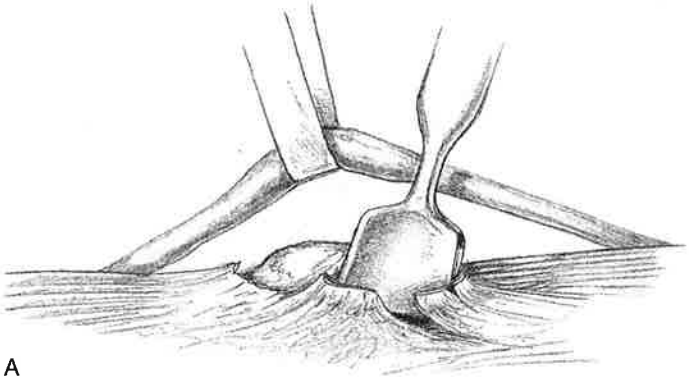
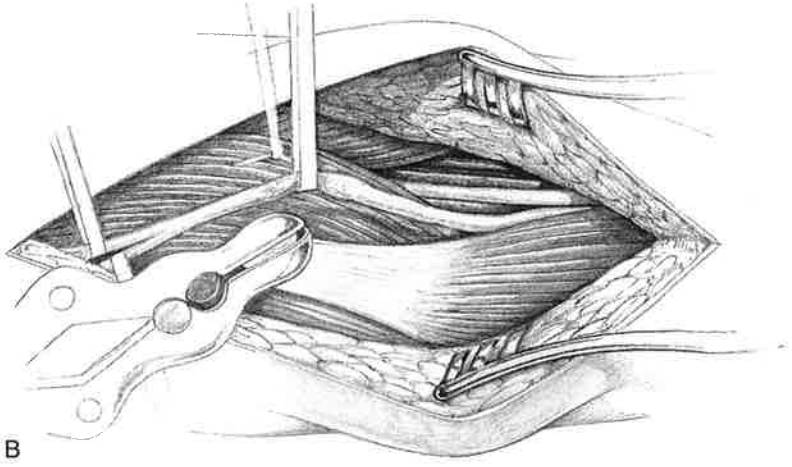


A

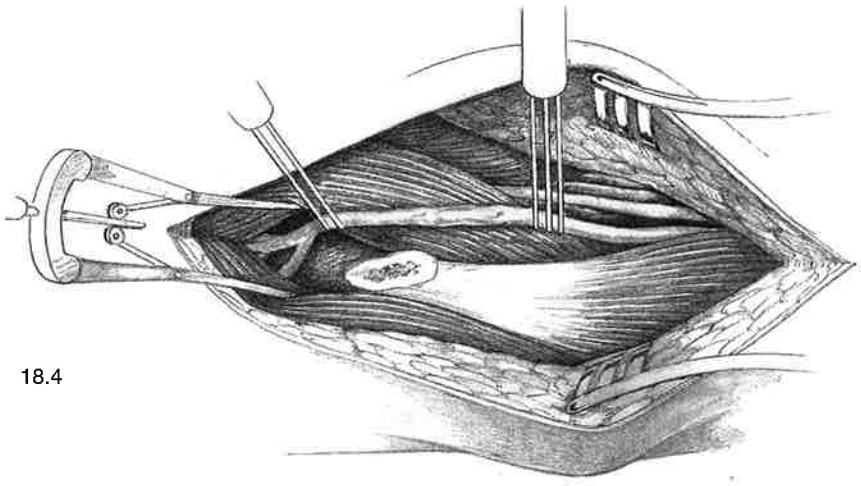
18.3 A & B

18.3 *A,* The inset shows a periosteal elevator used to dissect away soft tissues from the posterior aspect of the surgical neck of the fibula.

B, Resection of the head of the fibula is performed with Leksell rongeurs. The injured peroneal nerve has been displaced with its distal superficial and deep branches.



