

Incidence and Clinical Features of Postoperative Symptomatic Hematoma after Spine Surgery: A Multicenter Study of 45 Patients

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Abstract:

Introduction: Symptomatic postoperative hematoma after spine surgery is a rare but serious complication. The objective of this study was to investigate the incidence and clinical features of symptomatic postoperative hematoma after spine surgery.

Methods: We retrospectively identified 10,680 patients who underwent spine surgery between 2002 and 2012 in nine hospitals. We reviewed the incidence of postoperative hematoma and its clinical features, including time before onset, main symptoms, and neurological outcomes.

Results: The overall incidence of symptomatic postoperative hematoma after spine surgery was 0.4% (45/10,680). Postoperative hematoma was more frequent after thoracic spine surgery than after cervical or lumbar surgery. The onset of postoperative hematoma occurred at an average of 2.6 days (range 0-14 days) postoperatively. The chief symptoms caused by postoperative hematoma after spine surgery were tetra/paraplegia in 30 patients, hemiplegia in eight patients, intractable pain in five patients, and airway dysfunction in two patients. Surgical evacuation of the spinal epidural hematoma resulted in improvement of at least one grade in 35 patients, while four patients had complete motor paralysis even after evacuation surgery.

Conclusions: We report the clinical details of 45 patients with postoperative hematoma after spine surgery. This information could assist surgeons to make a prompt diagnosis and perform early evacuation surgery for postoperative hematoma following spine surgery.

Keywords:

spinal hematoma, incidence, complication, neurological outcome

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Introduction

Postoperative hematoma is one of the most serious complications after spinal surgery. Symptomatic postoperative hematoma requiring evacuation is relatively rare, occurring in 0.2-1.5% of cases¹⁻⁴⁾, but can lead to permanent disability.

Therefore, it must be detected and surgical decompression performed as soon as possible to optimize the patient's neurologic recovery^{1,3)}.

Postoperative hematoma after spine surgery can cause symptoms, including respiratory dysfunction, paralysis, neurogenic pain, and bladder and bowel dysfunction⁴⁻⁶⁾.

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Table 1. Number and Types of Surgeries and Incidences of Postoperative Hematoma.

Surgery	Number of Surgeries	Number of postoperative hematoma (%)	95% CI
Total	10680	45 (0.4)	0.3-0.6
Cervical	3034	16 (0.5)	0.3-0.9
Laminoplasty/laminectomy	1505	10 (0.7)	0.3-1.2
Posterior decompression and fusion	445	2 (0.4)	0.1-1.6
Anterior decompression and fusion	1016	4 (0.4)	0.1-1.0
Other	68	0 (0)	
Thoracic	880	9 (1.0) *	0.5-1.9
Posterior decompression	296	3 (1.0)	0.2-2.9
Posterior decompression and fusion	507	6 (1.2)	0.4-2.6
Other	77	0 (0)	
Lumbar	6766	20 (0.3)	0.2-0.5
Posterior decompression	2855	13 (0.5)	0.2-0.8
Posterior decompression and fusion	3811	7 (0.2)	0.1-0.4
Other	100	0 (0)	

* p=0.004.

Symptomatic postoperative hematoma usually occurs within several days after surgery, but cases of delayed onset occurring days to weeks after surgery have been reported^{6,7}. Although rapid detection and evacuation of the hematoma should be performed for optimal neurological recovery, the symptoms and onset of postoperative hematoma varies so much such that it is occasionally difficult to detect. We believed that a review of symptomatic postoperative hematoma cases could help surgeons make timely diagnosis of this serious complication. However, there are few reports of large case series of symptomatic postoperative hematoma following spine surgery, possibly because the incidence is extremely low. The present multicenter retrospective study is aimed at examining the incidence, clinical features, and postoperative neurological outcomes of symptomatic postoperative hematoma.

