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Original article

Treatment of hematomas after anterior cervical spine surgery: A retrospective study of 15 cases

Weiliang. Miao [a], Xiaojun. Ma [b,*], Deyong. Liang [c], Yu. Sun [c]

[a] Department of Orthopedics, Shanghai ZhongYe Hospital, Shanghai, Republic of China
[b] Department of Orthopedics, Shanghai General Hospital, School of Medicine, Shanghai Jiao Tong University, 200080 Shanghai, Republic of China
[c] Department of Orthopedics, The First Affiliated Hospital of China Medical University,Shenyang,Republic of China

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ABSTRACT

Objective. – Postoperative hematoma is a rare and dangerous complication of cervical spine surgery. The aim of this study was to investigate the incidence and related factors of postoperative hematoma, and to report on 15 cases at our institution over a 6-year period.
Methods. – Fifteen cases of postoperative hematoma were retrospectively identified. We investigated their neurological outcomes, characteristics, and surgical data, and identified risk factors associated with postoperative (PO) hematoma. Patients with hematoma were compared to those with no hematoma, in order to identify risk factors.
Results. – Retropharyngeal hematomas developed in seven cases and epidural hematomas in eight. The total incidence of postoperative hematoma was 1.2%: 0.5% retropharyngeal hematomas and 0.6% spinal epidural hematomas. At time of onset, the severity of paralysis was assessed as grade B in one case, grade C in six cases, and grade D in eight cases. Risk factors for PO hematoma were: (1) presence of ossification of the posterior longitudinal ligament (OPLL) ($P < 0.001$); (2) longer operative duration ($P = 0.048$); (3) greater number of surgical levels ($P = 0.02$); and (4) higher body mass index (BMI; $P = 0.035$). There was no significant difference in modified Japan Orthopedic Association scores between the hematoma group and non-hematoma group ($P > 0.05$).
Conclusion. – Precise preoperative preparation and systematic evaluation are central to successful management of PO hematoma after anterior cervical surgery. Risk factors for PO hematoma include multilevel decompression, OPLL, higher BMI, and longer operation time.

1. Introduction

Anterior cervical spine surgery has long been widely performed by orthopedic and neurological surgeons. The clinical outcome is good in the majority of cases. Nevertheless, many complications can occur [1]. Among these complications, hematoma followed by dyspnea and paralysis is the most concerning. These hematomas can be classified into two types: spinal epidural hematoma (SEH) and retropharyngeal hematoma (RH). Postoperative (PO) hematomas are thought to be multifactorial and may be caused by hypertension, increased venous pressure, coagulopathy, surgical invasiveness, and other possible correlative etiologies [2,3].

The initial characterization of SEH is commonly credited to Jackson (1869) [4], and it was first treated surgically by Bain (1897) [5]. SEH can be severe enough to induce neurological deficits, with a reported incidence ranging from 0.1% to 0.8% [6]. Other serious adverse events, including RH development, are associated with cervical spine surgery. RH can result in dyspnea and is reported to occur in 0.2–1.9% of cervical spine surgery patients [7]. The etiology of the hematoma is routinely classified as postoperative, traumatic, or spontaneous. In this study, we discuss only cases of postoperative hematoma.

Due to the low incidence of these complications, there is no universal consensus on evaluation, treatment, or preventative approaches. The most appropriate treatment is to evacuate the hematoma, but caution is advisable as PO hematoma located in the upper cervical spine has a high mortality and paralysis rate as compared with lumbar and thoracic hematomas [8]. Few studies have focused on PO hematoma from a cervical spine surgery perspective; therefore, whether to pursue conservative or surgical treatment is

* Corresponding author.
E-mail address: drmiaoweiliang0920@163.com (Xiaojun. Ma).

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Table 1
Characteristics of patients who developed postoperative hematomas.

Patient No.	Age (years)	Sex	Symptoms at onset	Surgical level	Surgical procedures
1	46	M	Dyspnea	C4–C6	ACCF
2	55	M	Tetraplegia	C4–C6	ACCF
3	69	M	Dyspnea	C3–C6	ACCF
4	61	M	Dyspnea	C3–C5	ACCF
5	40	M	Dyspnea	C3–C6	ACDF
6	70	F	Dyspnea	C3–C5	ACCF
7	55	M	Paraplegia	C4–C7	ACCF
8	71	F	Paraplegia	C4–C7	ACCF
9	44	M	Dyspnea	C2–C4	ACDF
10	57	M	Tetraplegia and dyspnea	C3–C5	ACCF
11	60	M	Paraplegia	C3–C6	ACCF
12	69	M	Tetraplegia	C3–C6	ACCF
13	54	M	Paraplegia	C5–C7	ACDF
14	44	M	Dyspnea	C5–C7	ACCF
15	55	F	Dyspnea and upper limbs Weakness	C4–C6	ACCF

M: male; F: female; ACDF: anterior cervical discectomy and fusion; ACCF: anterior cervical corpectomy and fusion.

difficult to decide. Thus, the purpose of this study is to retrospectively assess the clinical results of treatment, share our experience in case management, and identify risk factors for its occurrence. We also have attempted to search for some possible preventative strategies and to formulate treatment guidelines.

