Transfemoral Amputation

Preop
This 26 year old male sustained a gunshot wound to the left thigh. He was treated emergently with revascularization and fasciotomies. He was transferred to our regional trauma center one week after injury with extensive lower leg myonecrosis, renal failure, sepsis. An open knee disarticulation performed as life-saving procedure to remove the necrotic tissue of the lower leg. He is now stable and returns to surgery for definitive transfemoral amputation.

Apply tourniquet
After sterile prep and drape, apply sterile tourniquet.

Measure diameter of limb
Measure the diameter of the limb at the level of the planned bone cut.

Ioban plastic
Ioban plastic seal is used to seal off open knee disarticulation area.

Mark out incision lines
Incision lines are drawn for an equal anterior and posterior flap technique. They are designed so that if proximal extension is needed it will be in line with the more proximal incisions from his revascularization.

Flap planning
Flaps are both equal to ½ of the diameter of the limb + 1cm at the level of the planned bone cut.

Incisions through skin to fascia
Incisions are made in a decisive fashion through the skin, subcutaneous tissue and fascia to avoid feathered edges of tissue.

Identify vessels
Medially, the area of the vessels near Hunters Canal is identified.

Carry incision to bone
From this point, the incision is carried anteriorly and laterally through the muscle down to the bone.

Posterior lateral incision
The posterior lateral incision is made through the skin, subcutaneous tissue and fascia.

Posterior medial incision
The posterior medial incision is made through the skin, subcutaneous tissue and fascia.

Dissect between synovial tissue and quadriceps fascia
Because the knee joint was open and potentially colonized, the synovial tissue is removed to minimize the risk of infection. Dissection is done between the fascia of the quadriceps muscle and the synovial tissue in order to leave the synovial tissue with the distal femur and make certain it is removed with the amputation specimen.

Continued synovial tissue dissection
Continued dissection between the quadriceps and synovial tissue

Dissection carried down to femur
The dissection is carried down to the femur anteriorly and then laterally and the periosteum is divided.

Muscle elevated off femur
Quadriceps muscle is elevated up off of the femur.

Large retractor holds quad muscle
A large retractor holds up the quadriceps muscle to expose the femur.

Cobb elevator to free tissue
A Cobb elevator is used to free up the tissue circumferentially around the femur.

Divide femur
The oscillating saw is used to divide the femur perpendicular to its long axis. Saline is used to cool the saw blade and prevent

thermal damage to the bone.

Adductor tissue
The distal attachment of the adductor muscle is demonstrated. This tissue must be preserved and dissected off of the femur to be used for the adductor myodesis.

Adductor tissue dissected off femur
The overlying skin and subq tissue are dissected distally off the adductor fascia to better visualize the adductor. The adductor tissue is dissected off of the femur. The fascia is left with the muscle.

Adductors transected distally
The adductors are transected distally, after preserving adequate length for the adductor myodesis.

Vessels are transected posterior medially
In the posterior medial area, the vessels can be transected safely at this level. The tourniquet prevents blood loss.

The vessels are dissected free, divided, and the large deep femoral artery and both accompanying veins are clamped for later ligation.

Transect posterior tissue
The posterior muscle and tissue are transected cleanly with the amputation knife.

Vessels dissected and clamped
The large deep femoral artery and both veins are dissected up proximally and clamped.

Artery and two veins are double ligated
Stick tie:
A stick tie of 0 silk suture is used first. The stick tie will not slip or pulse off of vessels, but does leave a hole that could bleed or lead to a pseudo aneursym or an arterial/venous fistula.
Free tie:
A free tie is place proximal to the stick tie. The proximal free tie prevents bleeding at the site of the stick tie and also minimizes the chance of an arterial/venous fistula forming.

Sciatic nerve
The sciatic nerve has already divided into the **tibial** nerve, the **peroneal** nerve and the **sural** nerve. These nerves are dissected proximally.

