# Pelvic nerve injury following gynecologic surgery: a prospective cohort study

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**OBJECTIVE:** The purpose of this study was to determine the incidence and time course of postoperative neuropathy resulting from gynecologic surgery.

**STUDY DESIGN:** A single cohort of 616 female patients undergoing elective gynecologic surgery for benign or malignant conditions at a tertiary care academic medical center underwent a postoperative neurologic evaluation to identify postoperative neuropathy of the lower extremities.

**RESULTS:** Fourteen peripheral nerve injuries were observed in 11 patients, making the overall incidence of postoperative neuropathy 1.8% (95% confidence interval, 1.0–3.2). Injury to the lateral femoral cutaneous (5), femoral (5), common fibular (1), ilioinguinal/iliohypogastric (1), saphenous (1), and genitofemoral (1) nerves were detected. Complete resolution of neuropathic symptoms occurred in all but 1 patient (91%). Median time to resolution of symptoms was 31.5 days (range, 1 day to 6 months).

**CONCLUSION:** The incidence of lower extremity neuropathy attributable to gynecologic operations is low, and these neuropathies resolve in the great majority of cases.

**Key words:** gynecologic surgery, nerve injury, neuropathy, postoperative complication

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Iatrogenic neuropathy is a common but largely underrecognized cause of both short-term and persistent postoperative pain in patients undergoing major surgical procedures.[1] Intraoperative nerve injury occurs through compression, stretch, entrapment, or transection of peripheral nerve fibers. Injury to the ilioinguinal, iliohypogastric, obturator, femoral, genitofemoral, lateral femoral cutaneous, pudendal, sciatic, and common fibular nerves have all been documented after gynecologic surgery.[2-5]

Previous prospective studies have focused on the risk of nerve injury associated with the use of self-retaining retractors and lithotomy positioning.[3,6] Two retrospective studies have estimated the risk of nerve injury from major gynecologic oncologic procedures to be between 1.1% and 1.9%.[7,8] Prospective studies evaluating the incidence and risk factors for postoperative nerve injury after routine gynecologic surgery are lacking. The objective of this study was to determine the overall incidence of pelvic nerve injury following both major and minor benign and oncologic gynecologic surgical procedures at a single academic medical center.

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## Materials and Methods

Approval for this study was obtained from the Cleveland Clinic Institutional Review Board, and informed consent was obtained from all study participants. Female patients over 18 years of age undergoing an elective inpatient or outpatient gynecologic surgical procedure for oncologic and benign gynecologic conditions were eligible to participate. Patients with paraplegia, quadriplegia, progressive or recurrent neurologic condition (eg, multiple sclerosis), ASA class IV status, or patients undergoing emergent procedures were excluded.

On the assumption that the existing retrospective studies may have missed subtle or transient neurologic injury, we estimated a priori that the true incidence of pelvic nerve injury following gynecologic surgery is 3% for purposes of our sample size calculation. Assuming the incidence of nerve injury to be 3%, we needed 600 patients to determine the true incidence with a margin of error of $\pm$ 1.3% using a 95% confidence interval. To account for a predicted 10% rate of loss to follow-up and dropout, our enrollment goal was 660 patients over the time period of one year.

A comprehensive, standardized neurologic history and physical examination was performed preoperatively and again postoperatively within 24 hours of discontinuation of anesthesia by a single trained examiner (J.B.). The examiner was not blinded to the type of surgery, length of operation, or patient position. Motor strength was scored 0 to 5 according to the Medical Research Council rating scale, with 0 being absence of any resistance and 5 being full strength. Hip strength was tested in abduction, adduction, extension, flexion, external rotation, and internal rotation. Knee strength was assessed in flexion and extension. Ankle strength was assessed in dorsiflexion, plantarflexion, inversion, and eversion. Sensation of the abdomen and lower extremities were assessed using light touch and pinprick. Patellar and ankle jerk reflexes were scored as present or absent. Subjects were questioned about the presence of pain, loss of sensation, and/or abnormal sensation (eg,

paresthesias) in various areas including the abdomen, pelvis, and lower extremities. Subjects were questioned about the subjective feeling of weakness in their hip, knee, or ankle joints. Neuropathy was defined as loss of sensation, paresthesias, and/or dysesthesias in the known distribution of a sensory nerve, and/or weakness in a muscle group supplied by a peripheral nerve. Ilioinguinal and iliohypogastric neuropathies were reported as a single entity because they cannot be reliably distinguished on physical examination.

