SOME AMPUTATIONS OF THE LOWER EXTREMITY

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Hindquarter Amputations

Description of the Operation (First Stage)

Position on the Table. The patient is placed lying on his sound side with a sandbag in the small of the back and another under the thigh on the sound side. The upper arm is fixed on an arm rest, while the lower is held on a board. The surgeon stands behind the patient. There should be three assistants. The leg to be amputated is held by one assistant, one stands beside the surgeon and the other by his side, opposite the gluteal area.

Blood transfusion is commenced in the form of two intravenous drips. This is important, as the patient may need a rapid massive transfusion. One transfusion can be started in the forearm of the unaffected side and the other on the back of the forearm on the affected side.

A neoplex catheter is introduced and tied into the urethra before the operation is commenced.

The leg should be exsanguinated by an Esmarch's bandage to the mid-thigh before the operation is commenced and a piece of oiled silk is stitched over the anus to isolate this so that it does not encroach on the operative field.

The incision employed is that designed by Girard. It begins at the symphysis pubis and extends across the iliac fossa to the anterior superior spine of the ilium, continuing downwards over the greater trochanter and across the gluteal fold, then upwards to its point of origin. The attachment of the rectus abdominis muscle is cut and the inguinal ligament divided at its attachments to the pubis and the anterior superior iliac spine. If any doubt exists as to the extent and fixation of the disease in the case of a neoplasm on the inner aspect of the innominate bone this can readily be ascertained at this stage of the operation. The inferior epigastric vessels are ligated and divided and the spermatic cord retracted. At this stage the iliac fossa and the retroperitoneal pelvic space are exposed by retracting the detached abdominal wall and peritoneum medially.

In the case of a growth the tumour mass will be seen to fill the iliac fossa and its whole extent can be investigated as far back as the sacro-iliac joint.

The ureter should be carefully avoided; it is generally adherent to the peritoneum, and reflected with it.

It is important to expose the common iliac, the external iliac hypogastric arteries. A controlling tape is then placed round the common iliac artery, which is occluded throughout the remainder of the operation.

The external iliac artery is transfixed, doubly ligated and divided. The symphysis pubis is well defined and divided with a chisel. The amount of bleeding at this stage is usually minimal.

Second Stage

The patient is then gently turned further over on his sound side and the posterior dissection commenced by cutting through the muscles attached to the iliac crest and the gluteal attachments to the posterior surface of the sacrum. The dorsum of the ilium is exposed and the sciatic notch exposed. At this stage a Gigli saw is intro-duced underneath the sciatic notch and led through the notch from within the pelvis, withdrawing the Gigli saw by means of a heavy pair of forceps or to the dorsum of the iliac bone.

It is more expeditious and less shocking to saw through at the site of the sciatic notch than to di- verticulate at the sacro-iliac joint.

If the extent of the tumour growth does not permit splitting the ilium at the sciatic notch disarticulation at the sacro-iliac joint then has to be undertaken. This is a difficult procedure. After the ligaments have been cut, an osteotome is introduced into this joint and the two surfaces separated using a mallet.

The gluteal and obturator vessels and nerves, the sciatic nerve and the piriformis and levato-r ani muscles are sectioned. The sacro-tuberous, sacro-spinous and posterior sacro-iliac ligaments are then further severed. Returning to the anterior
dissection, the psoas muscle and femoral nerve are divided, while the external iliac vein is trans-
fixed and doubly ligated before it, too, is divided.
It will then be seen that the extremity is now almost free for removal and can be drawn away from the intact pelvic peritoneum by division of the anterior portion of the pubo-rectalis muscle which is inserted behind the pubis.
All small bleeding points are then caught up and the controlling tape on the common iliac artery removed. Normal pulsation occurs in this artery, the hypogastric and the stump of the external iliac artery. The amount of haemorrhage is again minimal.
This method of temporary occlusion of the common iliac artery provides excellent vascular control of the whole area and makes the operation a much safer procedure. The skin flaps are approximated after the peritoneum has been reinforced by suturing the remains of the gluteus maximus and levator ani muscles to the flank muscles and the rectus abdominis. Through and through interrupted silkworm sutures are used.
The most important points in successfully con-
ducting this operation are as follows:
1. Spinal anaesthesia eliminates some of the shock in this drastic operation, which involves severing of the lumbo-sacral plexus, the first and second sacral and the obturator nerves.
2. Adequate blood transfusion should be started at the commencement of the operation and carried on until the operation has been successfully com-
pleted and the blood pressure of the patient has again become stationary.
3. Haemorrhage is made minimal by the temp-
orary occlusion of the common iliac artery, which provides excellent vascular control.
4. Sawing through the dorsum ilii at the level of the sacro-iliac notch is a simple and expeditious method of dividing the bone and eliminates the shock and trauma of disarticulation of the bone at the sacro-iliac synchondrosis.
5. Gentle handling of the patient and gentle handling of the tissues further eliminates shock.
6. The danger of necrosis of the posterior skin flap incidental to common iliac artery ligation is avoided.

