

## Iatrogenic Femoral Neuropathy Following Pelvic Surgery: A Rare and often Overlooked Complication – Four Case Reports and Literature Review

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Femoral neuropathy can result from diverse etiologies following abdominal surgery. We describe four cases of postoperative femoral neuropathy after proctological procedures that were carried out at our hospital. The related symptoms developed occultly but eventually impaired patient motor or sensory functions in the lower extremities. When the patient fails to address associated suffering, it is easy for clinicians to neglect this type of morbidity. All patients recovered from neuropathy following timely detection of the disease entity confirmed by electromyography and nerve conduction studies, followed by adequate rehabilitation management. We hypothesize that postoperative femoral neuropathy may be closely related to unsuitable applications of self-retaining retractors, rather than being associated with other factors, such as gender, age, surgery time or body mass index (BMI). Furthermore, we used a literature review to examine the pathophysiology, diagnoses and treatment modalities of femoral neuropathy resulting from inappropriate placement of self-retaining retractors. Based on a thorough comprehension of the femoral nerves anatomical course and meticulous placement of retractor blades, these types of iatrogenic complications may be prevented. (*Chang Gung Med J* 2007;30:374-9)

**Key words:** neuropathy, femoral nerve, self-retaining retractor, pelvic surgery

Descartes<sup>(1)</sup> first described femoral neuropathy (FN) in 1822, and Gumpertz<sup>(2)</sup> subsequently identified postoperative FN following abdominal hysterectomy in 1886. Since then, numerous researchers have identified FN as a surgery related complication resulting from surgeries as diverse as abdominal hysterectomy,<sup>(3-5)</sup> inguinal hernia repair,<sup>(6)</sup> renal transplantation,<sup>(7)</sup> cystoprostatectomy,<sup>(8)</sup> total hip replacement,<sup>(9)</sup> aortic aneurysm repair,<sup>(10)</sup> and colectomy.<sup>(11-13)</sup> Neural injuries ascribed to stretching, compression, ischemic change, transection, ligation, iliopsoas hematoma, and cement encapsulation have been hypothesized to be the pathophysiology of

femoral neuropathy.<sup>(3-13)</sup> Deficits of motor and sensory function resulting from iatrogenic femoral neural injury are probably underestimated because most cases are self-limited and thus underreported.

The patients surveyed here exhibited FN following colorectal surgery at our institution, motivating us to review this disabling, iatrogenic complication. In all four cases a self-retaining Bookwalter<sup>TM</sup> retractor system was applied during surgery. Rehabilitation was done immediately when FN was confirmed by electromyography (EMG) and nerve conduction velocity (NCV) studies. All patients eventually recovered from their neural dysfunctions. The results

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of this study clarify the relationship between postoperative femoral neuropathy (PFN) and the use of retractors based on anatomical attitude. In addition, we present methods for preventing nerve injury.

## CASES REPORTS

### Case 1

A 68-year-old male patient, with body mass index (BMI) 31.5, height 165 cm and weight 86 Kg, diagnosed with lower-third rectal adenocarcinoma using colonoscopy and pathologic confirmation, was admitted for surgical intervention in the form of restorative proctectomy with colo-J-pouch anal anastomosis under lithotomy position. A self-retaining Bookwalter™ retractor was used to expose an adequate operation field during surgery. The total operation time was 4 hours. The patient had concurrent preoperative chemoradiotherapy for the rectal cancer, intended to improve local control of malignancy. On admission, the patient exhibited no special signs on neurological examination (NE). Notably, the patient complained of lying pain, difficulty in left hip flexion and left knee extension, and numbness over the anterior aspect of the left thigh when he tried to get out of bed on the third post-operative day. Neurological examination revealed weakness of the left hip flexor and knee extensor muscles with paresthesia over the anterior aspect of the left thigh. Left FN was confirmed via EMG and NCV studies. The patient initiated physical therapy immediately and was able to eat soon after surgery. Two months following surgery, the patient could walk; but persistent numbness of the left thigh continued until 6 months post-surgery.

### Case 2

A 76-year-old female patient, with height 158 cm, weight 77 Kg, and BMI 30.8, suffered rectosigmoid junction colon cancer. The patient took medication to control hypertension for a period. Her NE results were normal on admission. The patient underwent high anterior resection of colonic cancer with colectomy under lithotomy position, and a self-retaining retractor was used during surgery to assist in exploring the surgical field. The surgery took about 2 hours and no surgery-related complications were recorded. The day after surgery, neurological examination revealed bilateral knee extensor weak-

ness but with relatively preserved strength of knee flexors, hip, ankle flexors and extensors; and reduced sensation in the medial thighs. The patient underwent both EMG and NCV studies, which established bilateral FN. Physical therapy was initiated at 1 week following surgery. The patient could walk with assistance at 3 months postoperatively, and was able to walk unaided by 9 months postoperatively. Numbness of both thighs had disappeared completely at 15 months after surgery.

