

Trends of Spine Surgeries during the First COVID-19 Semi-Lockdown: Survey in a Non-Epidemic Region in Japan

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Abstract:

Introduction: In the early phase of the coronavirus disease 2019 (COVID-19) pandemic, the importance of triaging surgeries was suggested to reduce burdens on the existing health system and maintaining service. The governor declared a state of emergency and requested that residents avoid going out unnecessarily (semi-lockdown) for the entire prefecture including our medical region from February 28 until May 25, 2020. However, for several spine patients, a significant delay in care may result in the progression of extremity weakness and pain. This study aimed to investigate trends of spine surgeries during the first COVID-19 semi-lockdown in the non-epidemic region in Japan.

Methods: Spine surgeries performed in our institution from February 28 until May 25 between 2017 and 2020 were retrospectively reviewed and analyzed. We compared the number of spine surgeries and types of surgical spine pathologies between 2017 and 2019: previous years and 2020: a COVID-19 year.

Results: The mean number of spine surgeries performed in previous years was 121 cases, and the number of spine surgeries performed in a COVID-19 year was 109 cases. The percentage of urgent surgeries was 19.6% in previous years versus 37.6% in a COVID-19 year; the difference was statistically significant ($P < 0.05$). Among the urgent surgical spine pathologies, the prevalence of cauda equina or severe nerve root compression leading to progressive neurological deterioration or intractable pain was 20.2% in a COVID-19 year, which was significantly higher than 12.4% in previous years ($P < 0.05$).

Conclusions: The first COVID-19 semi-lockdown in Japan led to a decrease in elective cases and an increase in urgent cases and might affect progressive neurological deterioration for some spine patients even in a non-epidemic region.

Keywords:

COVID-19, spine surgery, non-epidemic region

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Introduction

The first case of the coronavirus disease 2019 (COVID-19) was in Wuhan, China, which was reported on December 31, 2019. Since then, the disease has spread throughout the world and has affected more than 200 countries and territories, with over 90 million infected people in 1 year. The COVID-19 pandemic has rapidly become one of the most catastrophic global health crises of our time¹⁾, and patients infected with the COVID-19 virus have placed an enormous strain on healthcare systems worldwide²⁾.

In the early phase of the COVID-19 pandemic, the importance of triaging surgeries was suggested to reduce burdens

on the existing healthcare system and maintaining service, with no exception in the field of spine surgery. Many hospital systems have developed protocols for evaluating which operations should be done urgently and which should be delayed³⁻⁵⁾. According to the guidelines for triage of non-emergency surgical procedures based on these publications, spine pathologies with progressive neurological deterioration, epidural abscess, and acute spine trauma should be proceeded with surgical intervention, whereas pathologies such as scoliosis without neurological deficit, low back pain, and neck pain are considered to postpone surgery. However, with low back pain ranking as the most disabling condition worldwide and neck-related issues ranking as the fourth

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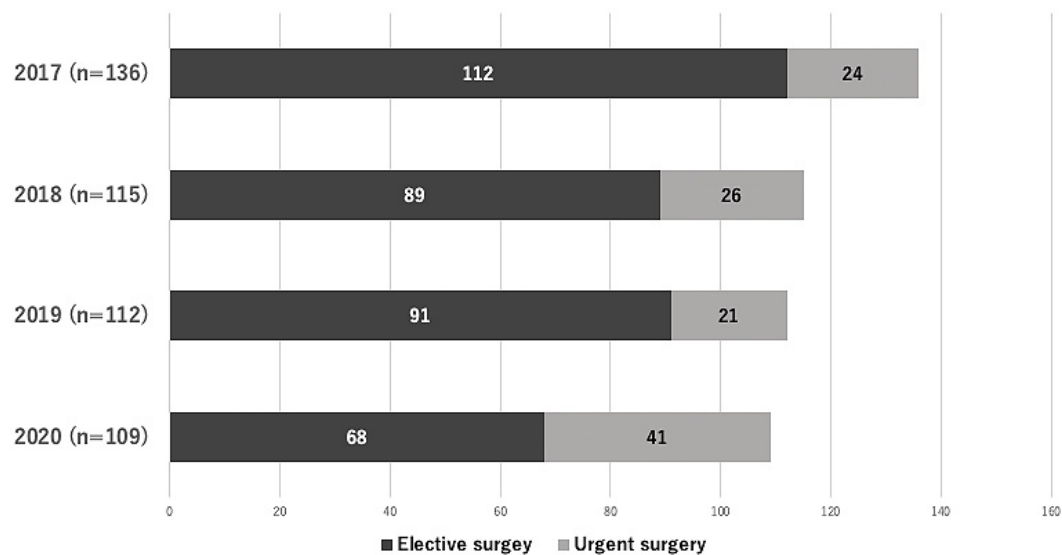