B

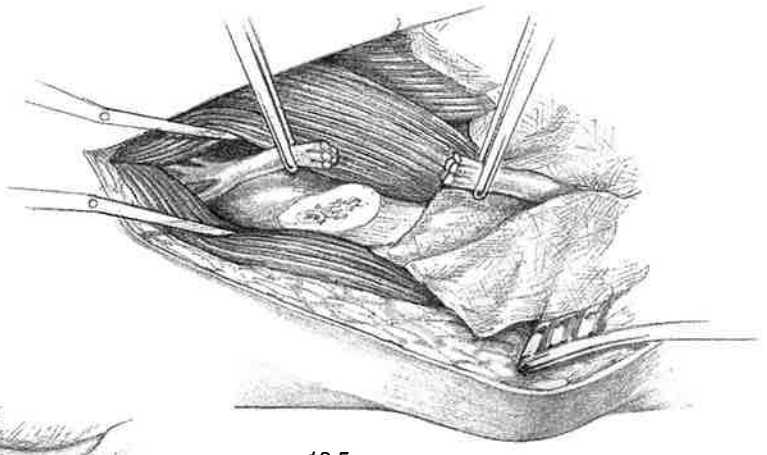


18.4

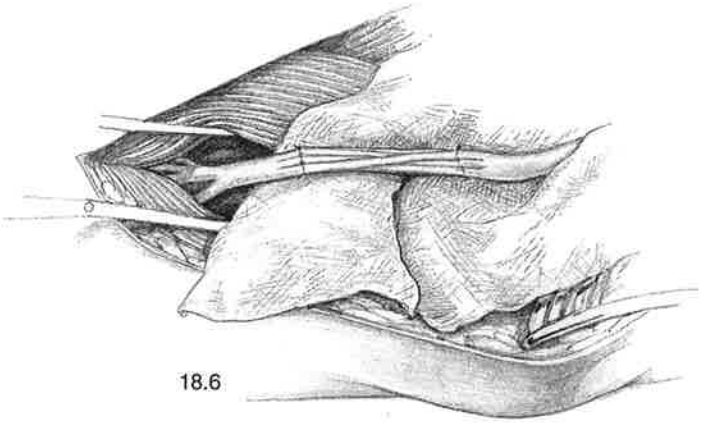
18.4 Nerve action potential (NAP) recordings are made from the peroneal nerve after neurolysis and partial fibulectomy or leveling off of the bone there.

18.5 The nontransmitting segment of the nerve has been resected, and the ends are made into fingers or groups of fascicles ready for graft repair.

18.6 The peroneal graft repair is complete.

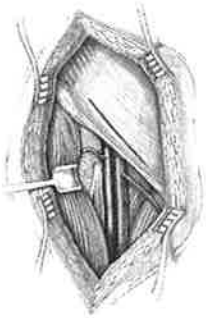


18.5



18.6

Chapter XIX

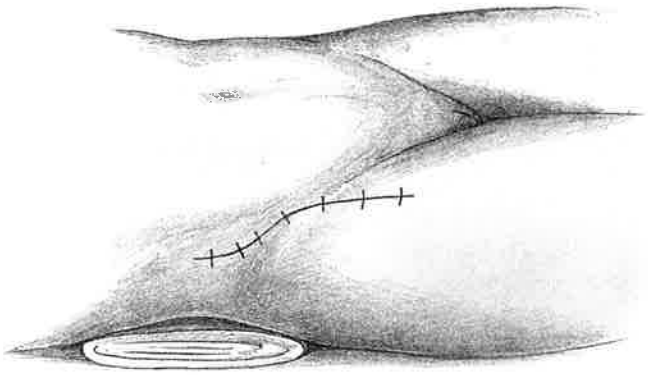


Femoral Nerve, Including Pelvic Origins

Although it is injured less frequently than the sciatic nerve, the femoral nerve can often be repaired with results that are superior to those with the sciatic nerve. The operation is usually done with the patient supine and the knee partially flexed. The incision for exposure of the thigh portion of the nerve is in the inguinal triangle just lateral to the usually palpable femoral artery (Figure 19.1). In the inguinal region, the vertically oriented anatomical structures are positioned from lateral to medial: nerve, artery, and vein, or "NAV" (Figures 19.2 and 19.3). A vertical incision extends from the inguinal ligament level distally to the junction of the upper and middle thigh. The incision is deepened to the iliacus fascia, which covers the femoral nerve and must be opened to expose it. When there is a scar in this region, it may help to expose the femoral artery and work laterally to identify the femoral nerve (Figure 19.4). The nerve branches about 1½ inches distal to the inguinal ligament. The saphenous branch arises fairly proximally and travels toward the medial thigh to run in the adductor canal region superficial to the femoral artery. Other sensory branches to the anterior thigh skin and motor branches to the quadriceps take off as a "leash" of nerves from the main femoral nerve. Small arteries and veins may accompany these branches and can make this dissection tedious, especially if the field is scarred due to the nature of the injury or prior operation. Some of the small vessel branches need to be ligated, which may help this portion of the dissection.