### Case 3

A 58-year-old male patient, with height 172 cm, weight 108 Kg, and BMI 36.5, underwent a reversal of Hartmann's operation (removal of end descending colostomy with gastrointestinal continuity-maintenance of colectomy via laparotomy) with the patient in the lithotomy position for ruptured sigmoid colon diverticulitis. The surgery time was about 3 hours. The results of his NE were normal on admission. During recovery from anesthesia, the patient was found to be incapable of extending his left leg. Moreover, a couple of days after the surgery, the patient complained of paresthesia over the anteromedial side of his left thigh. The surgery record indicated difficulty in identifying and mobilizing the descending colon and rectal stump. According to the surgery report, self-retaining retractors were applied and a deeper blade retractor appliance than routinely used was applied owing to the patient's rather obese abdomen. The NE following surgery identified weakness of both the left knee extensor and left hip flexor. The EMG and NCV studies were performed 12 days following the laparotomy and left FN was verified. The patient initiated physical therapy at 2 weeks after surgery. By 3 months postoperatively, the patient had begun to regain strength in his left quadriceps femori and had a more stable gait than before. At 9 months of follow up, the patient was pain free and walking freely.

### Case 4

A 37-year-old male patient, with height 172 cm, weight 52 Kg, and BMI 17.5, experienced an uneventful anterior resection with colorectal anastomosis and sacral fixation for rectal procedentia under lithotomy position. Abdominal Bookwalter™ retractors were used to explore the surgery field, and the operative time was approximately 2 hours. On post-

operative day 2, the patient fell while getting out of bed and subsequently suffered numbness with tingling sensation along the medial portion of the left thigh. He experienced left thigh weakness while flexing the left hip and extending the left knee, and hyporeflexia of the left patellar reflex occurred during the NE. The EMG and NCV studies demonstrated left FN on the 5<sup>th</sup> postoperative day, and rehabilitation with physiotherapy was done following the diagnosis of FN. The patient had regained motor and sensory function of the femoral nerve at 6 months after surgery.

## DISCUSSION

The femoral nerve, the largest branch of the lumbar plexus, originates from the posterior divisions of the ventral rami of the L2 to L4 spinal nerves. Following its initial course within the psoas muscle, the nerve emerges from the lower third of the lateral border of the psoas muscle, where it descends between the iliac and psoas muscle in a shallow groove. The nerve runs into the femoral canal behind the inguinal ligament, covered by the thick and poorly distensible iliacus fascia, which may cause nerve compression.<sup>(14)</sup> Owing to the low blood supply to the nerve in this area, any compression could easily cause ischemic damage to the nerve.<sup>(15)</sup>

The femoral nerve is vulnerable to damage by retractor injury owing to its anatomical position, to which the lateral blades of the Bookwalter™ retractor can easily compress in the event of improper use of retractors.<sup>(11)</sup> Vosborg and Finn<sup>(3)</sup> were the first to introduce FN with the use of the self-retaining retractor. They posited two mechanisms of retractor injury including: (1) the lateral blade depresses the psoas major muscle thus exerting pressure on the femoral nerve, and (2) the lateral blade impinging the muscle and nerve against the lateral pelvic wall. The femoral nerve may be injured by either of these two mechanisms. Rosenblum et al.<sup>(1)</sup> concluded that FN originating from a compression injury is of ischemic origin regardless of type of incision, pelvic pathology, or surgical technique. All of the four patients, three obese (cases 1, 2, 3 with BMI of 31.5, 30.8, 36.5, respectively) and one with a thin body build (case 4 with BMI of 17.5), underwent the application of the self-retaining Bookwalter™ retractor system during

surgery. At present, three sets of Bookwalter™ self-retaining retractor systems are available in our hospital, each is comprised two Balfour center blades, two Richardson retractors (one with a short depth blade and another with a longer blade), three Deaver blades, and one Harrington blade, with a uniform and non-optional size. In the three obese patients, two long-depth Richardson retractors at both sides of the abdominal wall were substituted for Balfour center blades to retract the rectus muscle laterally; and two or three Deaver retractors were used to hold the small bowel superior and thus clearly expose the pelvic operative field. In the fourth patient with a thin body build, routine use of two Balfour center blades and two Deaver blades was applied during his pelvic surgery. Surgery time, thin body habitus, and Pfannenstiel incisions have been suggested as contributing factors in PFN.<sup>(3)</sup> Surgery time ranged from 2 to 4 hours, three in obese body habitus and one in thin body habitus and midline laparotomy incision wound were depicted in our series. All patients were placed in the lithotomy position during surgery.