Materials and Methods

This study was approved by the ethics review boards of all nine participating institutions. Using the surgical database and medical records maintained by the nine participating institutions, we retrospectively reviewed those patients who underwent spine surgery between 2002 and 2012. However, patients who underwent surgery involving percutaneous procedures, including balloon kyphoplasty, percutaneous biopsy, and Halo-vest fixation, were excluded. Overall, 10,680 patients (3,034 cervical, 880 thoracic, and 6,766 lumbosacral surgery) were enrolled in the study. The collected demographic data included sex, age, diagnosis, and medical comorbidities. Treatment-related data were also collected, including surgical level, type of surgery, and placement of an epidural drain. The inclusion criteria for symptomatic postoperative hematoma after spine surgery were: (1.) confirmation of postoperative hematoma causing new-onset symptoms including neurological deficits, intractable pain, or respiratory distress after spine surgery by physical examination

and/or imaging studies including magnetic resonance imaging (MRI); and (2.) performance of evacuation surgery to resolve symptomatic postoperative hematoma. We reviewed the duration from initial surgery to onset and evacuation of postoperative hematoma, the patients' symptoms, and whether these improved after evacuation surgery. Neurological function was measured using the Frankel grade⁸.

Statistical analyses were performed to assess the rates of symptomatic postoperative hematoma in each location and to compare early and delayed onset. The Mann-Whitney *U* test was used for continuous variables and Fisher's exact test and Pearson's chi-squared test were applied to categorical variables. A p-value of < 0.05 was regarded as significant.

Results

We identified 45 patients (0.4%) who required reoperation because of symptomatic postoperative hematoma after spine surgery. Their mean age was 68.6 years (range, 23-82 years) and they included 29 men and 16 women. Eight patients were taking anticoagulation therapy for their comorbidities and one patient had received hemodialysis. In these cases, the patients were administered intravenous heparin rather than oral anticoagulants before surgery and administration was stopped 6-8 hours before surgery. Table 1 shows the incidence of postoperative hematoma for each surgical level and procedure. Postoperative hematoma occurred more frequently after thoracic surgeries (1.0%) than after cervical (0.5%) or lumbar (0.3%) surgeries (p = 0.004). Although there was no significant difference in terms of surgical procedures, thoracic posterior decompression and fusion surgery was most likely to cause symptomatic postoperative hematoma (1.2%). Postoperative closed suction drains were used for all patients and were removed 24-48 hours after surgery. We confirmed that the positions of the drains were optimal on postoperative X-rays. Symptomatic postoperative hematoma occurred before the removal of drains in 25 of 45 pa-

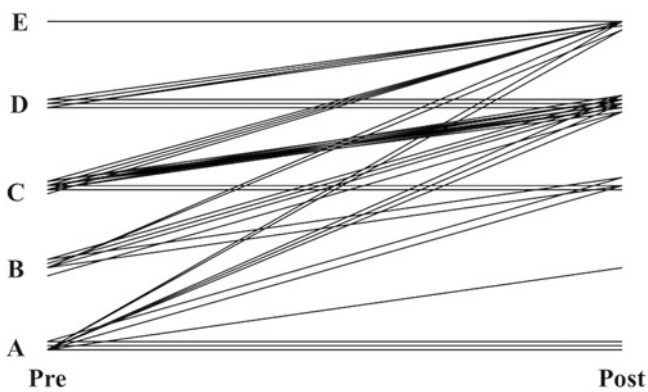


Figure 1. Course of clinical improvement for the 43 patients presented with neurological disability, of which 35 (81%) recovered by at least one grade.

tients (56%). The main symptoms of postoperative hematoma were paralysis in 38 patients, intractable pain in five patients, and respiratory distress in two patients. Both patients with airway dysfunction (0.2%, 2/1016 cases) initially underwent anterior cervical surgery and recovered after emergency evacuation surgery. In 12 of 43 patients with neurological symptoms, postoperative hematoma resulted in neurological deficits on one side of the body. MRI showed hematoma at the same side of the epidural space as symptoms in the patients with unilateral neurological deficits. Except for the two patients with respiratory distress, postoperative hematoma caused Grade A deficits in 11 patients, Grade B in eight patients, Grade C in 16 patients, Grade D in seven patients, and Grade E in one patient. The patient with Grade E had only upper extremity paralysis. In all patients, we confirmed that there were no neurological deteriorations immediately after the first surgery.