Figure 1. Number of elective and urgent spine surgeries in 2017, 2018, 2019, and 2020.

leading cause globally, there is a major demand for spine providers^{6,7}). Furthermore, for many spine patients, a significant delay in care may result in a progression of extremity weakness and pain with less predictable improvement after surgery. Ultimately, in several conditions, such as myelopathy, delaying surgical decompression may allow for neurological deterioration and irreversible patient harm.

Japan saw its first case of COVID-19 on January 16, 2020, and the disease has been gradually spreading widely across the country. The governor declared a state of emergency for preventing a crash of the healthcare systems and requested that residents avoid going out unnecessarily (semi-lockdown) for the entire prefecture including our medical region from February 28 until May 25, 2020. Nevertheless, reports of COVID-19 were sporadic (15 reports among 0.5 million residents until May 25, 2020) in our medical region. This study aimed to investigate trends of spine surgeries during the first COVID-19 semi-lockdown in a non-epidemic region in Japan.

Materials and Methods

All of the spine patients who had undergone spine surgeries in our institution from February 28 until May 25 between 2017 and 2020 were retrospectively reviewed. The following data were extracted from our database: the total number of spine surgeries, prevalence of each surgical spine pathology, and percentage of elective and urgent surgery (US) between 2017 and 2020. We determined that a spine procedure in which the patient was evaluated in an office setting and later provided an operative appointment date was an elective surgery (ES). A spine procedure in which the patient was hospitalized urgently because of serious neurological symptoms or excruciating pain, which required surgical intervention during hospitalization was a US. ES was mainly performed for lumbar spinal stenosis (LSS), lumbar disk

herniation (LDH), and cervical spondylotic myelopathy (CSM). US was performed for spine trauma, acute worsening of cervical or thoracic myelopathy, cauda equina, or severe nerve root compression leading to progressive neurological deterioration, or intractable pain and spinal infection including surgical site infection and epidural abscess.

The statistical analyses were performed using JMP Pro version 16.0 statistical software (SAS Institute, NC, USA). Chi-squared test or Yates' continuity correction was applied for statistical comparison, and $P < 0.05$ indicated statistical significance. This study was approved by the hospital ethics committee, and all the patients provided informed consent.

Results

The total number of spine surgeries were 136 cases in 2017, 115 cases in 2018, 112 cases in 2019, and 109 cases in 2020, and the number of ES were 112 cases in 2017, 89 cases in 2018, 91 cases in 2019, and 68 cases in 2020, respectively (Fig. 1).

Surgical spine pathologies included LSS, LDH, and CSM. The number of LSS was 76.0 cases in the mean of 2017-2019: previous years and 61 cases in 2020: a COVID-19 year; the number of LDH was 20.3 cases in previous years and 19 cases in a COVID-19 year; the number of CSM was 7.7 cases in previous years and 7 cases in a COVID-19 year (Fig. 2). The prevalence of LSS in previous years and a COVID-19 year was 62.8% versus 55.9% ($P = 0.198$ in Chi-squared test); the prevalence of LDH was 16.8% versus 17.3% ($P = 0.878$ in Chi-squared test); the prevalence of CSM was 6.3% versus 6.4% ($P = 0.848$ in Yates' continuity correction) (Fig. 3).

The percentage of US was 19.6% in previous years versus 37.6% in a COVID-19 year; the difference was statistically significant ($P < 0.05$ in Chi-squared test) (Fig. 4). The prevalence of acute worsening of myelopathy was 2.2% in previ-

