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Case Series

Emergent spine surgery during COVID-19 pandemic: 10 Months experience in Dr. Sardjito general hospital, Indonesia a case series

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ABSTRACT

Background: During the COVID-19 pandemic, the spine surgeon had to deal with some new challenges in treating emergency spine cases. This paper aimed to report our experience with spine emergency surgery during the pandemic, with already limited resources for surgery.
Methods: This was a retrospective, single-center study, involving all patients admitted to our hospital during a period of 1st March – 31st December 2020 and underwent emergent spinal surgery. The data were collected from the patients' medical records.
Results: We found 15 patients who met the inclusion criteria. Four patients were suspected to be infected by COVID-19, but none of them was confirmed to be infected by COVID-19 based on the PCR test. All patients had a history of injury: fell from height (53.3%), traffic accident (40%), and direct trauma (6.7%). The average time interval from injury to hospital admission was 38.6 h, from admission to surgery was 6.3 days, and from injury to surgery was 8.1 days. The patient who was suspected to be infected with COVID-19 has a significantly greater time interval from admission to surgery ($p = 0.012$). The surgery lasted for 3–6 h, with an average of 4.6 h. The average hospital stay duration was 13.3 days and it has a significant positive correlation with the time interval from admission to surgery ($p = 0.001$). Three months post-operatively, seven patients experienced an improvement in the Frankel grade, 4 patients had no changes in Frankel grade, and 2 patients died.
Conclusion: To our experience, the lack of human and material resources during the pandemic caused some delay in surgery. However, surgery performed later than 24 h during the pandemic might still bring benefit to the patient.

1. Introduction

In December 2019, an outbreak of pneumonia caused by a novel coronavirus was first reported in Wuhan, China [1]. The virus was subsequently named Severe Acute Respiratory Syndrome Coronavirus–2 (SARS-COV-2) and the disease was called Coronavirus Disease 2019 (COVID-19) [2]. Due to the highly contagious nature of the virus, the disease was rapidly spread worldwide, including in Indonesia. As of 5 January 2021, COVID-19 had infected more than 80 million people worldwide, with 1,84 million deaths. In Indonesia, there were 779.548 cases and 22.911 deaths [3].

This pandemic had greatly affected the healthcare systems. Some strategies were developed to reduce the risk of disease transmission between the healthcare provider and the patients, as well as minimizing healthcare resource utilization. One of the strategies was delaying elective surgery. By delaying elective surgery, hospital resources such as operating room, ventilator, inpatient bed, and personal protective equipment (PPE) can be preserved. It would also decrease the patient risk to get the COVID-19 infection during hospitalization [4].

However, the identification of patients who need emergent or urgent surgery versus those who can be delayed for months was a challenge, especially for the spine surgeon. For some spine conditions, a delay in surgical treatment might cause significant neurological deterioration with progression of pain and limb weakness. Furthermore, the surgical

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outcome would be less favorable [5].

The patient management during the pandemic should be decided after careful consideration about the benefit of the surgery, the risk for the patient, as well as the surgeon's safety [6]. The North American Spine Society (NASS) has developed a guidance document for triaging spine cases. The cases would be categorized as either emergent, urgent or elective [7]. For emergent cases, early surgical intervention is highly recommended as it may improve clinical outcomes and reduce overall health care costs [8,9].

As the emergent spine surgery should be continuously executed during the pandemic, the spine surgeon had to deal with some new challenges in treating the patients. To our knowledge, there are still few articles describing the surgeons' experience in performing emergent spine surgery during this pandemic, especially in Indonesia, where the available resources for spine surgery were still limited. Therefore, this paper aimed to report our experience with spine emergency surgery and describe the outcome, as well as the challenges that we confronted.

2. Method

We conducted a retrospective, single-center study, involving all patients admitted to our hospital during a period of 1st March – 31st December 2020 and underwent emergent spinal surgery. Our hospital was the only tertiary referral hospital in our Province. We use the NASS guideline for triaging the spine cases and considered the cases as emergent when they had progressive or severe neurologic deficit due to neurologic compression from any cause, spinal instability at risk of causing neurologic injury, epidural abscesses with neurologic deficit, or postoperative wound infection [7].

The data of interest were patients' demographics, admission diagnosis, etiology, surgical procedures, Intensive Care Unit (ICU) admission, duration of surgery, duration of inpatient care, the time interval from symptoms onset/injury to admission, the time interval between admission to surgery, the time interval from onset/injury to surgery, and outcome (Frankel grade changes and mortality within 3 months after surgery). The data were collected from the patients' medical records.