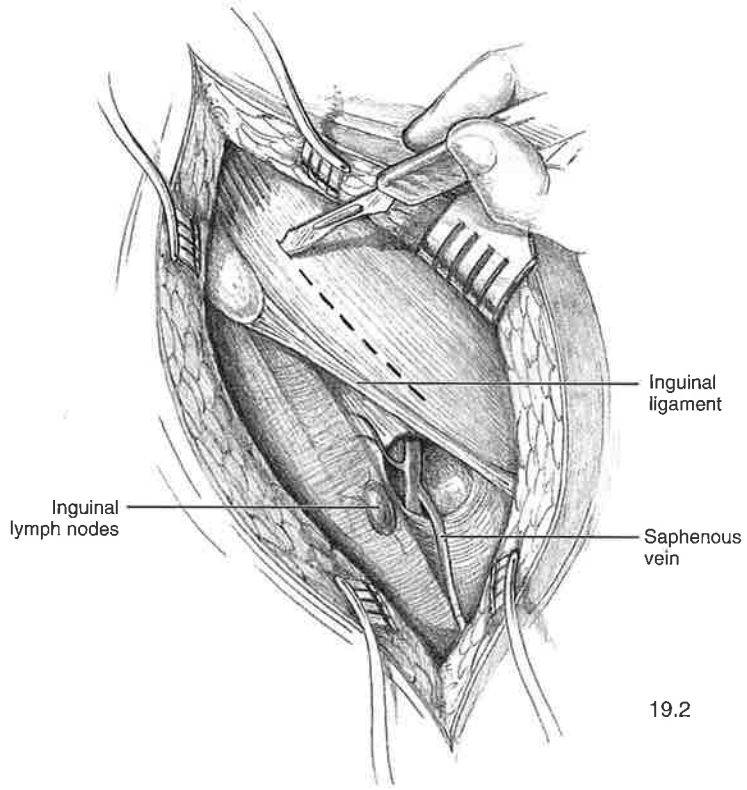
To expose the pelvic portion of the femoral nerve, a muscle-splitting procedure above or superior to the inguinal ligament is used (see Chapter XXVI for an example). The external oblique and then the internal oblique are split in the direction of their fibers. Some of the transversalis is then transected. Fat in the retroperitoneal space and beneath the abdominal wall is palpated, and blunt dissection is used to develop the retroperitoneal space. Deaver or similar retractors are then used to retract the abdominal contents superiorly and medially. The psoas muscle is identified, because the femoral nerve travels with it (Figure 19.5). Femoral nerve should not be mistaken for psoas minor tendon. Care must also be taken to identify and protect the ureter. Once identified, the nerve can be encircled with a Penrose drain and then dissected more proximally. In this way, one or more iliacus and psoas branches, which arise quite proximal on the nerve, can be identified and protected. More medially, genitofemoral branches can penetrate or lie atop the psoas. These branches are much smaller in caliber than the femoral nerve and are usually not mistaken for it. This type of muscle-splitting abdominal exposure can be combined with the inguinal dissection for a more extensive exposure of the femoral nerve and its branches.

More proximal lesions involving the femoral nerve can be exposed by a flank incision. The external and internal oblique muscles are split in the direction of their fibers, as is the transversalis muscle. This is usually done with the patient in a partial lateral decubitus position with the operative side uppermost. A Deaver or similar ribbon-shaped retractor is used to retract the abdominal contents and help develop the retroperitoneal space. By dissecting over the psoas muscle and developing the space along the lateral lumbar vertebrae, the sympathetic chain can be identified. Somewhat beneath the lateral border of the psoas, spinal nerves L2, L3, and L4, which give rise to the femoral nerve, can be identified, and the very proximal portion of the femoral nerve can be exposed.



