

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

Kyongsong KIM,¹ Toyohiko ISU,² Daijiro MORIMOTO,³ Rinko KOKUBO,¹ Fumiaki FUJIHARA,² and Akio MORITA³

¹Department of Neurological Surgery, Chiba Hokusoh Hospital, Nippon Medical School, Inzai, Chiba, Japan

²Department of Neurosurgery, Kushiro Rosai Hospital, Kushiro, Hokkaido, Japan

³Department of Neurological Surgery, Nippon Medical School Hospital, Tokyo, Japan

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

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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, most involved neurolysis. Some procedures to treat superior/middle cluneal nerve entrapment and Morton disease were neurectomies. Diabetes mellitus (DM), recorded when the patient's HbA1c level was 6.3 or higher, involved in 216 surgeries (21.2%) of 143 patients (20.7%).

Statistical analysis was performed with IBM SPSS for Windows ver. 25.0 (IBM Corp., Armonk, NY, USA). The complication rate involving the upper and lower limbs and PLSDs was compared using the Pearson's chi-square test. Intergroup comparisons of procedures with or without complications were subjected to the Mann-Whitney *U*-test (for serum total protein, albumin, the patient age, and the body mass index), to the Fisher's exact test (for reoperation and the administration of anticoagulant/antiplatelet drugs), and to the Pearson's chi-square test (for absence or presence of DM). Values are expressed as the mean \pm standard error of the mean.

Differences of $p < 0.05$ were considered statistically significant.

Results

Our overall surgical complication rate was 3.9% (41 of 1041 included procedures); 6 complications (14.6%) required surgical salvage and the other 35 (85.4%) were treated conservatively (Table 1). Of the latter, 30 were wound related. No patient experienced long-term sequelae from complications; there were no anesthesia-related complications. The complication rate was high after surgery for LFCN-E, SN-E, CPN-E, and TTS; all sites involved 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 ($p < 0.05$).

Among the 6 procedures whose complications required surgical salvage, one complication occurred after reoperation due to peroneal nerve palsy elicited by iatrogenic strangulation by subcutaneous suturing after common peroneal nerve neurolysis. 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 cubital 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

Table 1 Summary of complications based on the disease

Procedures addressing	Complications (%)	Complication			
		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 dermat)
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 dermat)
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 dermat: local dermatitis.

Table 2 Comparison of procedures with/without postoperative complications

	Complications		p value
	Yes	No	
Procedures	41	1000	
Age (years)	74.6 ± 1.6	68.8 ± 0.5	<0.05
DM	36.6% (n = 15)	20.1% (n = 201)	<0.05
Body mass index	24.5 ± 0.7	23.7 ± 0.02	ns
Serum total protein/albumin	7.1 ± 0.1/ 4.2 ± 0.1	7.0 ± 0.02/ 4.3 ± 0.02	ns/ns
Anticoagulant/antiplatelet therapy	9.8% (n = 4)	11.2% (n = 112)	ns
Re-operation	7.3% (n = 3)	9.9% (n = 99)	ns

DM: diabetes mellitus, ns: not significant.

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.¹⁻³⁾

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.¹⁾ encountered no postoperative mortality and no major systemic complications. Others^{2,3)} 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,²⁾ surgical-time prolongation,^{2,3)} serious surgical wound problems,²⁾ a brachial plexus pathology,³⁾ emergency surgery,³⁾ and a high body mass index^{1,3)} 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,⁹⁾ were

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.^{10,11} The complication rate after surgery for LFCN-E was 0–5%; hematomas and wound issues were common.¹² In an earlier series,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.¹³ The complication rate after brachial plexus surgery was 7.0%;³ it was significantly lower after head and neck operations.¹ Ducic et al.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^{1,13} 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 PLSD. 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.^{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.^{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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- Corresponding author: Kyongsong Kim, MD, PhD
 Department of Neurological Surgery, Chiba Hokusoh Hospital, Nippon Medical School, 1715 Kamagari, Inzai, Chiba 270-1694, Japan
e-mail: kyongson@nms.ac.jp