Post-operative Care
The patient is returned to a warm bed with the foot of the bed raised. The drip is usually required until the next day and the patient may require as many as 10 pints of blood.
It is necessary to keep the catheter in situ in the bladder for three or four days post-operatively and have this connected to a tidal drainage apparatus or by simple drainage.
The first dressing in the ward should be done under light pentothal anaesthesia and the drainage tubes removed. The stitches should be left in as in all amputation cases, for 10 to 14 days.
The patient should be given the freedom of the bed and encouraged to move about. This will not only help to ventilate his lungs, prevent post-
operative thrombosis, but also assist the nursing staff in paying attention to his pressure points. He can, of course, be rolled on to either side for attention to his back.
Blood counts are necessary to investigate the haemoglobin level for several weeks after the operation.
After the wound has healed the patient should be encouraged to become ambulatory on crutches, and when the operative sites are soundly healed and not tender he can be made a temporary pylon over an abdominal corset which fits the amputation area.
In six months' time the patient can be fitted with an artificial leg.
In spite of the severity of this ablation, these patients are able to walk and undertake a normal life. Compensatory scoliosis should be watched and this can be guarded against by planned exer-
cises to improve the tone of the erector spinae and abdominal muscles.

Technique of Disarticulation at the Knee Joint
The operation of disarticulation at the knee joint is best performed with the patient lying prone.
1. In cutting the skin flaps a generous amount of skin should be allowed, especially anteriorly. A semilunar incision, commencing at the level of the joint laterally, is carried downwards for about 2 in. below the popliteal fold. The flap includes skin and superficial fascia down to fat.
2. The popliteal fossa is now entered and the popliteal artery and veins are doubly ligated before division. They should be ligated below the origin of the superior genicular branches. The popliteal nerve(s) are divided.
3. The muscles bounding the popliteal fossa are then divided, including the popliteus muscle, the oblique popliteal ligament and the capsule.
The patient is then turned on his back and the operation is completed as follows:
4. A semilunar incision is made, commencing at the level of the joints laterally and passing down-
wards for at least a hand's breadth below the patella, and below the tibial tubercle, and finishing at the joint level medially. The ends of the anterior flap are made to join the ends of the posterior flap.
5. The skin should not be dissected from the subcutaneous tissue, but these should be kept in a single layer in order to preserve the blood supply
of the skin. The cuff of skin and fascia is dissected upwards until the ligamentum patellae is reached.

6. The ligamentum patellae is then divided at the level of the knee joint. Thus the knee joint is entered.

7. The knee is then flexed and the scalpel inserted between the femur and the semilunar cartilages, dividing the anterior parts of the capsule, coronary ligaments and synovium.

8. The knee is then flexed to a right angle and the cruciate ligaments are divided.

9. The remaining posterior portions of the capsule and synovium are then divided along with the collateral ligaments and the popliteus tendon.

10. The remaining muscles bounding the popliteal fossa are then divided and the limb is freed and is removed.

11. The anterior flap is turned upwards and the patella carefully enucleated, the surrounding fatty tissues being preserved and approximated by catgut sutures.

12. If a condylectomy is desired, the femoral condyles are easily removed flush with the popliteal surface of the femur with an osteotome. At the same time the origins of the gastrocnemius muscle and plantaris can be removed. The fascia of the posterior flap is approximated by a few catgut sutures to the infrapatella tissues. The wound is sutured in layers without tension and the suture line should be behind the femoral condyles.

At the end of the operation there should be a good pad of tissue over the lower ends of the femur. Drainage should be with a corrugated rubber drain, as these amputations are prone to form a haematoma.

Syme's Operation (Disarticulation of the Foot at the Ankle Joint)

The best description of this 100-year-old procedure is given by the older writers. Syme introduced his operation with a statement, 'It may be startling, but it is, nevertheless, true that amputation at the ankle joint, with hardly any exceptions, may and ought to supersede amputations below the knee.' This statement may not be as true as it was 100 years ago, but we should still stop and think before resorting to a below-knee amputation. Syme operated without a tourniquet. 'An assistant,' he said, 'has complete command of the vessels by grasping the ankle.' This is open to question and the writer recommends a tourniquet unless the vessels in the limb are diseased and are likely to suffer from the trauma of the tourniquet, in which case it is unwise to perform a Syme's amputation. Syme's original description, as quoted by Erichson, does not correspond in detail with D'Arcy Power's quotations from Syme's work.