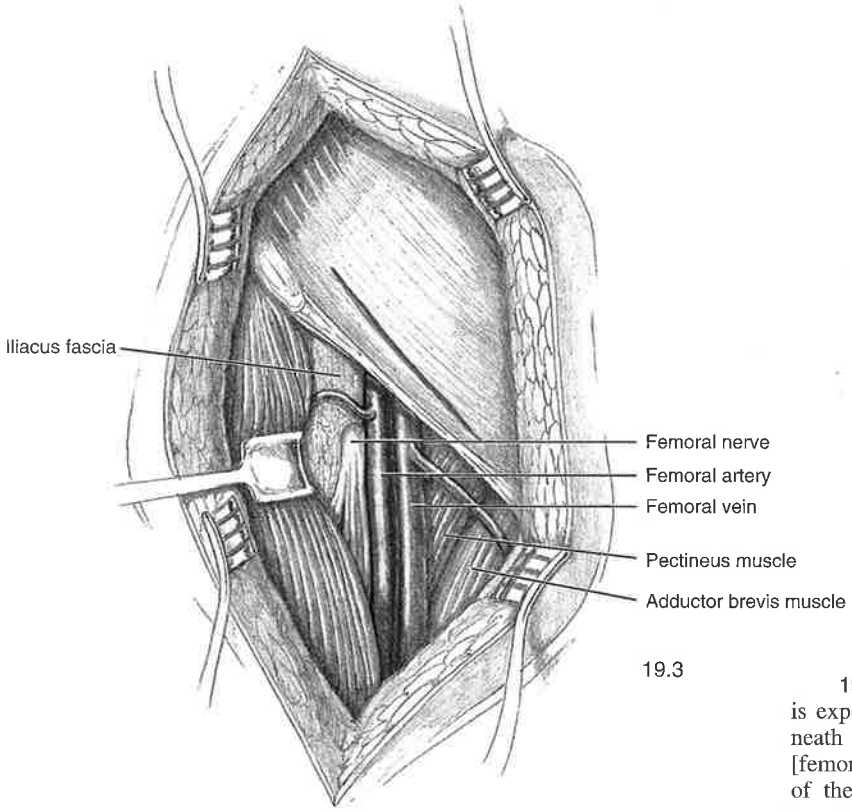
19.1

19.1 This is the usual incision used for femoral nerve exposure in both the femoral triangle and the pelvis. The incision begins distally in the femoral triangle and then crosses the midportion of the inguinal ligament to run in the lower quadrant of the abdominal wall.



19.2

19.2 Exposure of the inguinal region shows the femoral vein and saphenous branch, lymph nodes, iliacus fascia, and inguinal ligament from the anterior superior spine of the ilium running obliquely downward into the groin. The course of the muscle-splitting incision in the external oblique is shown by the dotted line. This inguinal incision is used if injury to the femoral nerve extends proximally into the pelvis.

