Perioperative Complications and Adverse Events after Surgery for Peripheral Nerve- and Para-lumbar Spine Diseases

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Abstract

Peripheral nerve diseases are common. Para-lumbar spine diseases (PLSDs) include peripheral neuropathy around the lumbar spine, e.g., cluneal nerve entrapment and gluteus medius muscle pain. While these diseases can be treated by less invasive surgery, postoperative complications have not been sufficiently investigated. We document complications after surgery for peripheral nerve diseases and PLSDs. Between July 2014 and December 2020, 678 consecutive patients with peripheral nerve diseases and PLSDs underwent 1068 surgical procedures (upper limb 200 sites, lower limb 447 sites, para-lumbar spine 394 sites, and tumor 27 sites). After excluding 27 procedures to address tumors, we examined the remaining 1,041 procedures undergone by 672 patients (average age 68.2 years) and recorded the complication rate observed within 30 days after the procedures. The overall surgical complication rate was 3.9% (41/1041 procedures); 6 procedures required surgical salvage and 35 were treated conservatively. There were no long-term sequelae from complications. The complication rate was high after surgery for lateral femoral cutaneous-, saphenous-, and common peroneal nerve entrapment and tarsal tunnel syndrome; all sites involved the lower limbs. As a result, intergroup comparison showed that the complication rate was significantly higher for the upper limb (3.0%) procedures than the lower limb (6.7%) and PLSD (1.3%) procedures. It was significantly lower for PLSD operations than lower and upper limb operations. The patient age and diabetes mellitus were significant risk factors for postoperative complications. Their rate was low in patients treated for peripheral nerve diseases and PLSDs; 34 of the 41 complications (82.9%) were related to the surgical wound.

Keywords: entrapment neuropathy, low back pain, risk factor, surgical complications

Introduction

Peripheral nerve diseases are common. Although they can be treated by less invasive surgical procedures,1–3 the complication rate after surgery for specific peripheral nerve diseases needs further elucidation.

Para-lumbar spine diseases (PLSDs) include peripheral neuropathy around the lumbar spine, e.g., cluneal nerve entrapment, sacroiliac joint pain, gluteus medius muscle pain, and piriformis syndrome.4–7 They affect the patients’ quality of life due to the elicitation of low back pain and buttock pain.8 We investigated the complication rates within 30 days after surgery for peripheral nerve diseases and PLSDs.

Patients and Methods

This study was approved by the Institutional Ethics Committee of Chiba Hokusoh Hospital, Nippon
Medical School. Informed consent for the surgery was obtained from all patients. Written informed consent for inclusion in this study was waived because of its retrospective design; patients could opt out on the home page of our institutions.

Between July 2014 and December 2020, 678 consecutive patients with peripheral nerve disease and PLSDs underwent 1068 surgical procedures at the neurosurgery departments of Kushiro Rosai Hospital; Chiba Hokusoh Hospital, Nippon Medical School; and Nippon Medical School Hospital. Of the 1068 procedures, 27 were performed to treat tumors; they were not included in this study. We retrospectively investigated the other 1041 procedures for complications that occurred within 30 days after the operation (672 patients, 368 females, 304 males, average age 68.2 years, range 15–91 years).

The surgical sites were the upper limb (n = 200); 163 (81.5%) addressed carpal tunnel syndrome (CTS), 29 (14.5%) cubital tunnel syndrome, and 8 (4.0%) Guyon canal syndrome. Lower limb procedures (n = 447) were performed to treat lateral femoral cutaneous nerve entrapment (LFCN-E; n = 28, 6.3%), femoral nerve entrapment (n = 4, 1%), saphenous nerve entrapment (SN-E; n = 5, 1.1%), common peroneal nerve entrapment (CPN-E; n = 120, 26.8%), superficial peroneal nerve entrapment (SPN-E; n = 27, 6.0%), tarsal tunnel syndrome (TTS; n = 257, 57.5%), and Morton disease (n = 6, 1.3%).

Among procedures to address PLSDs (394 sites), 200 (50.8%) involved superior cluneal nerve entrapment (SCN-E), 71 (18.0%) middle cluneal nerve entrapment, and 123 (31.2%) gluteus medius muscle pain. Of the 1,041 procedures, 531 (51.0%) were on the right side and 510 (49.0%) on the left side; 1,032 (99.1%) were performed under local anesthesia, on the right side and 510 (49.0%) on the left side; 1,032 (99.1%) were performed under local anesthesia, 123 (11.4%) for Morton disease. Diabetes mellitus (DM), recorded when the patient’s HbA1c level was 6.3 or higher, involved in 216 surgeries (21.2%) of 1,041 procedures (Table 1). The DM was present in 32.5% of the upper limb (75.0%) and SN-E 80.0%), and 12.4% of the lower limbs. As a result, intergroup comparison showed that the complication rate was significantly higher for upper limb (3.0%) procedures than lower limb (6.7%) and PLSD (1.3%) procedures (p < 0.05). It was significantly lower for PLSD operations than lower limb and upper limb operations (p < 0.05).

