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## Original Article

### Symptomatic Thromboembolism as an Uncommon Postoperative Complication in Young Patients with Spinal Deformity



### 年輕脊柱畸形的患者在術後出現有症狀的血栓栓塞是罕見的併發症

Omidi-Kashani Farzad\*, Hasani Mohammad, Moradi Ali, Rahimi Mohammad Dawood

Orthopedic and Trauma Research Center, Imam Reza Hospital, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

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#### ABSTRACT

**Background/Purpose:** Thromboembolism continues to be one of the most appalling postoperative complications. We aim to extend the findings of earlier authors on clinically symptomatic thromboembolic complications in young patients (<30 years old) operated due to major spinal deformity.

**Methods:** We retrospectively studied 297 patients (98 males and 199 females), with a mean age of  $17.8 \pm 4.2$  years (range, 1.8–29.8 years) and a mean follow-up period of  $12.3 \pm 5.9$  months (range, 6–84 months), who had been operated due to major spinal deformity from August 2005 to December 2012. A complete clinical examination was performed in all patients throughout the postoperative period to find out any symptomatic thromboembolism.

**Results:** We found three (1.01%) and two (0.67%) cases with symptomatic thromboembolism and extensive pulmonary embolism, respectively. All of them had a positive history of anterior spine surgery, and one of them had been placed in a poor posture for a long time to improve the inflammation of a surgical wound.

**Conclusion:** Despite the rarity of thromboembolism after surgery for major spinal deformities in young patients, the possibility still exists, and patients with a positive history of anterior spinal surgery or poor posturing are probably more susceptible.

#### 中文摘要

**背景/目的:** 血栓栓塞繼續最可惡的術後並發症之一。我們的目標是延伸作者早期對年輕 (< 30 歲) 脊柱矯正手術患者術後出現有臨床症狀的血栓栓塞併發症的研究成果。

**方法:** 回顧性分析從 2005 年 8 月至 2012 年 12 月當中, 297 個脊柱矯正手術患者 (98 男, 199 女) 平均年齡為  $17.8 \pm 4.2$  (範圍, 1.8–29.8 歲), 隨訪時間為  $12.3 \pm 5.9$  個月 (範圍; 6–84 個月)。所有患者接受全面的臨床檢查來檢視有否任何血栓栓塞的症狀。

**結果:** 我們發現三個 (1.01%) 有症狀的血栓栓塞病例和二個 (0.67%) 廣泛的肺栓塞病例。他們都接受脊柱前路手術, 其中一人曾經被放置在一個不正常的姿勢有很長一段時間, 以改善手術傷口的炎症。

**結論:** 儘管脊柱矯正手術後血栓栓塞在年輕患者是罕見的, 但風險仍然存在, 尤其是那些接受脊柱前路手術或術後姿態不佳的病人, 可能更容易受到影響。

## Introduction

A substantial and increasing body of research data emphasises that thromboembolism (TE) tends to be one of the most appalling complications after any kind of surgery.<sup>1</sup> There is no direct correlation between the occurrence of TE and the degree of surgical

dissection, and surprisingly, the prevalence of TE after spinal abnormality surgery is much less than that after hip or knee surgery.<sup>2–4</sup>

In spite of the fact that the exact explanation for this inconsistency is not distinct, a number of susceptible considerations exist. These predisposition factors comprise major operations, particularly those related to: lower extremities; muscular weakness that chiefly accompanies spinal cord injury; a history of previous TE; female patients; obesity; presence of underlying malignancy;

\* Corresponding author. E-mail: [omidif@mums.ac.ir](mailto:omidif@mums.ac.ir).

cardiac or respiratory failure; manipulation of the great vessels in anterior spinal surgeries; postponement of postoperative remobilisation of patients; existence of central venous lines; prolonged surgery; and inappropriate positioning of patients in intra- or postoperative settings (for example, the presence of pressure points at the groin area).<sup>5–7</sup>

The incidence of postoperative deep vein thrombosis (DVT) and pulmonary embolism (PE) in spine surgery patients has been reported to be 0.3–10% and 0–0.8%, respectively.<sup>8</sup> Low incidence of thromboembolic events in spine surgeries, repeated reports of postoperative epidural hematoma, and continuous discharge from the surgical lesions in the patients receiving anti-clotting agents compelled some spinal surgeons to abstain prescribing anticoagulant medications in postoperative period and execute mechanical measures instead. Although, here we mentioned these alarming side effects for anticoagulant agents, the majority of involved patients cohabit asymptotically with the disease. In this study, we sought to extend the findings of earlier authors on clinically symptomatic thromboembolic complications in young patients operated due to major spinal deformity.