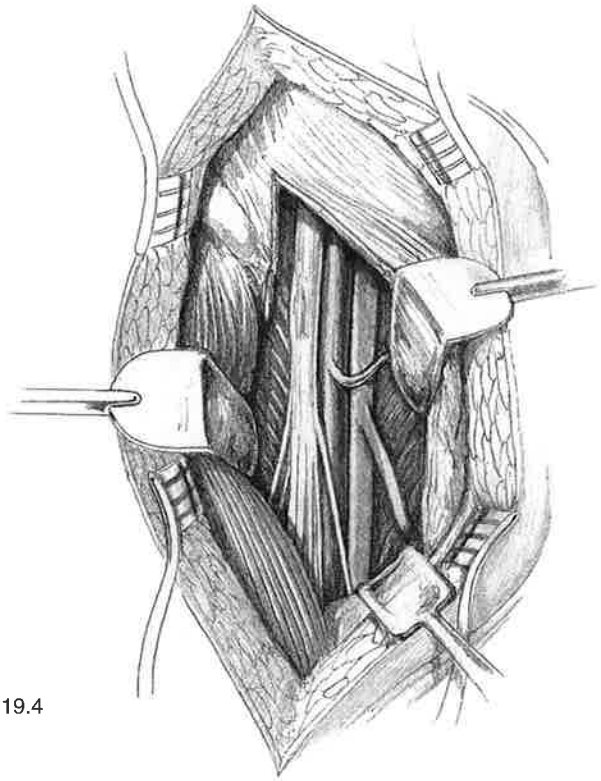


19.3

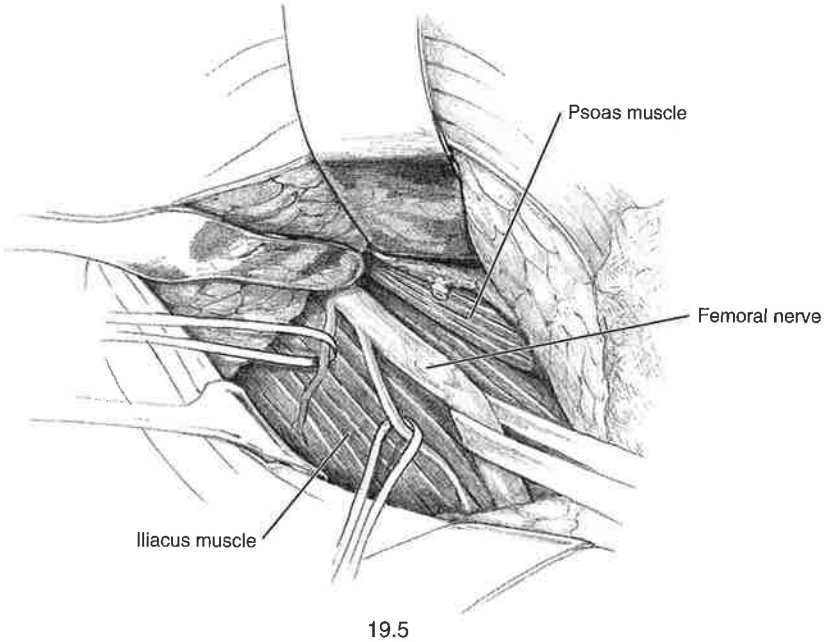
19.3 The right femoral nerve is exposed in the femoral triangle. Course beneath the inguinal ligament of "NAV" (nerve [femoral], artery, and vein) is apparent. Some of the iliacus fascia remains to be dissected away from the nerve. A hand-held retractor is on the sartorius.

19.4 After division of the inguinal ligament and a muscle-splitting incision of the abdominal wall, the distal intrapelvic portion of the nerve and vessels and the femoral triangle anatomy are exposed. The nerve has a contusive lesion in continuity at the level of the inguinal ligament.

19.5 The proximal pelvic portion of the femoral nerve is exposed as it comes from beneath the psoas muscle. The external and internal oblique and the lateral transversalis have been split. Then the retroperitoneal fat is bluntly dissected, and the peritoneum and lower abdominal contents are swept medially and held there by a sweetheart or broad ribbon retractor. Proximal iliacus nerve branches are marked by the relatively narrow Vasaloops.

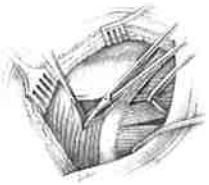


19.4



19.5

Chapter XX



Ilioinguinal, Iliohypogastric, and Genitofemoral Nerves

When these nerves are injured, usually as a result of surgical procedures in the lower abdominal wall, they can be responsible for disabling pain in the groin and genitalia. The ilioinguinal nerve can be entrapped by scar, suture, or staples or stretched and contused as a result of herniorrhaphy, appendectomy, or, less frequently, the lateral extent of a Pfannenstiel incision used for hysterectomy or other gynecological procedures. More superior lower quadrant abdominal incisions can involve the iliohypogastric nerve. Injury in this distribution is less frequent than that for the ilioinguinal nerve. Again, when it occurs, it is usually iatrogenic and related to herniorrhaphy or appendectomy or, on rare occasions, a flank incision used for lumbar sympathectomy or a lateral approach to the lumbar spine. Genitofemoral involvement usually relates to cesarean section or a Pfannenstiel incision used for gynecological procedures.