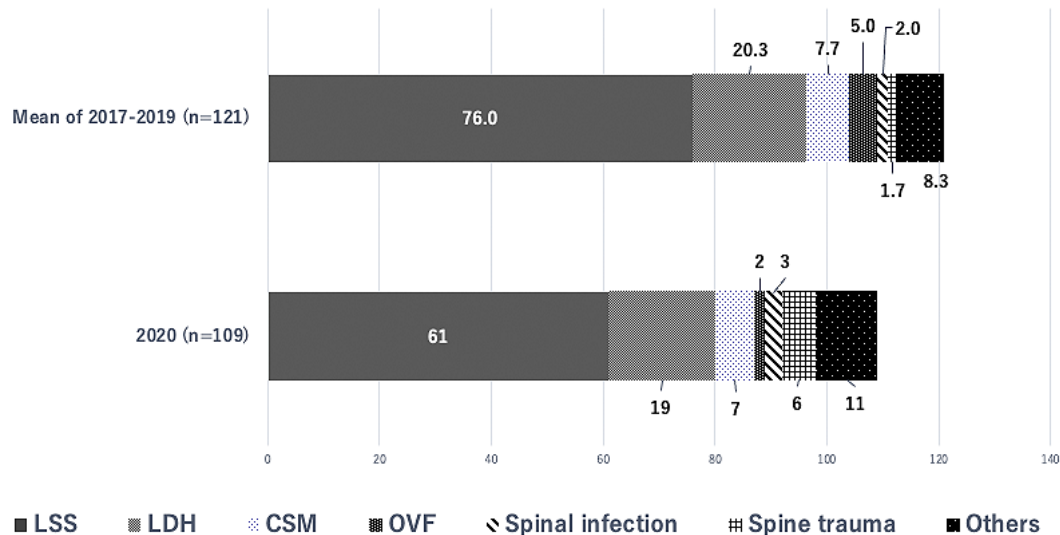


Figure 2. Breakdown of surgical spine pathologies in 2017–2019 and 2020. LSS: Lumbar spinal stenosis, LDH: Lumbar disk herniation, CSM: Cervical spondylotic myelopathy, OVF: Osteoporotic vertebral fracture

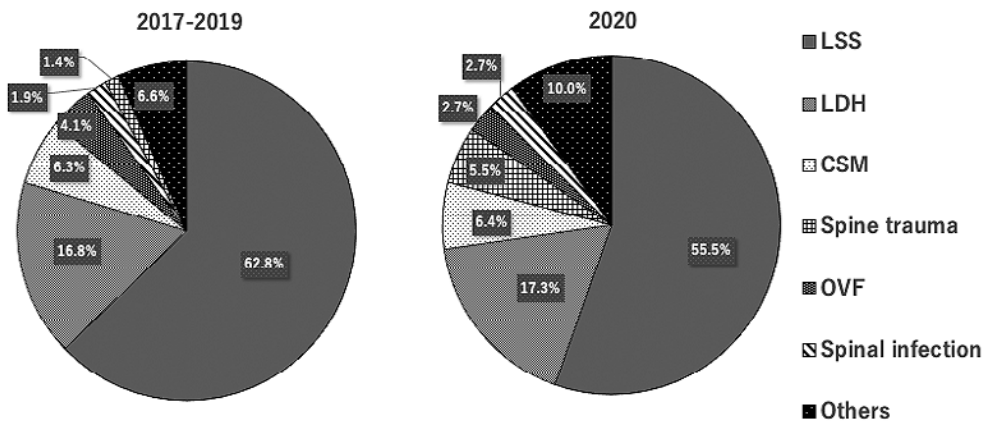


Figure 3. Prevalence of each surgical spine pathology in 2017–2019 and 2020. LSS: Lumbar spinal stenosis, LDH: Lumbar disk herniation, CSM: Cervical spondylotic myelopathy, OVF: Osteoporotic vertebral fracture

ous years versus 5.5% in a COVID-19 year ($P=0.144$ in Yates’ continuity correction), and the prevalence of cauda equina or severe nerve root compression was 20.2% in a COVID-19 year, which was significantly higher than 12.4% in previous years ($P<0.05$ in Chi-squared test) (Fig. 5).

Discussion

During the 20th century, three major pandemics ravaged the globe: the H1N1 Spanish flu of 1918, the H2N2 Asian flu of 1957, and the H3N2 Hong Kong flu of 1968⁸⁾. The more recent epidemic level outbreaks of Severe Acute Respiratory Syndrome (SARS) in 2002, H1N1 Swine flu in 2009, and Middle East Respiratory Syndrome (MERS) in 2012 provided certain regions around the world with an early opportunity to prepare for deadly infectious disease outbreaks⁹⁻¹¹⁾. Weiner et al. investigated whether prior experience with disease epidemics among the spine surgeon com-

munity had an impact on preparedness and response toward COVID-19¹²⁾. Surprisingly, their survey indicated that spine surgeons who indicated prior experience with SARS, MERS, H1N1, and Ebola outbreaks were no better prepared to take on the COVID-19 pandemic. They concluded that previous infectious disease outbreaks had only a subtle influence on the impact of COVID-19 and no substantial bearing on preparation for the current pandemic.