The tissue between the tibial and peroneal branches is dissected up to the common sciatic nerve.

The small sural branch is isolated as well.

Ligate nerve
The nerve is pulled distally to allow ligation with an absorbable suture. The sciatic nerve is quite large and has small vessels that can and do bleed. Ligation with an absorbable suture prevents this intra-operative and post-operative bleeding.

Cut suture
The suture is inspected and cut.

Divide nerve
The nerve is cleanly divided distal to the suture ligation.

Push nerve up proximally
The nerve must retract proximally to prevent the distal end of the sciatic nerve from becoming adherent to areas of scar and pressure. Using a finger helps assure that the nerve is not tethered and has indeed retracted proximally 5 to 10 centimeters from the level of the bone cut and flaps.

Sciatic nerve and branches
The sciatic nerve and its tibial, peroneal, and sural branches are shown.

Medial hamstring mobilization
Mobilization of the medial hamstring tendon for myodesis (the tendon and the muscle going into the tendon is shown). The tendon is pulled up through a proximal level in the posterior flap. This avoids tethering the subcutaneous tissue in the distal, posterior medial flap and facilitates a better closure of the tissue layer.

Tourniquet down
The sterile intra-operative tourniquet is let down, and lap sponges are used for compression and early hemostasis.

Hemostasis
Inspect the tissue, look for bleeding vessels. Hemostasis is obtained with electrocautery.

Expose femur
Excessive periosteum may calcify and form irregular bone. Therefore, it is removed. This also exposes the distal femur for the myodesis drill holes.

Irrigation
Irrigation of the tissue removes debris, bone dust, blood, and minimizes tissue contamination with bacteria.

Adductor muscle fascia and medial hamstring tendon clamped
Clamps are on the adductor muscle fascia and the medial hamstring tendon. They will both be myodesed to the femur.

Remove tourniquet
Fully removing the sterile tourniquet allows examination and mobilization of the proximal tissue.

Examine large vessels
Examination of the large vessels to assure the integrity of the ligation. The vessels can be seen pulsing.

Locate unicortical drill hole area
Pointing out the areas on the lateral and anterior femur where unicortical drill holes will be made for the sutures to be passed in and then out of the femur to act as myodesis points.

Drill 4 myodesis holes
Using a 2.5mm drill bit, 4 unicortical drill holes are made in the distal femur. Irrigation is used to cool the drill bit.

First hole is on the anterior-most portion of the femur. The three other holes move laterally from the first.

Four holes allows for the placement of three independent sutures: Anterior (A), Anterior Lateral (AL), and Lateral (L). The suture is of number 2 ticron; a strong non-absorbable suture.

Place 1st suture (A)
Suture is first passed from the outside of the cortex into the medullary canal. Suture is often easier to pass then from inside the bone with the blunt end of the needle as the sharp end gets caught in the trabeculi of the bone. This suture is placed in the first and second holes, starting medially. It is the most superior/anterior suture – anterior suture “A”.

Clamp suture
Suture “A” is clamped, the needle is left in place.

Unblock trabecular bone
If needed, a pointed bone clamp can be used to unblock trabecular bone from the pathway into the cortical bone hole.

Place 2nd suture (AL)
The second suture (anterior lateral, “ AL”) is passed using the blunt end of the needle in order not to damage the first suture and weaken it. The sutures share space within the central two holes. This suture is placed in the second and third holes.

Place 3rd suture (L)
The third suture (lateral, “L”) is placed in the third and fourth holes.

“A” suture used for myodesis of medial hamstring
The medial hamstring tendon and muscle are mobilized. The anterior suture will be used to myodese the medial hamstring muscle by suturing in the tendon, near the myotendinous junction.

A locking Krakow suture technique is used within the tendon to obtain secure fixation and minimize devascularization of the tendon tissue.

Medial hamstring tied up over femur
After suturing the tendon with the anterior suture (“A”), the medial hamstring is myodesed up and over the distal femur.