Both descriptions may be summed up as follows:

The foot projects well over the end of the table. The surgeon's left hand grasps the ankle. His thumb and forefinger mark the tips of the malleoli. The point of the knife is entered distal and posterior to the external malleolus. Taking a direction slightly backwards, the incision crosses the sole to a point ½ in. below and behind the tip of the external malleolus. It is better at this stage not to divide tissues behind the malleolus lest the posterior Tibial artery be severed before giving off its terminal branches. Erichson, however, states that this precaution is quite unnecessary, vide infra. The inclination of the incision should be decidedly backwards. The common fault is to make too large a heel flap. The heel flap is dissected off the plantar fascia and os calcis, keeping the edge of the knife in close contact with the bone. The tendo achilles is divided or raised with the periosteum. With the foot in plantar flexion the dorsal incision is now made. It joins the two ends of the incision for the heel flap. The dorsal incision passes across the line of articulation, i.e. about ½ in. proximal to the tip of the internal malleolus. The ankle joint is opened, while the foot is strongly plantar flexed. The lateral ligaments are divided by working the knife downwards each side between the malleoli and the astragalus. The foot is then removed. If the lower ends of the tibia and fibula have escaped injury or disease, only the projecting points of the malleoli are removed with saw or bone forceps. The saw line must be kept strictly at right angles to the long axis of the leg when removal of the articular surfaces is part of the operation. The tendons are drawn down and cut short and the nerves, i.e. anterior tibial and muscular cutaneous, together with the plantar nerves, are treated in like manner. The nerves must not be left long. If preferred, the dorsal incision may be made first, the ankle joint opened and the tendo achilles divided from the front.

Trans-metatarsal Amputation

Transverse amputation of the forefoot through all the metatarsals results in a surprisingly good walking foot, although the ease and efficiency of gait decrease progressively at each successively higher level of amputation. The tendency towards medial or lateral deviation is absent, because the balance of the foot is maintained. This is due to the preservation of the normal muscle attachments—tibialis anterior, tibialis posterior and the peronei—whilst symmetry and shape of the stump are achieved. (Squamous deformity of the stump is thus avoided.)

This operation is again performed with the intention of obtaining a long plantar and short dorsal flap.
The incision is placed on the dorsum of the foot, beginning at the midpoint on the inner aspect and passing convexly across the dorsum immediately distal to the anticipated bone level to a similar point on the outer aspect of the fifth metatarsal. The plantar incision starts at the point of origin of the dorsal incision and is convex across the plantar aspect of the foot at a level with the metatarsal heads; it passes slightly upwards to unite with the lateral end of the first incision. In forming the plantar flap it should be remembered that the cross-section of the medial side of the stump is greater in depth than that of the lateral; therefore the flap should be much longer on the medial side of the foot. A longer dorsal flap may be made if adequate plantar skin is not present, but the plantar skin should come up as far as the level of bone section on the inferior surface of the foot, since dorsal skin is not suitable for weight-bearing. If sufficient plantar skin is not available, then the metatarsals must be made shorter. The dorsal incision is now carried down to the bone, and the extensor tendons are divided and shortened so that they will retract above the edge of the wound. The incision on the plantar surface of the foot is carried down to the bone and the flexor tendons are severed and shortened. The plantar skin is dissected slightly proximal to the level of bone section and a flap is formed consisting of plantar skin, subcutaneous fat and a thin layer of plantar muscles. The intrinsic muscles of the foot are severed at the level of bone section. The metatarsal bones are now sectioned parallel to the tarsometatarsal joints and the fifth metatarsal is shortened and bevelled, all loose tags of periosteum being removed. Nerves are not isolated; they have all been sectioned and allowed to fall back in their beds above the line of bone section. Haemostasis is carefully secured. The skin flaps are approximated without tension, trimmed and closed with interrupted sutures. The skin on the sole of the foot, like that on the hand, is of a different texture to that of the dorsum; it heals slowly, so that the sutures should not be removed for about two weeks, and even then only alternate sutures until one is certain that union is taking place. Not infrequently the skin edges are de-vitalized and will slough off, leaving bone exposed. In this condition the wound should be left to granulate slowly and form a cicatrix which will be parallel to the site of amputation. Secondary suture should not be undertaken.