Although the COVID-19 pandemic constitutes catastrophic events for the entire population, such events are particularly impactful on healthcare systems. Hospitals have postponed elective surgical cases to avail additional beds, ventilators, and personal protective equipment in epidemic regions. Over 67% of spine surgeons globally reported a >75% decrease in their elective cases¹²⁾. In the largest family-owned hospital group in Germany, spine cases in the immediate aftermath of restrictions on elective surgeries fell 64.4% below baseline expected levels during the COVID-19

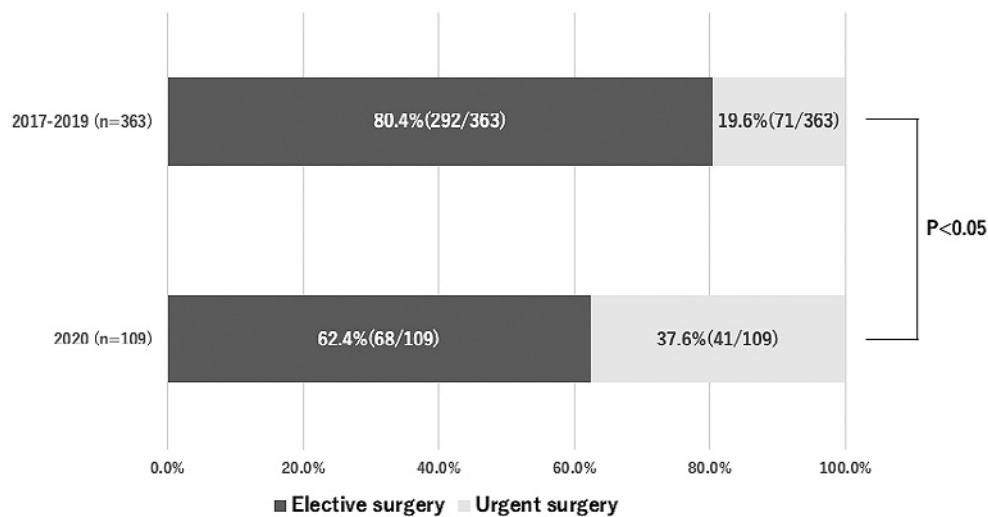


Figure 4. Percentage of elective and urgent surgery in 2017–2019 and 2020. The percentage of urgent surgeries in a COVID-19 year is significantly higher than in the previous years ($P<0.05$ in Chi-squared test).

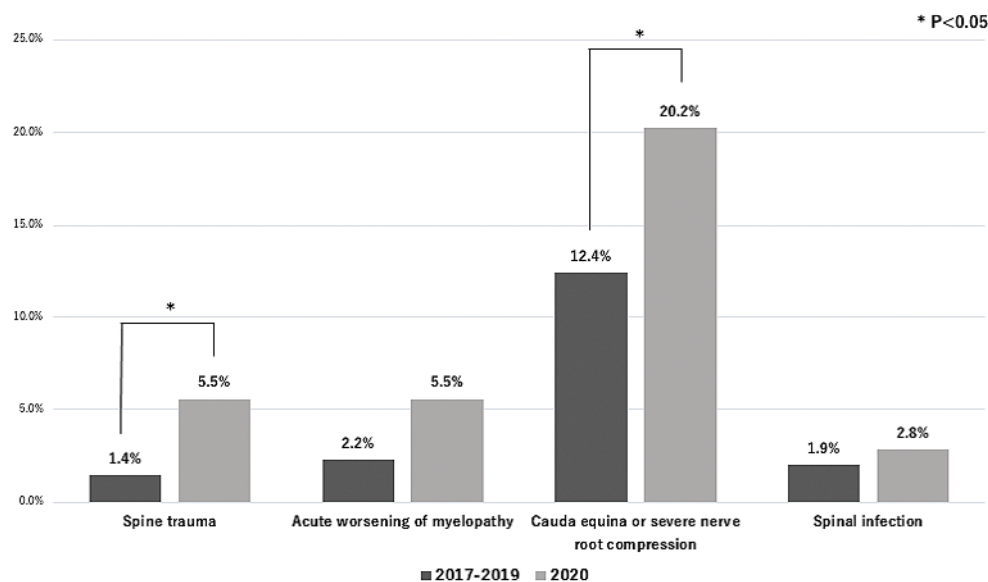


Figure 5. Prevalence of each urgent surgical spine pathology in 2017–2019 and 2020. The prevalences of spine trauma and cauda equina or severe nerve root compression in 2020 were significantly higher than in 2017–2019 ($P<0.05$ in Chi-squared test).

pandemic¹³). Conversely, we did not need to triage spine surgeries during the COVID-19 semi-lockdown because reports of COVID-19 were sporadic (15 reports among 0.5 million residents) in our medical region; therefore, we were just concerned about a potential possibility of an increase in patients’ requests for canceling or postponing surgeries for self-quarantine and stay-at-home order.