## Materials and methods

Following the local institutional review board approval, a retrospective review of hospital records was performed. We studied patients younger than 30 years who had been admitted to our orthopaedic department and underwent surgery due to spinal deformity from August 2005 to December 2012. Throughout these years, after the patients signed the informed consent, all the spinal surgeries were carried out by the first author (F.O.K.). Patients younger than 30 years with major spinal deformities (such as scoliosis and kyphosis with various aetiologies) who had undergone primary and revision surgeries were included in our study. We excluded those cases with less than 6 months of follow-up.

No postoperative anticoagulant agents were prescribed for this group of patients. Mechanical measures such as lower extremity elastic bandage were also used rarely. We did not perform postoperative screening with Doppler ultrasonography or ventilation/perfusion scan routinely, but the patients underwent complete clinical examination throughout this postoperative period. Furthermore, at the slight suspicion of any thromboembolic phenomena, diagnostic Doppler ultrasonography was requested immediately. Statistical analysis was used to compare the patients with thromboembolic sequels with other patients. Patients' sex and age, approach to surgery, location of the operated spine, and the number of involved vertebrae were analysed statistically. SPSS version 16 (SPSS Inc. Released 2007. SPSS for Windows, Chicago, USA) was hired for statistical analysis.

**Table 1**  
Distribution of the procedures performed in our patients

Aetiology	No. of patients	No. of surgeries	Anterior/posterior approach	Mean age, y (SD)	Male to female ratio
Scoliosis					
Idiopathic	182	263	81/182	17.3 (5.2)	0.16
Congenital	21	29	8/21	11.1 (3.5)	2
Neuromuscular	9	14	5/9	16.3 (3.2)	1.25
Syndromic	3	5	2/3	24.2 (3.6)	0.5
Kyphosis					
Scheuermann's	39	64	25/39	24.1 (4.2)	2.25
Congenital	16	24	8/16	16.9 (9.2)	1.67
Post-traumatic	12	16	4/12	22.8 (7.3)	5
Postlaminectomy	5	9	4/5	21.3 (2.8)	0.67
Implant removal	4	4	0/4	25.2 (3.6)	0.34
Revision surgery	3	3	0/3	23.5 (5.3)	0.5
Irrigation and debridement	3	5	0/5	23.6 (3.9)	2

SD = standard deviation; y = year.

## Results

In a nutshell, 436 major spinal deformity surgeries were performed in 297 patients (98 males and 199 females) with a mean age of  $17.8 \pm 4.2$  years (range, 1.8–29.8 years) and a mean follow-up period of  $12.3 \pm 5.9$  months (range, 6–84 months). Demographic data and distribution of the procedures performed in our patients, along with their underlying aetiologies, are illustrated in Table 1.

After reviewing the medical records of all these patients, we found three cases (incidence: 1.01%, 2 males and 1 female) with symptomatic TE, which are elucidated subsequently. All these cases had a history of anterior spine surgery in their medical records. Two of the three patients (0.67%) had extensive PE. Due to the small number of thromboembolic events that occurred in this study, statistical significance of these trends cannot be established.

### Case 1

A healthy 20-year-old man with backbone deformity was admitted to our clinic. After performing all clinical and paraclinical check-ups, he was diagnosed with adolescent idiopathic scoliosis. A two-stage (anterior and posterior) spinal fusion and instrumentation (with 1-week interval) were executed subsequently. The patient had a sudden cardiovascular attack 3 days after the second operation. He was resuscitated and he was placed on mechanical ventilation using an endotracheal tube. The patient died 5 days later. At autopsy examination, extensive PE was confirmed.

### Case 2

A 28-year-old female with trunk disfigurement was admitted to our centre. Following a complete preoperative evaluation, a two-stage anterior–posterior spinal fusion and instrumentation surgery were performed in order to treat her adolescent idiopathic scoliosis. Subsequent to her first-stage surgery, she experienced a sudden cardiac arrest. In paraclinical studies, extensive DVT of the right lower extremity and a huge PE were detected on duplex ultrasonography and pulmonary angiography. The patient was dismissed about 1 month after the first surgery. She did not want to be operated to complete the treatment.

