

Knee Disarticulation Amputation

Pre-Op

64 year old man, previous spinal cord injury, diabetes, renal failure, and a history of spasticity with dynamic knee flexion contracture. He had an open left ankle disarticulation for sepsis and severe foot infection 5 days previously.

Patient positioning

- Left hip towel bump to roll the patient slightly and keep the leg from externally rotating
- Black foam ramp pad to elevate the operative site above heart level and to minimize venous bleeding
- Padded thigh level tourniquet, or plan for the use of a sterile tourniquet
- TED hose and sequential compression device on the non-operative leg to minimize the chance of deep venous thrombosis (DVT)
- Foam pad under the non-operative leg to minimize pressure on the heel, malleolus, and proximally where the peroneal nerve is near the fibular head

Mark out boney landmarks

Patella, knee joint line, tibial tubercle, and the patellar tendon

Limb diameter at condyles

For a long posterior flap knee disarticulation, the flap is equal to the diameter of the limb at the level of the femoral condyle plus one cm.

Ioban plastic

Ioban plastic drape is used to seal off the open ankle area.

Aesanguinate before inflating the tourniquet

Aesanguination is acceptable because the area of infection was removed at the time of open amputation.

Incisions through skin to the fascia

Lateral and anterior

Elevate soft tissue anteriorly to expose the patellar tendon

The patellar tendon will be elevated off of the tibial tubercle and preserved for later reconstruction. Tenodesis of the patellar tendon to the cruciate ligament remnants on the femur will be done to stabilize the quadriceps mechanism and keeps the patella from retracting proximally.

Incisions through skin to the fascia

Medial incision through skin and subcutaneous tissue to the fascia.

Continue to expose patellar tendon

Complete the posterior incision to and through the fascia

Saphenous vein and nerve

On the medial side, dissect out the saphenous vein to ligate with absorbable suture. Clamp the vein. Locate the saphenous nerve, draw it down, transect it, and allow it to retract. Ligate the saphenous vein with absorbable suture.

Incise sides of patellar tendon

Incise on the medial and lateral edges of the patellar tendon. This allows isolation of the tendon so that it can be dissected up, off of the tibial tubercle.

Elevate tendon off of tubercle

Incise across the distal aspect of the patellar tendon to divide the fibers as they blend into the periosteum at the distal edge of the tibial tubercle. Sharply elevate the patellar tendon up and off of the tibial tubercle in order to

expose the front of the knee joint.

Lift up tendon to expose the fat pad

Palpate the anterior joint line where the capsule attaches to the tibial plateau.

Incise anterior joint line

Sharply incise down onto the anterior joint line and onto the top edge of the tibial plateau.

Enter the joint

Enter the joint below the meniscus, keeping the menisci with the femur.

Release the anterior aspect of the lateral and medial menisci

Dissection under the menisci helps preserve the vascular meniscal rim, which will add mechanical strength to the capsule for the myodesis and closure.

Release the anterior cruciate ligament

To allow translation of the tibia forward and more completely expose the knee joint.

Bone hook

Place a bone hook onto the tibia to pull forward and translate the tibia anteriorly. It is initially resisted by the anterior cruciate ligament.

Release remaining fibers

Release the remaining fibers of the anterior cruciate ligament and the posterior meniscal attachments. The tibia subluxes forward to expose the posterior tibial joint line.

Dissect the capsule off the posterior tibial joint line

Release the posterior cruciate ligament of the posterior edge of the posterior tibial plateau

Dissect around the fibula and release the lateral collateral ligament

Use the amputation knife to dissect the soft tissue down the posterior tibial plateau

Dissect all of the soft tissue directly off of the posterior aspect of the tibia and the fibula and keep the soft tissue with the posterior myofasciocutaneous flap.

Use the scalpel to fully release the flap off the fibula

Divide through the distal end of the flap.

Note the normal motion between the tibia and the fibula

Remove the menisci

Dissect the center portion of the menisci off of the capsule. Leave a small rim of the vascular portion of the menisci to eventually sew the muscle flap to as a myodesis.

