients who undergo the procedure in regional anesthesia find comfortable. If the patient receives general anesthesia the surgeon should make sure that the patient is placed correctly avoiding any further positional damage to nerves or joints. The "traditional" approach as described by Trickey may compromise vessels and neurologic structures in the popliteal fossa of the knee and may therefore be the cause of damage to those structures, especially when performed by inexperienced surgeons. The skin flaps at the corners of the "lazy S" incision may get healing problems. The incisions - whether "lazy S" or straight - may lead to

some wide scarring (7, 15, 33). If postoperative swelling is extensive, there is the risk of restricted venous flow and increased risk of thromboses

### Summary:

A total of seven different approaches to the knee have been described. Those approaches have proven to be most valuable to the authors. Indications, advantages, disadvantages and risks of these approaches have been described. A thorough knowledge of the anatomy and (bio) mechanics of the knee joint is mandatory in order to perform surgical procedures successfully

- Think before you cut (5, 34)
- You may not be the last surgeon operating on this knee joint
- Split layers in line with fibers
- Take care to preserve the infrapatellar branch of the saphenous nerve
- Take care to the blood supply of the patella
- Do not make dissections in the subcutaneous layer, go down to the subfacial layers

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