Tendon secured
The myodesis is secured with a second pass of the suture through the tendon.

Excess tendon is removed
The tendon can be secured to the periosteum as well.

Adductor muscle advanced
The adductor muscle with its fascia is advanced over the distal end of the femur to illustrate where it goes and how the AL and L sutures will be used to secure the two separate parts of the fascia for a secure myodesis.

Posterior muscle fascia sutured
Before the adductor myodesis, the posterior muscle fascia is brought up over the distal end of the femur and secured to the hamstring tendon and periosteum with absorbable suture.

Suture adductor fascia
The illustration shows the placement and locking points for the Krakow technique suture used to secure the adductor tendon.

The lateral (L) suture is placed through the adductor fascia, securing the posterior edge of the fascia and the central portion of the fascia again with a Krakow locking suture technique.

The central (AL) of the three sutures is identified. This is used to secure the central portion of the adductor fascia and then the anterior portion of the adductor fascia with a Krakow locking suture technique.

Adductor muscle secured
Adductor is mobilized across the femur and suture advanced and tied. As one strand secures the tendon in a locking fashion, the suture must be tightened by advancing the free end of the suture through the drill holes in the femur and pulling the adductor fascia up and over the femur to secure it in place.

Now, the second suture is secured.

Deep quadriceps myodesis
Absorbable suture is used to secure the deep fascia of the quadriceps to the myodesis point by suturing it to the adductor fascia and periosteum.

A second suture is used to secure the deep fascia of the vastus lateralis to the myodesis point.

More sutures placed to secure the deep quadriceps fascia to the myodesis area on the distal femur and help keep the femur centralized within the muscle mass.

In a transfemoral amputation, the greater trochanter and abductor muscle insertion remain normal, so abduction remains strong. The lesser trochanter and attachment of the iliopsoas tendon also remain normal and therefore flexion remains strong. The main goal in a transfemoral myodesis is to try and restore some extension and some adductor strength to the limb. This helps rebalance the limb between flexion and extension, and abduction and adduction.

Test positioning of the flaps

Bring the drain out anterior and lateral
The drain is cut between holes and placed deeply.

Fascial closure
Start the fascial closure by bisecting the posterior muscle flap and then finding the central areas of the quadriceps muscle and tendon to centralize the flap closure.

Several of the central sutures are placed so that the layers are clearly identified. These sutures are tagged before tying to allow good visualization of the layers. After placing 3 or 4 sutures, the central area may be tied and secured. Absorbable 0 dexon type suture is used.

Probing for holes in the fascial closure. A secure fascial closure helps prevent muscle herniation and helps healing.

Subcutaneous closure
Start the subq closure with dermal suture, horizontal placement, using a 2-0 absorbable suture.

Trim excess skin
Trim any excess skin.

Nylon skin closure
Start the nylon skin closure with a 3-0 nylon suture placed in the figure 8 fashion.

Suture drain in place
Suture the drain in place to prevent it from being pulled out, dislodged, or removed early. In an AKA, the dressing is a soft ACE wrap spica around the waist, but the soft dressing can be easily opened to cut the stitch and remove the drain anytime it is ready.

Hook the drain to suction

Clean the leg and remove old blood

Bandaging
non-stick adaptic gauze

4x4 gauze is opened up and laid across the incision, and then one by one laid over the wound. Gauze should not be in a large lump that can put pressure on the skin and cause skin breakdown.

Fluff gauze to add padding and some compression

Kerlex roll gauze to secure the dressing and apply gentle compression to the end of the amputation site. 2 rolls.

Apply mongo extra long 6 inch ace wrap around the above knee amputation site, the proximal limb, and the waist in a spica fashion. The gauze is wrapped in an angled fashion to avoid proximal constriction of the limb and avoid the “tourniquet effect”.

Secure the spica ace with tape to keep it from getting tangled, displaced, or becoming tourniquet-like.