Another arose after surgery for LFCN-E; a hematoma was removed 2 weeks postoperatively. One procedure to address SCN-E required wound reopening and suturing for local wound infection. The other 3 procedures were followed by wound dehiscence; 2 CPN-E surgery sites needed resuturing and one operation for TTS made skin grafting necessary.

Inter-group comparison of the procedures with or without complications revealed that only the patient age and DM were significantly associated with the elicitation of postoperative complications (Table 2). The DM was present in 32.5% of the surgeries for the upper limb (33.5% for CTS, 34.5% for cubical tunnel syndrome, and 25.0% for Guyon canal syndrome), 22.8% of lower limb surgeries (CPN-E 20.8%, TTS 20.6%, LFCN-E 17.9%, SPN-E 44.4%, Morton disease 0%, femoral nerve entrapment 75.0%, and SN-E 80.0%), and 12.4% of surgeries for PLSDs (10.0% for SCN-E, 21.1% for middle cluneal nerve entrapment, and 11.4% for gluteus medius muscle pain). The DM presence did not affect high incidence of postoperative complications in lower limbs.

### Discussion

The overall complication rate within 30 days after 1041 procedures for peripheral nerve disease and PLSDs was 3.9%. None of the complications was major; overall, 34 of the 41 (82.9%) complications...
The reported overall complication rate within 30 postoperative days ranged from 2.9 to 4.4%. Complications at the surgical site ranged from 1.6 to 2.1%; most were superficial and were resolved by the administration of antibiotics. However, some patients experienced systemic complications that required readmission. Ducic et al. encountered no postoperative mortality and no major systemic complications. Others reported deaths and systemic complications after 1.5% of procedures that tended to involve brachial plexus surgeries; the complications included deep venous thrombosis and blood loss requiring transfusion. Of our 1041 surgeries, 1,032 (99.1%) were performed under local anesthesia and neither external fixation nor movement restriction was enforced.

A complication severity of grade III–IV, surgical-time prolongation, serious surgical wound problems, a brachial plexus pathology, emergency surgery, and a high body mass index were risk factors for complications after peripheral nerve surgery. Few of our surgeries required more than 120 min; none were emergent and none of the wound issues were serious. Only the patient age and DM, a significant risk factor for surgical-site infection in multiple types of surgery, were wound related. The postoperative complication rate was the highest after surgery for lower-limb issues.

Our search of the literature found only three other reports addressing surgical complications after high-volume peripheral nerve surgeries. The reported overall complication rate within 30 postoperative days ranged from 2.9 to 4.4%. Complications at the surgical site ranged from 1.6 to 2.1%; most were superficial and were resolved by the administration of antibiotics. However, some patients experienced systemic complications that required readmission. Ducic et al. encountered no postoperative mortality and no major systemic complications. Others reported deaths and systemic complications after 1.5% of procedures that tended to involve brachial plexus surgeries; the complications included deep venous thrombosis and blood loss requiring transfusion. Of our 1041 surgeries, 1,032 (99.1%) were performed under local anesthesia and neither external fixation nor movement restriction was enforced.

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Table 1 Summary of complications based on the disease

| Procedures addressing | Complications (%) | Surgical salvage required | Superficial wound dehiscence | Localized wound infection | Others |
|-----------------------|------------------|----------------------------|----------------------------|--------------------------|--------|
| Upper limb            |                  |                            |                            |                          |        |
| CTS (n = 163)         | 6 (3.7)          | 0                          | 4                          | 2                        | 0      |
| PLSDs                 |                  |                            |                            |                          |        |
| SCN-E (n = 200)       | 4 (2.0)          | 1                          | 0                          | 2                        | 1 (subcut hx) |
| GMeM pain (n = 123)   | 1 (0.8)          | 0                          | 0                          | 0                        | 1 (asthma) |
| Lower limb            |                  |                            |                            |                          |        |
| LFCN-E (n = 28)       | 4 (14.3)         | 1                          | 0                          | 3                        | 0      |
| SN-E (n = 5)          | 1 (20.0)         | 0                          | 0                          | 0                        | 1 (local derm) |
| CPN-E (n = 120)       | 8 (6.7)          | 3                          | 4                          | 1                        | 0      |
| SPN-E (n = 27)        | 1 (3.7)          | 0                          | 1                          | 0                        | 0      |
| TTS (n = 257)         | 16 (6.2)         | 1                          | 9                          | 4                        | 2 (local derm) |
| Other* (n = 118)      | 0                | 0                          | 0                          | 0                        | 0      |
| Total (1,041)         | 41 (3.9)         | 6                          | 18                         | 12                       | 5      |

*Other includes cubital tunnel syndrome (n = 29), Guyon canal syndrome (n = 8), middle cluneal nerve entrapment (n = 71), femoral nerve entrapment (n = 4), and Morton disease (n = 6).