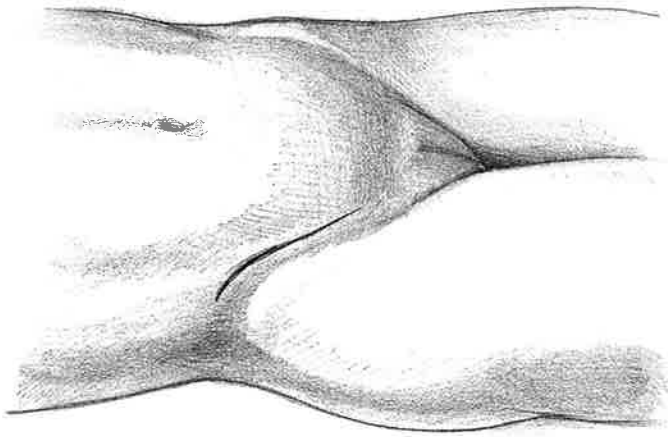
The distribution of sensory changes and the nature of the symptoms overlap, but with experience, they can usually be differentiated. The ilioinguinal nerve supplies some sensation to the region of the symphysis pubis and medial thigh and in males to the dorsum of the penis and some of the upper scrotum. In females, the regions of the mons pubis and the labia major receive sensory input. The iliohypogastric nerve supplies some sensation to the lower abdominal skin above the pubis and also gives a lateral branch to the superior gluteal area. The genitofemoral nerve usually provides a genital branch that innervates the cremaster muscle and scrotal skin in males and the round ligament in females. A femoral branch innervates the skin in the region of the femoral triangle.

Operatively, the ilioinguinal nerve is usually found beneath the external oblique muscle, except at the flank level, where it is between the internal oblique and transversalis muscles (Figures 20.1 and 20.2). Usually, the prior operative incision is reopened and extended if necessary. Then the external oblique fascia and muscle are split superior to the inguinal ligament with an oblique incision (see Figure 20.2). If possible, more normal nerve is identified laterally as it penetrates the internal oblique to run medially beneath the external oblique (Figure 20.3). If a lesion such as a neuroma is found, the injured nerve is resected rather than repaired, because repair usually relieves pain only temporarily. Often, scar from prior procedures makes precise dissection difficult. In such cases, we systematically dissect out and resect as much scar as possible. In this fashion, the nerve and nerve branches are excised along with the scar (Figure 20.4).

Genitofemoral branches penetrate the rectus abdominis and can be hard to find. Once again, the area of the scar is resected, and sometimes the involved branches can be excised and the patient helped.

These nerves originate from the high lumbar plexus (L1-L2). They run laterally in the retroperitoneal space and then travel in the abdominal wall. The lateral femoral cutaneous nerve also has a retroperitoneal course before leaving the pelvis medial to the anterior superior spine of the ilium. If need be, this nerve can usually be located in the pelvis and sectioned at that level. To do this requires a muscle-splitting lateral abdominal incision and a retroperitoneal approach.