We perform descriptive statistics for all variables (proportion, mean, minimum and maximum value, and standard deviation/SD). We did the independent *t*-test for analyzing the difference of time interval between admission to surgery for the patient suspected to have COVID-19 infection and those who were not. The correlation between the time interval from admission to surgery and the hospital stay duration was analyzed using spearman's test. The logistic regression test was done to analyze the effect of the assessed time intervals on the outcome. The p-value of <0.05 was considered significant. The statistical analysis was performed by using SPSS 23.0. This study has been reported as PROCESS 2020 criteria and registered at Universitas Gadjah Mada Research Repository with registered ID 202104023.

3. Result

During the study period, we found 15 patients who met the inclusion criteria, consisted of 2 females (13.3%) and 13 males (86.7%). The patient's age ranged from 24 to 72 years old, with an average of 54.4 years old (SD = 13.39). Four patients (20%) were suspected to be infected by COVID-19, but none of them was confirmed to be infected by COVID-19 based on the PCR test. All patients had a history of injury: 8 patients (53.3%) fell from height, 6 patients (40.0%) had traffic accident, and 1 patient (6.7%) had direct trauma. The patients' diagnosis and the performed surgical procedure were described in Table 1.

The average of time interval from injury to hospital admission was 38.6 h (range = 5–168; SD = 49.28), from admission to surgery was 6.3 days (range: 5 h - 14 days, SD = 4.87), and from injury to surgery was 8.1 days (range: 0.5–16.0, SD = 5.53) (Table 2). The patient who was suspected to be infected with COVID-19 has a significantly greater time interval from admission to surgery. The average interval time was 11.23

Table 1
Description of the patients' diagnosis and the surgical procedure.

No	Spine Diagnosis	Frankel	Another diagnosis	Surgical procedure
1	Burst fracture of the L1 with Spinal shock	A	–	Laminectomy, decompression, stabilization
2	Close unilateral facet dislocation of the C6–C7, Burst fracture of the C6, Close fracture of spinous process of the C2–C3, Close fracture of bilateral transverse process of the C6, Multiple lytic lesions of the C3–C5	C	Malunion of middle third of the right ulna	Laminectomy, decompression, stabilization with PF C5–C7, open biopsy
3	Central cord syndrome at the level of C6, Teardrop fracture of the C5, Burst fracture of the C6, Close fracture of spinous process of the C6	C	Hypertension stage I	ACDF C6–C7
4	Central cord syndrome at the level of C4 due to hematomyelia at the level of C4–C5 in patient with neglected spondylolisthesis of the C3–C4	C	Hepatitis C infection	Anterior decompression of 4th - 5th cervical spine, interbody cage fusion C3–C4, deformity correction and fusion
5	Anterior cord syndrome at the level of C5 due to hematomyelia at the level of C4–C6, compression fracture of the C4–C6	C	**Suspect COVID-19**	Laminectomy, Decompression and Stabilization with PF C3-T2
6	Burst fracture of the T12, Close fracture of the left transverse process of the T11-L3	A	Traumatic Brain Injury, multiple closed ribs fracture, **suspect COVID-19**	Laminectomy, decompression, and stabilization with PF T11-L1
7	Burst fracture of the C5–C6	A	History of stable angina post PCI 4 years ago, type II diabetes mellitus, hypoalbuminemia	Laminectomy, decompression, and stabilization with PF C3-T2
8	Close fracture of spinous process of T9-T11, Burst fracture of the T11	A	Traumatic Brain Injury, Multiple closed ribs fracture	Laminectomy, decompression, and stabilization with PF T7-L1
9	Burst fracture of the T11, traumatic spondyloptosis of the T10-T11	A	Mild brain injury, right hematothorax, Close fracture of the left 11th ribs, Abdominal blunt trauma with stable hemodynamic, **suspect COVID-19**	Laminectomy, Decompression, Open reduction, Stabilization with PF T7-T12
10	Burst fracture of the 10th thoracic spine Frankel A TLICS 6	A	Bilateral pulmonary contusion, Close fracture of the left 10th rib	Laminectomy, decompression, and stabilization with PF T8-T11
11	Anterior cord syndrome at the level of C6, Hematomyelia at	C	Traumatic cerebral edema, Open depressed fracture of the right frontal	Laminectomy, decompression, haematoma evacuation, and

(*continued on next page*)

Table 1 (*continued*)

No	Spine Diagnosis	Frankel	Another diagnosis	Surgical procedure
	the level of C6-T1, PLC injury at the level of T2-T3		bone, Close fracture of the right mandible	stabilization with PF C5-T4
12	Teardrop fracture of the C4, Compression fracture of the T9, Avulsion fracture of spinous process of the C7-T1	D	–	ACCF C3–C5
13	Burst fracture of the L1	B	–	Percutaneous laminectomy, decompression and minimal invasive stabilization
14	Central cord syndrome at the level of C5	C	Mild brain injury, **suspect COVID-19**	Percutaneous hemilaminectomy and decompression
15	Burst fracture of the L1	D	–	Laminectomy, decompression, stabilization with PF T12-L2

PLC: Posterior Ligamentous Complex; PCI: Percutaneous Coronary Intervention, PF: Posterior Fusion, ACDF: Anterior Cervical Discectomy and Fusion; ACCF: Anterior Cervical Corpectomy and Fusion.