In our data, each prevalence of LSS, LDH, CSM, osteoporotic vertebral fracture, and spinal infection was not statistically significant between previous years and a COVID-19 year, but the number of ES in a COVID-19 year decreased by 30.1% in comparison with that in the previous years despite without triaging. As there were no government or hospital restrictions on undergoing our elective cases, the main

reason for a decrease in ES was considered to be patients’ requests for canceling and postponing surgeries. In fact, the number of orthopedic outpatients in the semi-lockdown period decreased by 32% in comparison with that in the previous years. By contrast, the number of nonelective surgeries in a COVID-19 year increased by 73.0% in comparison with that in the previous years. Especially, the prevalence of cauda equina or severe nerve root compression leading to progressive neurological deterioration or intractable pain significantly increased. However, there were no significant differences in the prevalence of patients with LSS and LDH. No patients required emergency surgeries due to metastatic spinal tumors. The percentage of urgent cases that had been followed up in our hospital in previous years and a COVID-

19 year was 12.7% and 19.5%, respectively. There was no increase in the rate of urgent cases that had been followed up in other hospitals. The data suggested that some patients with cauda equina or severe nerve root compression declined in hospital visits during the semi-lockdown period and developed unfortunate neurological deterioration or intractable pain.

To prevent these situations, spine providers should have urged patients with serious spine problems to visit a hospital and receive appropriate examination and treatment under exhaustive infection control even on semi-lockdown, but there were no formal hospital guidelines for caring for spine patients during an epidemic/pandemic in our institution. Thus, formal institutional guidelines for pandemic crisis preparedness are needed to mitigate future pandemic unforeseen problems.

In the United States, to avoid direct contact with patients, orthopedic and spine providers rapidly introduced and expanded telemedicine programs through previously underutilized digital communication platforms during the COVID-19 pandemic¹⁴⁻¹⁶. Satin AM et al. reported that spine telemedicine visits were associated with high patient satisfaction¹⁷. The spread of telemedicine visits may be one of the sensible solutions to the problem of medical examination in Japan as well. Patient education is also important^{18,19}. Spine surgeons should provide information regarding risks of surgical delays such as irreversible neurological damage for spine patients. The internet has become a valuable source of patient education material, but most of the spine-related patient education materials on professional society and practice-based websites have low readability, and many patients have difficulty with comprehension^{20,21}. Patient education through telemedicine provided by attending spine surgeons and other health care professionals, as well as internet-based patient education might be effective to improve patient comprehension.

This study has several limitations. First, this is a single-center experience of a private institution and may not be fully generalizable to a larger Japanese experience. Second, there are no clear criteria for urgent hospitalization. Not only the patient's condition but also other factors such as the characteristics of the patient and the hospital bed availability might affect the decision making of urgent hospitalization. Finally, the reason for the increase in spinal trauma was uncertain, but it could be related to the fact that two other emergency designated hospitals in our medical region were specified for accepting COVID-19 patients and limited the number of general emergency patients they would accept.

The COVID-19 pandemic had a great impact on daily medical practice including spine surgeries. In our institution, elective cases decreased by 30.1%, and urgent cases increased by 73.0% under the semi-lockdown period even in a non-epidemic region. Self-quarantine and stay-at-home order for preventing COVID-19 outbreak might affect the delay in seeking medical attention and cause progressive neurological deterioration of radiculopathy and cauda equina syndrome for some spine patients.

Conflicts of Interest: The authors declare that there are no relevant conflicts of interest.

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Author Contributions: Masaru Tanaka wrote and prepared the manuscript with support from Masahiro Kanayama, Yukitoshi Shimamura, and Fumihiko Oha. Masahiro Kanayama conceived the original idea, and all of the authors conceived the study concept and study design. Takeru Tsujimoto and Yuichi Hasegawa carried out the statistical analysis. Tomoyuki Hashimoto, Hidetoshi Nojiri, and Muneaki Ishijima supervised the research project. All authors participated in the interpretation of the results and writing of the report and approved the final version.

Ethical Approval: The Institutional Review Board of Hakodate Central General Hospital approved the protocol followed in this study (approval code: 2021-19).

Informed Consent: Informed consent was obtained from all participants in this study.

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