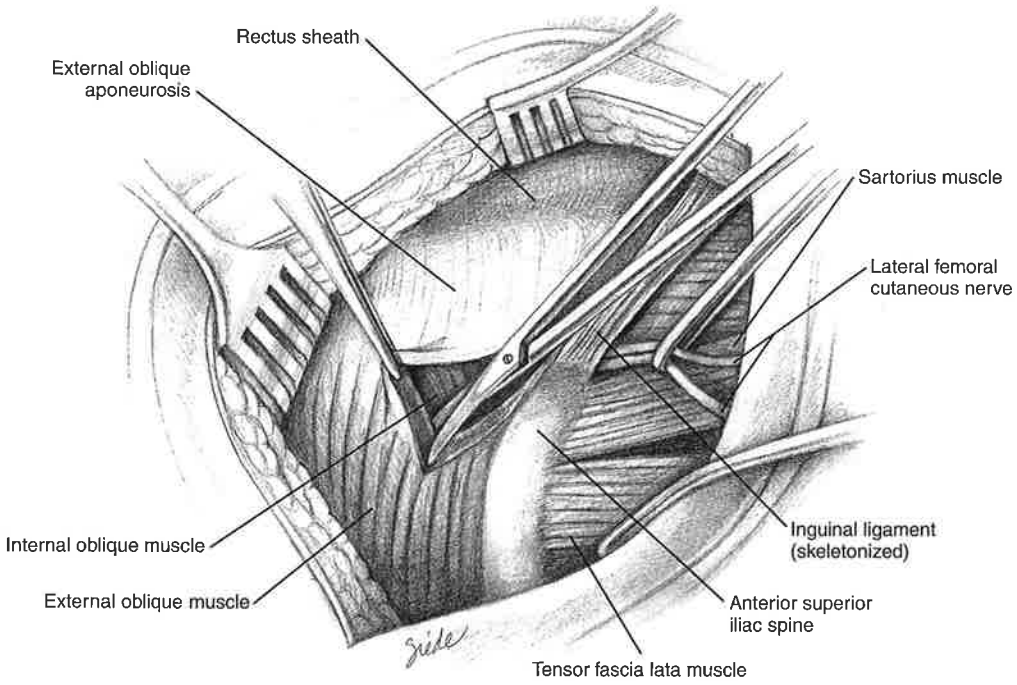
The iliohypogastric nerve tends to run parallel but superior to the ilioinguinal nerve and is usually at a deeper level beneath some of the internal oblique. After its origin from the L1-L2 spinal nerves, it passes through the psoas and anterior to the quadratus lumborum. It lies between the transversalis and internal oblique muscles and then penetrates the internal and external obliques as it branches and extends medially.



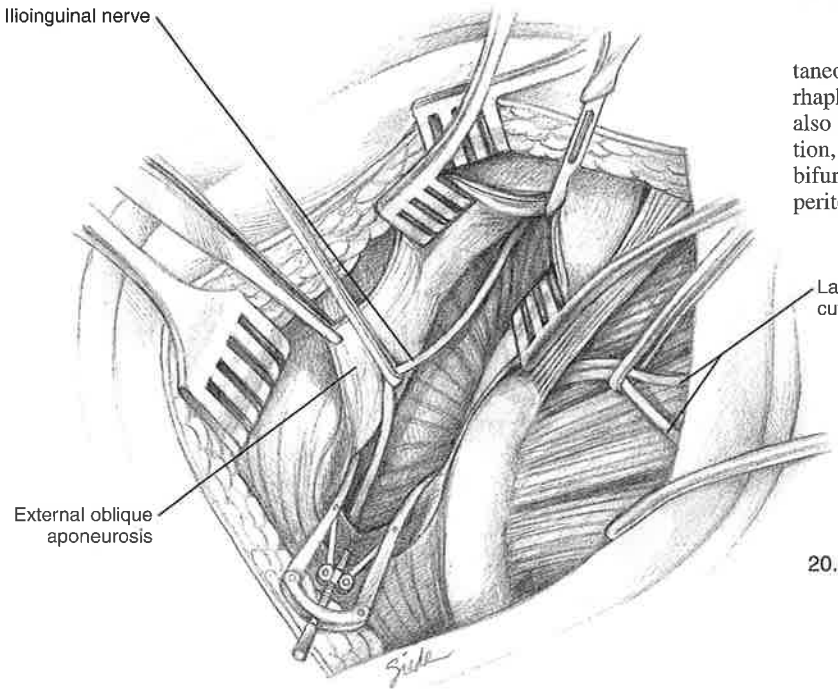
20.1

20.1 The incision is placed above the ilium for exposure of the ilioinguinal or iliohypogastric nerve. A similar incision can be used for a lower abdominal quadrant muscle-splitting exposure of the distal pelvic portion of the femoral nerve. This incision can also be combined with a femoral triangle incision to expose both the distal pelvic portion of the femoral nerve and its course in the proximal thigh.