Subjects with findings suggestive of peripheral neuropathy at the 24 hour postoperative evaluation were reevaluated at their normally scheduled postoperative follow-up visit (2–6 weeks after surgery) and then every 3 months until 1 year or resolution of symptoms to document the natural history of the condition, including progression, regression, and intervening treatment. Our study neurologist (D.P.) was available for consultation to verify neurologic findings when the primary examiner was unable to differentiate abnormal findings. For patients who were identified as needing formal neurologic evaluation, the neurologist's findings as well as the results of any neuorologic tests were recorded. In order to capture cases where symptoms of neuropathy became apparent after the initial 24 hour examination, clinicians involved with the care of study patients were instructed to contact the principal investigator.

Patient demographics including age and race, as well as past medical history including obesity, diabetes, heart disease, smoking, and peripheral vascular disease were obtained from the electronic medical record. Overall morbidity was calculated using the age-adjusted Charlson Comorbidity Index.[9] Data collected at the time of surgery included type of surgery, indication for surgery, stirrup type, duration of surgery, type of anesthesia (general, regional, local), use of self-retaining retractors, and intraoperative complications. Procedure time was calculated as the time in minutes between the recorded incision and closing events.

Data analysis was performed using JMP 6.0 (SAS Institute, Cary, NC). Incidence is reported as a percentage with 95% confidence interval. Means were compared using Student $t$ test for continuous variables and proportions were compared using $\chi^2$ for nominal and ordinal data. Probability values less than .05 were used to demonstrate statistical significance.

## RESULTS

Seven hundred sixty-two consecutive patients were approached for enrollment in this study between July 2007 and July 2008. Six hundred and sixty patients met enrollment criteria and consented to study participation. Details of participant enrollment and follow-up are found in the Figure. Six hundred and sixteen patients were screened for neuropathy postoperatively. The baseline characteristics of the cohort are listed in Table 1. At the preoperative neurologic evaluation, preexisting lower extremity neuropathies were observed in 12 (1.9%) participants prior to the surgery. These preoperative neuropathies included 1 femoral, 3 pudendal, 1 genitofemoral, and 7 lateral femoral cutaneous.

Surgical procedures performed are listed in Table 2. Overall, 22% were performed via laparotomy, 43% vaginally (including hysteroscopy), 26% laparoscopically, 14% other (including vulvar procedures and inguinal lymphadenectomy), and 5% by a combination of routes. Six percent were performed in the supine position without stirrups, 46% were performed in the low or high lithotomy position with support Boots (eg, Allen stirrups or yellow fin stirrups; Allen Medical Systems, Acton, MA) and 47% were performed in high lithotomy with candy cane stirrups.

Fourteen new peripheral nerve injuries were observed postoperatively in 11 patients, making the overall incidence of de novo postoperative neuropathy 1.8% (11/616; 95% confidence interval [CI], 1.0–3.2). Age, body mass index (BMI); Charlson Comorbidity index (CCI), history of smoking, history of peripheral vascular disease, history of neurologic disease, history of lumbar spine disease, and operative time were not significantly different between those who developed neuropathy and those who did not. Of the 21 patients not receiving preoperative examination per the protocol, none subsequently developed a postoperative neuropathy. None of the patients who underwent surgery in the supine position developed a postoperative neuropathy (0%; 95% CI, 0.06–9). Four subjects who underwent surgery in the dorsal lithotomy position with support boots developed a postoperative neuropathy (1.3%; 95% CI, 0.04–2.7) compared with 7 subjects (2.6%; 95% CI, 0.7–4.4) who underwent surgery in high lithotomy position with candy cane stirrups, ($P = .46$). In all, 5 lateral femoral cutaneous, 1 common fibular, 5 femoral, 1 ilioinguinal/iliohypogastric, 1 saphenous, and 1 genitofemoral neuropathies were detected (Table 3). Bilateral neuropathies of the femoral or lateral femoral cutaneous nerve were observed in 3 (27%) subjects. Complete resolution of neuropathic symptoms occurred in all but 1 subject (91%). One subject required physical therapy and another required a trigger point injection with local anesthetic to achieve symptomatic resolution; the remaining required no specific treatment. The median time to resolution of symptoms was 31.5 days (range, 1 day to 6 months).

Five lateral femoral cutaneous (LFCN) neuropathies were observed in 4 participants (Table 3). Three unilateral cases occurred in subjects undergoing vaginal surgery in candy cane stirrups, all of which were left-sided. One participant undergoing a laparoscopic procedure in boot stirrups suffered a bilateral LFCN neuropathy. All 4 subjects with LFCN neuropathies reported loss of sensation and paresthesias of the anterolateral thigh proximal to the knee. None reported neuropathic pain symptoms. Complete resolution was achieved in all 4 subjects with a range of 62 to 136 days.

Five femoral neuropathies were identified in 3 patients. A left-sided femoral neuropathy with involvement of the saphenous nerve was identified in a single subject undergoing vaginal surgery in candy cane stirrups. Motor strength and reflexes were intact. Two bilateral femo-