Self-retaining retractors were the main factors in patients with PFN, regardless of blade type, owing to the blades of these retractors repeatedly pushing the nerve against the abdominal wall, and compressing the nerve during surgery in its course through the body at the psoas muscle.<sup>(11,12)</sup> Hakim and Katirji<sup>(16)</sup> posited that lithotomy position could cause FN, not only through nerve compression at the inguinal ligament, but also through stretching the nerve via excessive hip abduction and external rotation. Additionally in prospective study, Goldman et al.<sup>(5)</sup> concluded that the incidence of FN was directly proportional to the use of self-retaining retractors. Factors such as operation time, body build, and pattern of incision exerted controversial influences on the development of femoral neuropathy.<sup>(3,4)</sup>

“Prevention is better than treatment” is a widely recognized maxim. Most femoral neural injuries are preventable. Positional factors should be considered, including limitations of lower extremity flexion, external rotation, and abduction of the hip to avoid nerve compression under the inguinal ligament. Adequately sized self-retaining retractor blades should be positioned according to each patient’s body build such that the physicians retract only to the rectus abdominus. Operators should meticulously ensure that the retractor blades do not directly com-

press the psoas muscles. Furthermore, comprehensive knowledge of the anatomy of the femoral nerve should minimize direct transection, suture, anesthetic, or electrocautery injuries.<sup>(11,12,17)</sup> Moreover, numerous methods of preventing PFN have been developed, including abstinence of direct contact between the retractor blades and psoas muscle<sup>(18)</sup> and palpation of the femoral pulse following retractor application.<sup>(1)</sup> However, neither of these options can reliably prevent PFN.

The FN, regardless of etiology, can cause motor dysfunction and weakness of the quadriceps muscle group with sparing of thigh adduction causing gait disturbance and difficulty in ascending stairs. Sensory loss over the anterior thigh and most of the medial thigh is typical, with extension down the medial calf to the arch of the foot. More proximal lesions may also manifest with weakness of hip flexion. Because the obturator nerve shares the same nerve roots as the femoral nerve, adductor weakness indicates radicular pathology. The patellar reflex is typically weak or absent.<sup>(17)</sup> Notably, neuropathy related clinical presentation manifests when the patient falls while attempting to get out of bed postoperatively. All of the cases reported here experienced various degrees of motor and sensory deficits during the first 3 days postoperatively.

When combined with neurological investigations as EMG and NCV, NE could give a definite diagnosis of FN. The four patients in this study demonstrated positive results in response to the neurological workups.

Management of PFN comprises primarily of aggressive physiotherapy provided there is no substantial disruption of the nerve, and once potentially reversible causes such as psoas hematoma are excluded.<sup>(12)</sup> Prognosis is generally considered good. Goldman et al.<sup>(5)</sup> reported a total recovery rate of 94% in a large series of 282 patients, with only 17 patients still exhibited mild symptoms at 116 days post-surgery. Some researchers have reported that recovery generally occurs between 3 and 6 months after the operation and have suggested exploration when symptoms fail to improve by 14 weeks after surgery.<sup>(1,4,11)</sup> Hospital stay is thus reduced, with immediate institution of physical therapy. Mild injury to the femoral nerve owing to retraction can cause neuropathic injury, which rapidly recovers as observed in this study and others.<sup>(7,11-13)</sup> Femoral nerve

motor function is usually regained earlier and more completely than sensations during the course of recovery.

In conclusion, appropriate positioning of the body without overstretching the psoas muscle, adequate size and placement of self-retaining retractor blades during pelvic surgery, and avoiding retractor injury from direct compression of the psoas major or impingement of the femoral nerve, can reduce the incidence of PFN. When PFN does occur surgeons should diagnose it promptly and initiate physical therapy in the hospital, as well as provide appropriate outpatient and home therapy after discharge.

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## 骨盆腔手術後引起之醫源性股神經病變：罕見與可能被忽略的併發症、四例病例報告及文獻回顧

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開腹手術後所引起之股神經病變其病因可為多發性。在此，我們舉出四例於本院接受大腸直腸手術後，併發之股神經病變。股神經病變所引發之症狀初始或許並不明顯，但最後終會造成下肢運動與感覺功能的異常。因此，若病患未適切陳述相關症狀，臨床醫師往往容易忽略此類併發症。適時地利用肌電圖檢查與神經傳導檢查，確立這四位病患術後股神經病變的診斷；並且在適切的復健治療後，他們均無因股神經病變所引起之任何相關性功能異常。由本院這四位病例報告，我們可歸納出：由於術中開腹自動開張器的不當置放，可能是引起此術後併發症的主要原因，而非病患的性別、年齡、手術時間長短或身體質量指數所致。因此，經由文獻的回顧，我們去探討有可能因術中開腹自動開張器的不當置放，而引起股神經病變其病理生理過程、診斷與治療方式。經由對於股神經其解剖位置與走向的全盤性瞭解與適當放置自動開張器，或許可避免發生術後股神經病變的併發症。(長庚醫誌 2007;30:374-9)

**關鍵詞：**神經病變，股神經，自動開張器，骨盆腔手術