The mean time of onset of postoperative hematoma was 2.6 days (range, 0-14 days) after the initial surgery. Delayed onset of postoperative hematoma (postoperative day 4 or later) was observed in 10 patients (22%). In all but one patient, we performed emergency evacuation surgeries when postoperative hematoma led to the development of neurological deficits. In this singular case, evacuation surgery was performed 12 days after the onset of paralysis because of a late diagnosis. After evacuation surgery, 35 of 43 patients (81%) showed neurological improvement by at least one grade, but four patients (9.3%) had complete motor paralysis even after evacuation surgery (Fig. 1).

Discussion

Our multicenter retrospective study demonstrated the overall incidence of postoperative hematoma after spine surgery and analyzed the clinical symptoms and neurological prognosis of 45 patients. To the best of our knowledge, this is the largest reported study of patients with symptomatic postoperative hematoma. The incidence of symptomatic postoperative hematoma (0.4%) in our study was almost the same as that reported in other studies¹⁻⁴, and identified simi-

lar regional differences in its occurrence i.e., symptomatic postoperative hematoma occurred more often at the thoracic level (1.0%) than at the cervical (0.5%) or lumbosacral (0.3%) levels^{1,2}. The reason why symptomatic postoperative hematoma most easily develops in the thoracic spine is believed to be associated with spinal kyphotic alignment^{1,9} and poor blood supply¹. Kyphotic alignment leads to a narrowing of the space between the paravertebral muscle and the spinal cord so that a postoperative hematoma can easily compress the spinal cord and induce neurological symptoms⁹. The thoracic spinal cord was also reported to have a lower blood flow than that at the cervical and lumbosacral levels¹⁰. Because of this ischemic environment, hematoma in the thoracic spine is more likely to result in neurological deficits^{1,10}.

The preventive efficacy of suction drain placement against postoperative hematoma remains controversial. Although a randomized study using magnetic resonance imaging showed that insertion of a drain decreased the size of the hematoma¹¹, a retrospective comparative study found that the use of a suction drain did not influence the development of postoperative hematoma¹². In our study, 25 patients with postoperative hematoma were presented for removal of their drains. It remains unclear whether a suction drain should be inserted, because postoperative hematoma could occur even when the suction drain is working well.

Several reports have described delayed postoperative hematoma that developed more than three days after initial surgery^{2,6,7,13}. Uribe et al. first reported seven cases of delayed postoperative hematoma with an incidence of 0.17% and a mean onset time of 5.7 days postsurgery⁷. Sokolowski et al. reported one case of delayed onset that occurred 20 days after the initial surgery⁶. In the current study, there were 10 cases (0.1%) of delayed postoperative hematoma with an average onset of 8.4 days (range, 5-14 days) after the index surgery, which is comparable to the results obtained in previous studies^{2,6,7,13}. Little evidence is available with regard to the risk factors for delayed postoperative hematoma after spine surgery. Studies have hypothesized that age, multilevel procedures and scarring caused by previous spine surgery, anticoagulant therapy and increase in physical activity are associated with delayed postoperative hematoma^{6,7,13,14}. However, in our study, there was no significant difference between early and late postoperative hematoma cases with respect to age, anticoagulant therapy, or surgery location (Table 2). Furthermore, none of the patients in our study who developed delayed hematoma had undergone previous spine surgery at the same site, and one patient developed delayed postoperative hematoma while straining to defecate¹³. Ntourantonis et al. reported that potential hypertension could induce delayed postoperative bleeding¹⁵. Thus, temporary postoperative hypertension caused by an increase in activity may pose a risk for delayed postoperative hematoma. We should keep in mind that postoperative hematoma can develop up to several weeks after the original surgery.