### Case 3

A 17-year-old boy with left thoracic adolescent idiopathic scoliosis was referred to our hospital. We had planned a two-stage surgical treatment. After the completion of the first surgical stage, we assisted the patient to lie in the right lateral decubitus posture with the operated (left) side up to prevent pressure sore over the sharp rib hump

prominence. In that patient, the surgical interval between the first and second operations was 2 weeks, due to a superficial surgical wound infection. Two days after the second stage of the operation, his right leg swelled gradually. Although the patient had no respiratory complaints, extensive DVT in the proximal part of the right lower extremity was detected by duplex ultrasonography. Pulmonary angiography was not remarkable. The patient was treated with appropriate anticoagulant agents and consequently cured without any sequel.

## Discussion

In this retrospective study, the incidence of TE events was 1.01%, and all the involved patients had a history of anterior spine surgery. Although the number of cases in our study was small, it seems that some predisposing factors, such as a long-term interval between two stages (anterior and posterior approaches) of spinal surgery, poor positioning of the patients in the early stage of postoperative period, and delayed postoperative ambulation, may have important roles in developing TE.

A significant independent underlying factor may be the age of the patient.<sup>5</sup> Older patients undergoing major spine reconstructive surgical treatment are at substantial risk for PE.<sup>9</sup>

Cheng et al<sup>10</sup> in a systematic review studied the risk factors associated with TE events in patients with spine surgery. They evaluated 29 relevant articles and included all spine surgery patients (not only young patients who were less than 30 years old). They found that patients undergoing surgery to correct spinal deformity and trauma had a higher incidence of TE than those receiving surgery for degenerative diseases. The overall incidence of TE in patients undergoing surgery to correct spinal deformity was 5.3% in Cheng et al's<sup>10</sup> study, whereas the incidence was 1.01% in our study; the difference is probably due to the age limitation that was set in our study.

The reported incidence of PE after adult spinal deformity surgery (without thromboprophylactic drugs) is about 2.2%.<sup>11</sup> Pateder and coauthors,<sup>12</sup> in a retrospective study, determined the incidence and predisposing factors of PE in patients who received anticoagulant drugs after adult spinal deformity surgery. Similar to our study, a screening test was not performed routinely unless a clinical suspicion was raised. They studied 361 cases with 407 procedures and finally reported an incidence of 2.4%. They found that anterior spinal surgery and the right-side approach were associated with a significantly higher incidence of PE, and recommended thromboprophylaxis in these groups. In the study we conducted, there were two cases with PE (incidence: 0.67%); again, this difference in the incidence of PE in these two studies is probably due to the difference in the age range of the patients.

A number of factors such as surgical location, age of patients, and screening tools may play important roles in the incidence of TE complications.<sup>13</sup> Initially, we reviewed for a possible correlation between locality or extent of surgery and risk of endothelial injury in the literature.<sup>14,15</sup> Although this information was reminiscent of a relationship between the number of surgical vertebral levels and the risk of PE, with the small number of thromboembolic events that occurred in this study, statistical significance of these trends cannot be established.

Sequential compression boots can be used as DVT prophylaxis for posterior spinal fusion.<sup>16</sup> However, a higher prevalence of TE phenomena following combined anterior/posterior spine surgeries indicates the need for more efficient measures to prevent this potentially devastating complication.<sup>17</sup> Anterior spine surgery, especially at the lumbosacral area, necessitates substantial manipulation and retraction of the great vessels.<sup>11,18</sup> Therefore, it may augment the risk of DVT and subsequent PE.<sup>17</sup> Kim et al,<sup>19</sup> in a retrospective study on 119 patients, compared the efficacy of the combined anterior/posterior approach with that of the posterior-

only approach with respect to the development of PE. The reported incidences of PE in patients with combined surgeries and those with posterior-only approaches were 7.5% and 1.6%, respectively. In our study, all the involved cases with DVT or PE had a positive history of anterior spine surgery.

DVT is easily detectable by Doppler ultrasound, but PE may occur even in the absence of underlying DVT. Therefore, even in patients with no clinical or Doppler sign of DVT, the clinician should be highly suspicious.<sup>20</sup> In addition to the retrospective design of the study, another disadvantage of this project is the lack of routine application of screening tools to all the patients. Some patients might have existed with less severe clinical manifestations that we were not aware of. In conclusion, despite the fact that postoperative TE after surgery for major spinal deformities in young patients is a relatively rare complication, the possibility still exists, and patients with a positive history of anterior spinal surgery or poor posturing are probably more susceptible.

## Conflicts of interest

The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.

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