Table 2
Time interval from injury to hospital admission, hospital admission to surgery, and the patients' outcome 3 months post-operatively.

No	Onset/Injury – Hospital Admission	Hospital admission to surgery	3 months outcome
1	36 h	6 days	Not available
2	24 h	1 day	Improvement of Frankel grade to D
3	24 h	4 days	Improvement of Frankel grade to D
4	6 h	10 days	Improvement of Frankel grade to D
5	8 h	10 days	Improvement of Frankel grade to D
6	24 h	12 days	Not available
7	24 h	1 day	Died (5 days post-surgery)
8	12 h	1 day	Died (3 months post-surgery)
9	144 h	9 days	No changes in Frankel grade
10	24 h	2 days	Improvement of Frankel grade to B
11	48 h	14 days	Improvement of Frankel grade to D
12	24 h	6 days	No changes in Frankel grade
13	168 h	5 days	Improvement of Frankel grade to C
14	5 h	14 days	No changes in Frankel grade
15	8 h	5 h	No changes in Frankel grade

days for suspected COVID-19 cases and 4.56 days for the other cases ($p = 0.012$).

Two patients (13.3%) underwent minimal invasive surgery, while the others (86.7%) underwent open surgery. The surgery lasted for 3–6 h, with an average of 4.6 h (SD = 0.83). Postoperatively, 7 patients (46.7%) were admitted to the ICU. The average duration of ICU care was 2.14 days (range = 1–3; SD = 0.6). The average hospital stay duration was 13.3 days (range = 6–30 days, SD = 7.40). The time interval from admission to surgery has a significant positive correlation with duration of hospital stay (correlation coefficient: 0.785, $p = 0.001$).

The 3 months outcome post-surgery was described in Table 2. There was no significant effect of the time interval between the injury to surgery ($p = 0.532$), injury to admission ($p = 0.806$), as well as admission to surgery ($p = 0.610$) on the improvement of Frankel grade.

4. Discussion

To date, the situation of COVID-19 pandemics in Indonesia was continuously getting worse. The active cases were continuing to increase and on 6th January 2021, there were 237 deaths of medical doctors, four of them were orthopedic surgeons [10,11].

The deaths of the healthcare professional caused by COVID-19 is extremely undesirable, as the number of health professionals in Indonesia was still minimal. The number of medical doctors in Indonesia was the lowest two in Southeast Asia, which was 4 doctors per 10.000 people [12]. The number of medical specialists was also insufficient. By 2019, there were only 1.150 orthopedic surgeons for more than 250 million people [13].

To prevent the death of the healthcare professionals, best effort should be made to ensure their safety and protect them from being infected by COVID-19. There were some strategies implemented in our hospital for this purpose: 1) reduce the number of medical procedure/surgeries; 2) prioritize the cases which can be treated with minimal invasive surgery and cases with short duration of hospital stay; 3) the senior staffs were made unavailable for direct medical management (they only available for consultation via telemedicine); 4) make sure the COVID-19 status in the patient before they underwent surgery (Fig. 1). The latter was also due to the unavailability of our hospital in surgery for patients with COVID-19 infection.

These strategies had influenced the performance of spinal surgery in our hospital. Our hospital has two spine surgeons, one of them is a senior. Before the pandemic, we used to perform about five spine surgery per week. During the pandemic, the spine surgery was reduced to three per week, maximally. The reason for this was to avoid overworking for the spine surgeon, as only one spine surgeon available for surgery during the pandemic. Because the number of surgeries was extremely limited, we put the emergent or urgent cases as our priority to receive surgery and postpone the elective surgery. We proceed to perform the elective surgery only when there were no emergent or urgent cases to work on.

Emergent spinal surgery was supposedly being executed without delay [14]. Previous studies demonstrated favorable neurological outcomes in patients who underwent early (<24 h) and ultra-early surgery