The shape of the medial (left) and lateral (right) menisci

Isolate the femoral remnants of the cruciate ligaments

The patellar tendon will eventually be sutured to the femoral remnants of the cruciate ligaments.

Popliteal vessels and tibial nerve

Dissect in the posterior tissue to expose the popliteal vessels and the tibial nerve.

Tibial nerve

The tibial nerve is dissected off of the vessels

Popliteal vessels

The popliteal vessels are clamped and then trimmed to appropriate length for ligation

Double ligation of the popliteal vessels with first a stick tie of 0 silk suture (non-absorbable). The stick tie could leave a small hole that could bleed, form an arterial-venous fistula or a small pseudo aneurysm, so a second free tie is placed.

The free tie of 0 silk non-absorbable suture proximal to the stick tie to avoid problems with the hole in the vessel.

Common peroneal nerve

Dissect out the common peroneal nerve. Pull the peroneal nerve distally 5 to 10 cm, transect it sharply, and allow it to retract away from areas of pressure and scar.

Tibial nerve

Pull the tibial nerve distally 5 to 10 cm and transect it.

Small saphenous vein and sural nerve

In the subcutaneous tissue of the posterior flap, the small saphenous vein is located and clamped for ligation. The sural nerve is found just lateral to the small saphenous vein. At this level it can be proximal to where the medial and lateral sural nerves join to form the common sural nerve.

Sural nerve

Pull the sural nerve 10 to 12 cm distal, divide it and allow it to retract well away from the areas of pressure and scar.

The tibial, sural, and common peroneal nerves

These are three of the 4 nerves of concern in a knee disarticulation. The fourth nerve was the saphenous nerve managed earlier in the procedure.

Small saphenous vein

Ligation of the small saphenous vein.

Trial look at flap coverage

Trial look to approximate the muscle coverage and determination that the medial gastrocnemius muscle will be sufficient to cover the joint.

Examine medial and lateral gastroc muscles

Begin to develop the plane between the two muscles.

Separate medial and lateral gastroc muscles

Separation in the central area between the medial and lateral gastroc muscle bellies.

Dissect lateral gastroc

Dissect the lateral gastroc muscle off the fascia so that it can be removed.

Keep the superficial fascia with the posterior flap. Dissect the muscle up proximally.

Vascular pedicle

Dissect and clamp the vascular pedicle to the lateral gastroc muscle.

Transect the gastroc

Transect the thin proximal portion of the gastroc muscle near its origin.

Ligate the vascular pedicle

Ligate the vascular pedicle of the lateral gastroc muscle

Let tourniquet down

Hemostasis

Obtain hemostasis with pressure, and then with electrocautery or small ligation of bleeding points.

Saphenous vein

Clamp another branch of the saphenous vein for ligation.

Saphenous nerve

The main portion of the 4th nerve, the saphenous, is finally found, drawn down and divided to allow it to retract. The earlier small nerve was probably a branch of the saphenous.

Ligate the saphenous vein

Ligate with absorbable suture.

Osteoarthritis

The surface of the femoral condyle shows moderate wear of the articular cartilage surface indicative of moderate osteoarthritis. This is consistent with a 64 year old man.

Irrigation

Use saline irrigation solution to remove debris and hematoma, and to minimize bacterial contamination.

Hemostasis

Use electrocautery to obtain hemostasis.

Trial mobilization of patellar tendon

Trial to show the placement of the patellar tendon down near the femoral remnants of the cruciate ligaments. The hip is bent up into a fully flexed position so that the patellar tendon can be mobilized down into the femoral groove.

Dissect fat pad

Use electrocautery to dissect the fat pad off of the posterior surface of the patellar tendon.

First stitch

Place a large, non-absorbable suture of #2 ticon securely through the remnants of the anterior and posterior cruciate ligaments in a locking stitch fashion.

Test the suture's strength

Second stitch

Place a second #2, large, non-absorbable suture in the locking Krakow fashion in the under surface (deep posterior surface) of the patellar tendon. This will be used to tenodesis the patellar tendon to the cruciate ligament remnants.

Tenodesis

By fully flexing the hip up to 90 degrees, one can mobilize the patella down distally into the femoral notch and then tie the two sutures together. This serves to create a tenodesis of the quadriceps muscle through the patellar tendon to the femur.