**Amputations of Toes**

**General Considerations**

1. The indications for amputation of the toes are similar to those for amputations of the fingers, with the addition that painful deformed toes are more frequently amputated than are deformed fingers. The big toe rarely requires amputation; the fifth toe, however, often does. Wherever possible, one should avoid amputating one or more intervening toes, as the remaining toes are pushed together and become clumped and painful. It is good practice, if the big toe and other toes require amputation, to amputate all the toes and make a dorsal scar. Patients with all their toes amputated get about comfortably for 35 to 40 years, whilst partial amputations of the toes require periodic operations and amputations and give the patient a great deal of trouble.

2. The metatarso-phalangeal joint of the great toe is one of the important pivotal points on which the foot rests; therefore, it should never be amputated or disarticulated except when absolutely essential. A single toe, however, even a great toe, should never be left when the other four require removal, as there will undoubtedly be lateral displacement, which is very troublesome.

The heads of the metatarsals should always be saved if at all possible.

It should be remembered that the joint lies as far behind the web as the apex of the toe is in front of it, so that the incision should start further back than might be at first expected.

**Amputation of a Toe With and Without Removal of the Metatarsal Bone**

As a rule it is not advisable to perform partial amputation of a toe, except of the great toe, but instead one should disarticulate at the metatarso-phalangeal joint, otherwise the stump of the toe is only an inconvenience.

For the phalanges and interphalangeal joint the oblique circular incision is indicated, whilst for the metatarso-phalangeal joint a racket incision is made. The dorsal part of the incision extends down to the bone, which is removed subperiosteally.

In the case of the great and little toe, the dorsal portion of the incision is not placed over the middle of the phalanx and the metatarsal bone, but towards the middle line of the foot, so that the cicatrix may be out of reach of lateral pressure.

The best results for removal of the great toe are obtained by this method:

1. An incision, starting from over the head of the first metatarsal, is made, extending distally almost to the interphalangeal articulation; it then crosses the plantar surface of the toe, extending to the web of the first and second toe; the end of this incision is then carried back to the site of the commencing incision.

2. The incisions are deepened, the tendons divided, the joints opened and the toe removed.

3. The remaining internal flap is brought across
the head of the metatarsal bone and leaves a neat cicatrix not exposed to pressure.

**Disarticulation of the Distal Phalanx of the Great Toe**

For a large plantar flap, hold the toe between the thumb and first two fingers of the left hand, the thumb on the pulp of the toe, the fingers on the nail.

1. Cut the plantar flap as the toe is thus held.
2. Enter the knife at right angles to the surface, just over the head of the proximal phalanx.
3. Cut along the side of the toe to the pulp. This incision should be parallel to the phalanx and nearer to the dorsal than to the plantar aspect.
4. Shape the flap and return to the same point on the opposite side. The incision should extend down to the bone.
5. Forcibly flex the toe and make a semilunar incision of the skin across the dorsum and a transverse cut that at once divides the extensor tendon and opens the joint.
6. Rotate the toe out, divide the internal lateral ligament.
7. Rotate it in and divide the external band. Thus disarticulation is complete.

The long plantar flap should not be cut by transfixion. If the flap has been well cut, the two plantar digital arteries will not be injured, but will be buried in the flap until they anastomose at its free end. They may easily be cut accidentally if, in dissecting the flap back, the knife is not kept close to the bone. They also lie near to the sides of the joint (plantar aspect) and may be easily injured in careless disarticulation.

**Disarticulation of All the Toes (Metatarso-phalangeal Disarticulation)**

Each toe may be dealt with separately as follows:

1. The toe is dorsiflexed and an incision is carried round it at the place where it emerges from the general cutaneous envelope of the foot. When complete, all the incisions are united at the webs on the plantar surface. The incision runs along the furrow between the digits and the ball of the toes.
2. Over the metatarso-phalangeal joint of the great and little toes a tarso-lateral incision is made. Thus two rectangular flaps are formed.
3. The toes are then bent towards the sole.
4. The extensor tendons are divided as far back as possible, the dorsal and plantar portions of the capsule, together with the lateral ligaments, are divided and, lastly, the plantar tendons are cut across as high as possible.

This is an excellent operation and gives gratifying results for badly deformed toes.

**Amputation or Disarticulation of the Phalanges of the Four Outer Toes**

In operating upon the smaller toes the neighbouring digits should be held aside by the assistant.

In disarticulation of the second phalanx use the oval or racket incision and proceed precisely as in the corresponding operation in the hand.

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