2. Materials and methods

We reviewed the quality-assurance records for patients who underwent anterior cervical spine surgery over a 6-year period at our institutions, from 2006 to 2012. Clinical information was recorded by spine surgeons following surgery, and was collected by the authors. Patients with traumatic or spontaneous hematomas, those who were younger than 18 years of age, and/or those who were treated with a posterior or anterior-posterior surgical approach were excluded. The remaining 15 patients were retrospectively identified using medical data, including previous medical history, physical and neurological examinations, and radiology results.

All selected patients' hematomas were diagnosed based on magnetic resonance imaging (MRI). We used a series of preoperative and intraoperative data to identify the related risk factors. The preoperative factors included blood tests and a history of anticoagulant use, as well as the intraoperative cases which included blood loss, vessel damage, and operative duration; these were all identified in the operative records. Patients who developed a hematoma were compared with those who did not, to identify any risk factors.

Patient's neurological deficits were classified using the American Spinal Injury Association (ASIA) scale grading and the modified Japanese Orthopedics Association (mJOA) scores. Neurological recovery conditions were based on the longest follow-up duration through telephone contact or outpatient visits.

Data were reported as the mean ± standard deviation (SD) when normally distributed or as the median when non-normally distributed. Differences were assessed using the Student's *t*-test for normally distributed continuous data or the Mann-Whitney U-test for non-normally distributed continuous data. $P < 0.05$ was considered statistically significant. Statistical analyses were performed using SPSS version 17.0 statistical software (SPSS, Inc., Chicago, IL).

3. Results

A total of 1258 patients underwent anterior cervical spine surgery during the study period. From these, 15 hematoma cases were reviewed. A retropharyngeal hematoma developed in seven cases, and an epidural hematoma in eight. The total incidence of postoperative hematoma was 1.2%; 0.5% were RH and 0.6% were SEH. Each patient had a drain placed in the prevertebral space prior to wound closure that was maintained for at least the first 24 hours. No patients were identified who received anticoagulant therapy or had signs of infection according to laboratory data.

Characteristics of the cases are presented in Table 1. The mean follow-up time was 15.8 ± 5.4 months (range: 12–40 months). Patients had an average age of 56.7 ± 10.2 years (range: 40–71 years). The hematoma evacuation was performed in 80% of patients (12/15). Two patients needed intubation to secure their airway. However, there was a failure in one patient, who had to undergo emergent cricothyrotomy due to a laryngeal edema. Then, the hematoma evacuation was performed immediately. The vascular and muscular bleeding sources of hematoma were identified in seven cases (58%).

The hematoma occurred from 1 hour to 90 hours post-procedure (median 5 hours). The average operative interval (OPI, the time interval between diagnosis and hematoma evacuation) was 101.8 ± 69.5 minutes (range: 55–300 minutes). The majority of cases had some evident recovery at the time of last follow-up, with the exception of one patient who died of cardiovascular disease after discharge. We performed the evacuations within 24 hours of the onset of compression signs and symptoms in 11 cases, and among them, seven cases were decompressed within 6 hours. However, only one patient exhibited symptoms at 90 hours after the initial surgery. Postoperative MRI was performed in all patients. They all had a diagnosis of postoperative hematoma. Detailed information is shown in Table 2.

At the time of onset, the severity of the paralysis was assessed as grade B in one case, grade C in six cases, and grade D in eight cases. However, three patients were treated conservatively and three patients required evacuation twice, two of whom suffered from residual symptoms. In all patients, the recovery scale was improved after the procedures. There was no significant difference in mJOA scores between the hematoma and non-hematoma groups ($P > 0.05$). The average initial mJOA score of the hematoma group was 10.9 ± 2.5 (range: 6–14); however, the mean follow-up mJOA score increased to 15.0 ± 0.8 (range: 14–16). The mJOA recovery scale ranged from 40% to 85.7%. We found that the last follow-up mJOA scores were significantly higher than the initial scores ($P < 0.001$). Treatment and diagnosis data are presented in Table 2. A comparison of the two groups indicated that

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