20.2 The external oblique is being split in the direction of its fibers.



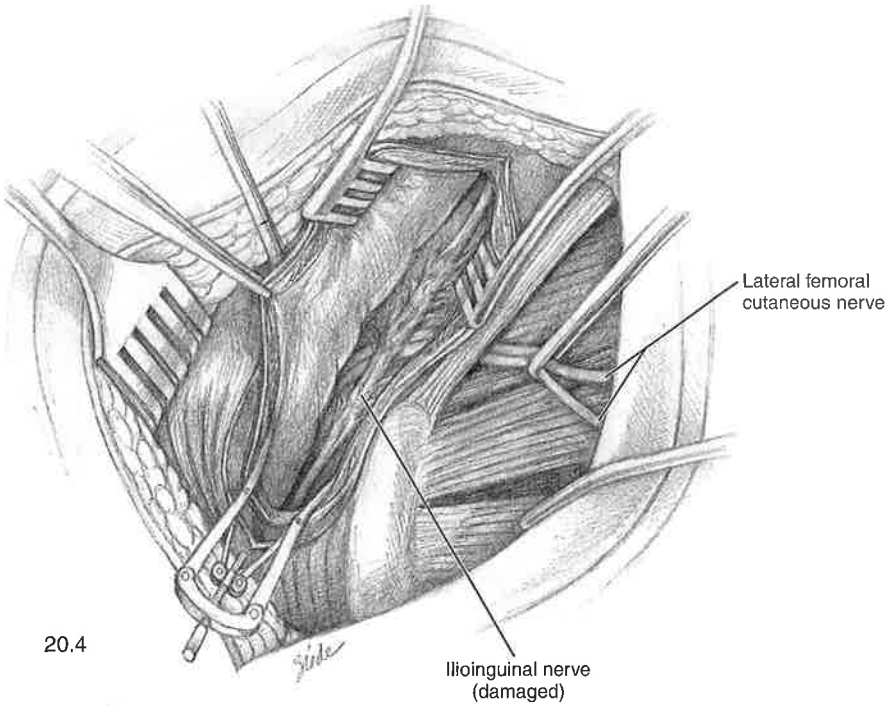
20.2



20.3

20.3 The ilioinguinal nerve is exposed beneath the external oblique muscle. Note exposure of the lateral femoral cutaneous nerve near the anterior superior spine of the ilium and medial to the sartorius muscle.

20.4 A scarred ilioinguinal cutaneous nerve may be associated with herniorrhaphy. The lateral femoral cutaneous nerve is also seen in the proximal thigh. In this dissection, the lateral femoral cutaneous nerve is bifurcated and has been exposed at a retroperitoneal as well as proximal thigh level.



20.4

Lateral Femoral Cutaneous Nerve

The lateral femoral cutaneous (LFC) nerve is more laterally located than the femoral nerve. It exits the retroperitoneal portion of the pelvis to go just medial to the anterior superior spine of the ilium. It is covered by the fascia, which has to be opened to expose the nerve distal to the inguinal ligament. At the level of the spine of the ilium, the nerve is under the lateral extension of the inguinal ligament. This is sometimes opened to expose the nerve at this level. The LFC is not always an easy nerve to find, especially when a prior neurolysis has been done in an attempt to treat meralgia paresthetica. The spine of the ilium is a good landmark if it has not been removed. The LFC is usually found just medial and usually closely applied to the anterior superior spine. Distal to this level, the nerve is somewhat beneath and medial to the medial border of the sartorius. More proximally, the nerve can be found at an intrapelvic level, approaching the pelvic rim at a retroperitoneal level, lateral to the pelvic portion of the femoral nerve, and medial to the retroperitoneal course of the iliohypogastric and ilioinguinal nerves.

The incision usually begins below the inguinal ligament in an up-and-down fashion. The medial edge of the sartorius is found and dissected out (see Figure 20.2). Once a branch of the nerve is found deep to the investing fascia, it is traced proximal to the spine of the ilium (see Figure 20.3). We prefer to resect a segment of this nerve when meralgia paresthetica is the reason for operation. With neurolysis alone, the disorder may recur. Most patients prefer an area of hypesthesia along the lateral thigh to the painful hyperesthesia of meralgia paresthetica.

If the nerve needs to be located at an intrapelvic level and before it reaches the brim of the pelvis, the lower abdominal muscles can be split and a retroperitoneal approach developed, similar to that used to expose the intrapelvic ilioinguinal or femoral nerves (see Figures 20.2 and 20.4).