CTS: carpal tunnel syndrome, PLSDs: para-lumbar spine diseases, SCN-E: superior cluneal nerve entrapment, GMeM: gluteus medius muscle, LFCN-E: lateral femoral cutaneous nerve entrapment, SN-E: saphenous nerve entrapment, CPN-E: common peroneal nerve entrapment, SPN-E: superficial peroneal nerve entrapment, TTS: tarsal tunnel syndrome, subcut hx: subcutaneous history, local derm: local dermatitis.

Table 2 Comparison of procedures with/without postoperative complications

| Complications | Yes | No | p value |
|---------------|-----|----|---------|
| Procedures    | 41  | 1000 |         |
| Age (years)   | 74.6 ± 1.6 | 68.8 ± 0.5 | <0.05   |
| DM            | 36.6% | 20.1% | <0.05   |
| Body mass index | 24.5 ± 0.7 | 23.7 ± 0.02 | ns      |
| Serum total protein/albumin | 7.1 ± 0.1/7.0 ± 0.02/ | ns/ns |
| Anticoagulant/antiplatelet therapy | 9.8% | 11.2% | ns      |
| Re-operation  | 7.3% | 9.9% | ns      |

DM: diabetes mellitus, ns: not significant.
important risk factors in our series. Neither the serum total protein or albumin level nor the administration of anticoagulant or antiplatelet agents was a risk factor in our study. We suspect that the relatively good nutritional status of our patients contributed to their reliable hemostasis during the less invasive procedures.

The complication rate after peripheral nerve surgery varies and depends on the surgical site. A low complication rate (1.4%) was reported after surgery for CTS, the most common peripheral neuropathy.\(^\text{10,11}\) The complication rate after surgery for LFCN-E was 0–5%; hematomas and wound issues were common.\(^\text{12}\) In an earlier series,\(^\text{13}\) 12% of TTS operations were followed by complications; they were noninfected wound dehiscence that healed. No complications occurred after common and deep peroneal nerve surgery.\(^\text{13}\) The complication rate after brachial plexus surgery was 7.0%;\(^\text{14}\) it was significantly lower after head and neck operations.\(^\text{1}\) Ducic et al.\(^\text{1}\) also reported wound issues after operations for TTS, SPN-E, and LFCN-E.

Ours is the first comprehensive investigation of postoperative complications after surgery for upper limb and lower limb diseases and PLSDs. In this series, we performed 323 PLSD procedures; complications occurred after 5 of these procedures (1.6%). We encountered higher complication rates after surgery for lower-limb diseases (LFCN-E, SN-E, CPN-E, and TTS) than upper limb diseases and PLSDs. However, the number of LFCN-E (n = 28) and SN-E (n = 5) procedures was low and our experience with surgery for these anomalies was not extensive; these factors may have contributed to this observation.

Our series included 120 CPN-E and 257 TTS procedures; 8 of the former (6.7%) and 16 of the latter (6.2%) were followed by complications. Others\(^\text{11,13}\) also found that complications are more likely to be a problem after TTS surgery. It is unclear why the complication rate was high after our CPN-E and TTS surgeries; we think that our allowing the patients to walk unrestrictedly immediately after completion of the procedure may have played a role, as may have difficulties in keeping wounds in the lower limbs clean. It is easier to deal with wounds in the upper limbs and those related to the treatment of PSLD. The blood flow in areas affected by PLSD is stronger than in the upper and lower limbs, and this may help to reduce wound problems.

To avoid postoperative complications, the surgical wound must be as small as possible and suturing must be performed with great care.\(^\text{14,15}\) Whether some postoperative gait restriction would have contributed to lowering our rate of wound problems needs to be investigated. In high-risk patients, negative-pressure wound therapy, although expensive, may be useful as it modulates the infusion of blood, stimulates vascularization, and promotes regional granulation.\(^\text{16,17}\)

**Conclusion**

The rate of complications after less invasive surgery for peripheral nerve disease and PLSDs was low in our series. The elicitation of postoperative complications depended on the surgical site: among our 437 lower-limb operations, 30 (6.9%) resulted in postoperative complications (LFCN-E: 4 of 28, 14.3%; CPN-E: 8 of 120, 6.7%; TTS: 16 of 257, 6.2%). The patient age and DM were significant risk factors for postoperative complications.

**Conflicts of Interest Disclosure**

The authors declare they have no conflicts of interest and no commercial relationships and that they received no support from pharmaceutical or other companies. All authors are members of the Japan Neurosurgical Society (JNS), and all have completed the Self-reported COI Disclosure Statement Forms available at the website for JNS members.

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