Transfemoral Amputation

Pre-Op Plan

As with all amputations, one critical decision is where exactly to cut the femur. Several factors must be taken into consideration when choosing where to cut the femur for a transfemoral amputation.

1. All of the diseased, severely traumatized, or infected tissue must be removed.

2. The bone cut must be proximal enough to perform a myodesis and allow the flaps to cover the end of the femur without tension.

3. Having a very long transfemoral amputation has some benefits:
   a. Creates a longer mechanical lever arm for strength.
   b. Leaves more of the normal adductor attachment to minimize contractures.
   c. Creates a longer limb for seating support and transfers.

4. But, having a very long transfemoral amputation has some real drawbacks:
   a. Makes padding the residual limb more difficult.
   b. Does not leave adequate room for prosthetic components.
   c. Creates complex leg length and knee center prosthetic situations.

5. Leaving metaphyseal bone is very controversial, and is not typically recommended. In theory it is suggested that the larger diameter of bone might increase end bearing, but this has not been shown clinically. In addition, long amputations at this bone level, when covered by muscle and skin flaps, do not have enough space between the end of the residual limb and the opposite leg knee center for socket, connectors, knee unit, let alone a rotator unit.

6. Many transfemoral amputees enjoy having a rotator unit installed between the socket and the knee unit. A rotator unit is useful when getting in and out of a car, when donning pants, shoes and socks, and when sitting in confined spaces. A rotator and its connectors need 2.5 to 3 cm of additional space.

7. Space needed between the skin and ideal knee center is 10 cm if a rotator is to be used and 7.5 cm without a rotator.

8. Given that the myodesis and skin closure adds approximately 5 cm between the end of the bone and the skin, then the bone should be cut 15 cm proximal to the knee center if a rotator is to be used, and 12 cm proximal to the knee center if a rotator is not going to be used.

9. A rotator unit can still be used on a long transfemoral amputation, but the knee center on the amputated leg will then be lower than the opposite knee center. The lower leg will also be shorter than the opposite leg. This creates a situation similar to many knee disarticulation patients. Although it appears awkward and is biomechanically sub-optimal, it has not been shown to be more detrimental than standard transfemoral component placement in any documented study.

When prepping and draping a patient for a transfemoral amputation, it is advisable to have surgical access all the way up to the hip and groin area. Therefore, using a standard tourniquet applied above the prepped field is not recommended. After the prep and draping, a sterile tourniquet can be used and applied for a short time to limit blood loss during the amputation.

Skin and Flaps

Skin incisions are drawn out based on the proposed level of the femoral bone cut. Level selection for a transfemoral amputation should be above the zone of injury.

The anterior to posterior diameter of the limb at the level of the bone cut is measured. The length of the flaps is ½ the diameter of the limb plus 1cm.

Incisions should be made through skin, subcutaneous tissue and fascia in a decisive fashion to avoid feathered edges. Incise through the muscle and down to the bone. Dissect soft tissue out of the way and dissect down through the periosteum.

Nerves

Sciatic Nerve:

The sciatic nerve has often divided into the **tibial**, **peroneal**, and **sural** nerves at this level. The nerves may still be together, or may have started to separate out anatomically. The surgeon should make certain that all three branches are addressed. The nerves are dissected proximally.

The nerves are then pulled distally to allow ligation with 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.

After ligation, the nerve is pulled distally and transected. Then, use a finger to ensure the nerve moved up proximally and was not tethered. The nerve ending should end up away from areas of scar, pulsating vessels, and closure. The ending should be away from areas of pressure in a standard prosthesis.

Vessels

Femoral Vessels:

Locate the femoral vessels (an artery and two veins). Dissect the vessels proximally and clamp for double ligation.

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 aneurysm 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.

Tie off small peripheral and muscular vessels. Obtain hemostasis with electrocautery.

Bone

Femur:

Clear soft tissue off of the femur circumferentially with the Cobb elevator. Use the Cobb to work through the very thick linea aspira posterior fascial attachments on the femur as well.

Do not leave strips of periosteum, which may calcify and lead to spikes of bone or heterotopic ossification.

A carefully dissected periosteal flap may be used to cover the end of the femur. While some surgeons discuss the theoretical advantages of this technique, it should be pointed out that adding a periosteal flap has not been shown in any controlled studies to improve functional outcome. This remains open to discussion and further study.

Use large retractors to hold the quadriceps out of the way, and use an oscillating saw to divide the femur perpendicular to its long axis. Cool the saw with saline.

Rasp the bone to smooth edges in preparation for myodesis.

Myodesis

Myodesis is performed to attach and stabilize muscle directly to bone in order to provide fixed resistance against which a muscle can move, to maintain function, and to provide distal padding of the bone. In this procedure, deep muscle layers are attached directly to the distal portion of the bone, and then more superficial layers are sewn to each other above the bone attachment as a myoplasty.

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.

The **adductor** and **medial hamstring** muscles will be used for myodesis at this level. Early on, the distal medial skin and subq tissue should be elevated to reveal the attachment of the adductor. The adductor is preserved longer than the other muscles so that later the myodesis can be performed.

Suture Placement:

Using a 2.5mm drill bit, 4 uni-cortical drill holes are made in the distal femur. Irrigation is used to cool the drill bit.

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

Four holes allow for the placement of three independent sutures: Anterior (A), Anterior Lateral (AL), and Lateral (L).

Suture A:
Suture is first passed from the outside of the cortex into the medullary canal. Suture is often easier to pass then from the inside of the bone with the blunt end of the needle as the sharp end gets caught in the trabeculi of the bone. The suture is placed in the first and second holes, starting medially. It is the most superior/anterior suture.
Suture AL:
The second suture (anterior lateral, " AL") is passed using the blunt end of needle in order not to damage the first suture and weaken it. The sutures share space within the second hole. This suture is placed in the 2 nd and 3 rd holes.
Suture L:
The third suture (lateral, "L") is placed in the 3 rd and 4 th holes. It shares the 3 rd hole with suture AL. Again, it is passed using the blunt end in order not to damage suture AL and weaken it.

Adductor Myodesis:

The adductor muscle is advanced over the distal end of the femur. At the discretion of the surgeon, one of the three sutures is used with the Krakow locking suture technique on the adductor fascia. The Krakow technique obtains secure fixation with four locking points and minimizes devascularization of the tissue.

Medial Hamstring Myodesis:

The hamstring tendon and muscle are mobilized. Again, the surgeon chooses the most appropriate suture and uses it to myodese the medial hamstring muscle by suturing in the tendon, near the myotendinous junction.

The hamstring is brought over the distal end of the femur and myodesed with a locking Krakow suture technique to obtain secure fixation and minimize devascularization of the tendon tissue.

Reinforcement of the Myodesis:

The surgeon chooses a suture and uses it to reinforce both the adductor and the medial hamstring myodesis and to keep the femur centered in the muscle mass.

Further Myodesis:

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

Closure

Close the deep fascia of the quadriceps to the deep fascia of the hamstrings.

A deep suction drain is placed and brought out medially and laterally. It is cut between holes to facilitate removal.

Then, close the superficial fascia. Trim any excess skin and complete the superficial fascial closure.

Complete the subcutaneous closure with dermal 2-0 absorbable suture in a horizontal placement.

Trim corners to avoid a "dog-eared" appearance.

Complete the skin closure with 3-0 nylon sutures places in the figure 8 fashion.

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

Bandaging

Non-stick adaptic gauze

4x4 gauze is opened up and one by one laid across the incision. 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 the “tourniquet effect”.

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