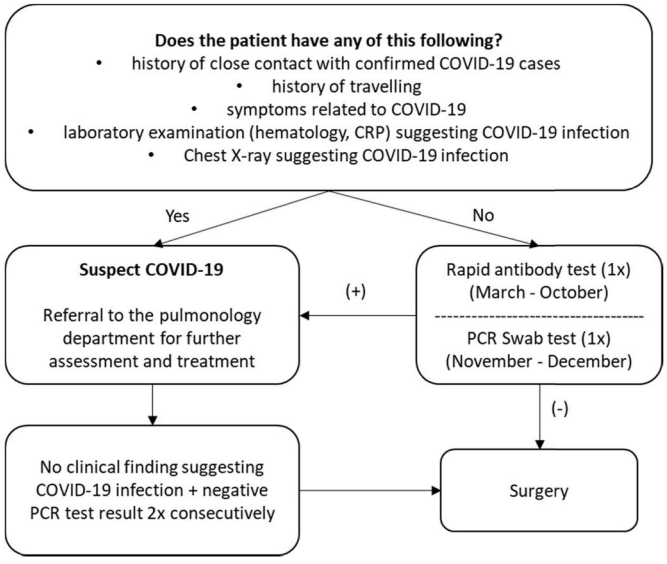

Fig. 1. Our protocol for evaluating COVID-19 infection in a patient who was going to have surgery.

(<8-h) for their acute traumatic spinal cord injury [8,15,16]. Early surgical decompression has the potential to reduce surgical blood loss, decrease the length of stay in the ICU, and reduce the risk of secondary complications after traumatic SCI During the pandemic, reduce the time interval between admission and surgery will decrease the duration of hospital stay, lessen the risk of COVID-19 transmission, and minimizing the utilization of medical resource [17].

In our situation, an early surgical procedure which less than 24 h from injury was difficult to achieve. The time interval between injury and admission itself was more than 24 h, on average. After the patients have been admitted to the hospital, a significant delay to surgery was mainly due to the hospital protocol policy to ensure the patients' COVID-19 status before surgery. Because of the limited resource of PCR test facilities in our region, it might take up to 3 days to get the PCR test result. Therefore, the patient with suspected COVID-19 infection had significantly greater time intervals because they should have PCR negative results two times consecutively. This was the main reason for the surgery delay of more than a week from admission. The other reason for the long delay of more than a week was the patients' accompanying medical conditions that need to be treated before the surgery.

Surgeries within 24 h from admission were possible in the period when PCR test is not mandatory for surgery (from March to October) and when the PCR test laboratory could process the sample quickly. The delay up to 7 days from admission was mainly because some spine surgery equipment could not immediately available: we should order the equipment first and wait for days until it is ready. The other causes were the unavailability to conduct the spine surgery during the weekend and prolonged time to get the PCR test results.

Despite almost all surgery was performed after more than 24 h post-injury, a large proportion of our patients experienced an improvement in the Frankel grade within 3 months post-operatively. Besides, there was no patient who had worsening Frankel grade. Two patients who died after surgery were all having another serious medical condition. Therefore, from our experience, emergent spine surgery performed later than 24 h may still beneficial.

We could not demonstrate the more satisfactory outcome of early surgery because we only had one patient who underwent surgery in less than 24 h from injury. A study by Vaccaro (1997) found no significant difference in neurological outcome between cervical spinal cord decompression after a trauma that is performed less than 72 h after injury and performed longer than 5 days [18]. It is possible that significant neurological benefit can be achieved when the surgery is performed in less than 24 h, but after that, the outcome will not be significantly different.

In our study, all the cases of spine emergency were caused by trauma. Fall from height and traffic accidents were responsible for nearly all the cases. Although the number of trauma cases was reduced during the pandemic, Park et al. (2020) reported an increase in the proportion of falls from height, possibly because people did more activities to renovate their home or do-it-yourself tasks. Also, fewer motor vehicles in the street might cause people to increase the speed and subsequently cause severe injury if they collide [19]. Therefore, to prevent such injuries, people should be more educated to increase safety when working at heights as well as when driving/riding a motor vehicle.

This study has several limitations. The included patient was limited, the follow-up duration was still minimal, and we do not have a control group for comparison. Further research should be conducted to assess the outcome of the patients after a longer period, with more samples and a control group. However, we believe our paper will benefit to provide information that can be used as a foundation for developing policy or strategies in similar upcoming situations.

5. Conclusion

In response to the COVID-19 pandemic, some strategies had been developed to increase the safety of healthcare providers and patients. To our experience, the lack of human and material resources caused some delay in surgery. Nevertheless, surgery performed later than 24 h during the COVID-19 pandemic may still beneficial. In the suboptimal situation for conducting emergent spine surgery, a greater effort should be made to prevent the cases: prevent the trauma particularly fall from height and traffic accident.

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Ethical approval

The informed consent form was declared that patient data or samples will be used for educational or research purposes.

Consent

Written informed consent was obtained from the patient for publication of this case series and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Yudha Mathan Sakti and Rosyad Nurkhadafi conceived the study, drafted the manuscript and critically revised, and facilitated all project-related tasks.

Registration of research studies

This study has been registered at Universitas Gadjah Mada Research Repository with registered ID 202104023.

Guarantor

Yudha Mathan Sakti.

Declaration of competing interest

No potential conflict of interest relevant to this article was reported.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2021.102513.

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