Postoperative hematoma after spine surgery can induce di-

Table 2. Summary of Cases of Early and Delayed Onset Hematoma.

	Early	Delayed	P value
Total	35	10	
Onset (days)	0.9 (0-3)	8.4 (5-14)	<0.01
Age	68.4±10.8	69.3±8.0	0.99
Sex (M/F)	23/12	6/4	0.72
Anticoagulant therapy	6	3	0.39
Surgical location	C: 14, T: 6, L: 15	C: 2, T: 3, L: 5	0.37
Main symptoms	Paralysis: 31, pain: 2, Airway dysfunction: 2	Paralysis: 7, pain: 3	0.11

M=male; F=female; C=cervical; T=thoracic; L=lumbar

Table 3. A Summary of Postoperative Hematoma Patients with Unilateral Symptoms.

Age	Sex	Surgical Level	Initial surgical procedure	Onset of postoperative hematoma (days)	Date of evacuation surgery (days)	Pain	Paralysis	
							Pre	Post
76	M	C	ACDF	0	0	+	B	D
64	M	L	PSF	0	0	+	B	E
75	M	L	PSF	1	13	+	C	D
73	M	C	CLP	0	0	-	B	D
71	F	L	LAMI	3	7	+	D	E
62	F	T	PSF	12	12	-	C	D
76	M	L	LAMI	14	19	+	D	E
72	F	L	LAMI	7	7	+	C	D
70	F	T	LAMI	6	6	+	C	D
62	F	L	LAMI	1	1	+	C	E
55	M	L	DISC	0	0	+	C	E
23	M	L	DISC	0	0	+	D	E

M=male; F=female; C=cervical; T=thoracic; L=lumbar; ACDF=anterior cervical discectomy and fusion; PSF=posterior spinal fusion; CLP=cervical laminoplasty; LAMI=laminectomy; DISC=discectomy

verse symptoms including tetraplegia or paraplegia, hemiplegia, bladder and bowel dysfunction, intractable pain, and respiratory distress. Patients with cervical and thoracic postoperative hematoma are likely to develop tetra/paraplegia, whereas those with lumbar postoperative hematoma experience a decrease in muscle power, intolerable pain, and bladder and bowel dysfunction^{3,4)}. Regardless of the location of postoperative hematoma, the symptoms are usually bilateral, although in our study 12 patients experienced unilateral neurological deficits (Table 3). Cases of patients with lumbar postoperative hematoma who developed unilateral neurological symptoms have been reported^{6,16)}. In patients with cervical and thoracic postoperative hematoma, hemiplegia is rare. Some cases of spontaneous cervical spinal epidural hematoma coexisting with hemiparesis have been reported^{17,18)}. Therefore, it is important that physicians consider the possibility of postoperative hematoma even if patients exhibit unilateral neurological symptoms.

Several limitations of this study should be acknowledged. First, we evaluated only the 45 patients who underwent evacuation surgery, so we had no data for patients with symptomatic postoperative hematoma who did not have surgery. Second, there was no precise definition of postoperative hematoma after spine surgery. Third, because this was a

multicenter study, the decision about whether to perform evacuation surgery depended on the individual surgeon. Fourth, detailed population demographics and surgical information including comorbidities, medication, and postoperative bleeding volume are lacking. A well-designed multicenter prospective study should be conducted to investigate these factors in the future. Despite these limitations, this study included the largest case series of patients with symptomatic postoperative hematoma after spine surgery reported to date. Data collected in this study will provide doctors with useful information about postoperative hematoma after spine surgery.

Conclusion

This large multicenter study demonstrated the incidence, onset, clinical symptoms, and outcome of symptomatic postoperative hematoma. The time of onset and symptoms were so varied so surgeons should always consider the possibility of postoperative hematoma when a patient with a neurological deficit after spine surgery presented.

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

Author Contributions: Soichiro Masuda wrote and prepared the manuscript, and all of the authors participated in the study design. All authors have read, reviewed, and approved the article.

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