Trim the excess patellar tendon

Reinforce tenodesis

Use another #2 non-absorbable suture to reinforce the tenodesis of the patellar tendon to the posterior joint capsule and the cruciate ligament remnants in the femoral notch.

Myodesis

The medial gastroc muscle is mobilized up over the femoral condyles to provide distal padding and myodesis of the muscle to the anterior joint capsule. The muscle is centered over the femoral condyles.

Suction hemovac drain

Place the deep hemovac drain just lateral to the femoral condyle. The drain is brought out the lateral side and not the medial in order to avoid damage to the saphenous vein. Cut the drain between holes.

MYODESIS

Begin the myodesis of the medial gastroc muscle centrally on the femur. The first suture sews the fascia of the gastroc muscle to the anterior capsule of the knee and centers the muscle over the femoral condyles. Sewing the fascial layers and not the muscle holds the muscle in place, but minimizes the creation of avascular muscle.

Medial suture

A medial suture helps to center the medial side to the muscle.

Lateral suture

A lateral suture helps to center the lateral one-half of the muscle flap.

Further sutures

Further sutures to fully secure the muscle closure over the distal femur and securely close the deep layer. The myodesis securely closes the fascia of the medial gastroc muscle across the capsule of the knee to perform a deep, secure closure.

Close the corners

Close the medial and lateral most corners of the muscle flap and the articular space with a deep fascial stitch. Since this is an articular joint, without a tight closure the joint fluid that is still created between the patella the femur could leak and create synovial fistula and ongoing drainage in the post-operative period.

Trial positioning

The trial positioning of the posterior fasciocutaneous flap and the redundant skin to be removed from the lateral side of the flap.

Center the flap

Secure the flap in position and inset the flap by placing the all important first stitch to center the flap in the desired position.

Medial closure

Close the fascial layer of the medial side of the flap.

Remove medial “dog ear”

Identify the extra skin at the medial corner. Use the forceps to place traction on the skin where it wants to fold and create a new corner without a dog-ear appearance by removing the two corners of skin.

Align medial corner

Place a subcutaneous suture to align and close the medial corner.

Lateral closure

Move laterally to close the fascia. Identify the best inset for the lateral closure with the large area of extra skin to be removed.

Excise excess tissue

Examine the lateral skin and mark out the incision. Sharply excise the excess skin and create a smooth, symmetric closure.

Subcutaneous closure

The subcutaneous closure continues to the lateral corner.

Remove lateral “dog ear”

Identify the extra skin at the lateral corner. Use the forceps to place traction on the skin where it wants to fold and create a new corner without a dog-ear appearance by removing the two corners of skin.

Close dermal layer

Use horizontal dermal sutures to accurately align the skin edges, and to close the subcutaneous space. This closure is performed with absorbable suture.

The subcutaneous and dermal closure continues around the entire flap.

Nylon skin closure

Use nylon sutures for the final skin closure.

Steri-strips

Apply skin prep and then apply steri-strip skin tapes to lessen the tension from the sutures and seal the area between sutures.

DRESSING

Adaptec non-stick gauze

Open 4x4 gauze

Apply 4x4 gauze over the distal end. Apply them one at a time and against the incision line to prevent a large layer of gauze that can shift around or apply too much pressure.

Fluff gauze padding

Kerlex roll gauze

Care is taken to keep a gauze layer between the skin and the drain.

Remove the drapes and the tourniquet

Webril cotton cast padding

In order to facilitate removal of the drain, place webril padding below and above the drain. It is also wrapped over the gauze fluff dressing on the distal end.

Plaster Splints

Plaster splints are used to make a rigid dressing over the end and sides of the residual limb. The plaster makes a rigid dressing that helps control swelling and edema and protects the limb from minor external trauma that may occur to the amputation site during patient transfers and with the patient's bed activity.

Bias cut stockinet

Wrap over the plaster with bias cut stockinet.

Rest leg on a pillow while the plaster dries

The plaster is molded on a pillow.

Tape

Tape to prevent the bias cut gauze from shifting and becoming disheveled.