

Incidence of Symptomatic Pulmonary Embolism in Spinal Surgery

Chatupon Chotigavanichaya MD*,
Monchai Ruangchainikom MD*, Choompon Piyavanno MD*,
Ekkapoj Korwutthikulrangsri MD*, Sirichai Wilartratsami MD*,
Surin Thanapipatsiri MD*, Areesak Chotivichit MD*

* Department of Orthopaedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

Background: Pulmonary embolism (PE) is a serious condition in orthopedic surgery. The incidence of PE, which is a sequelae of VTE in spinal surgery, is quite low. In the limited available published data, incidence rates of PE in spinal surgery are comparable to that of hip or knee arthroplasty surgery. The role of pharmacologic thromboprophylaxis remains controversial in spinal surgery.

Objective: The present study was designed to evaluate the incidence of symptomatic pulmonary embolism in spinal surgery at a single tertiary care institute.

Material and Method: A retrospective study of the medical records of patients that were diagnosed with symptomatic pulmonary embolism in spinal surgery from 2002-2012. The reviewed data were retrieved from the database of the Faculty of Medicine Siriraj Hospital, Mahidol University in Bangkok, Thailand.

Results: Three cases of symptomatic pulmonary embolism were found from 9,184 spinal surgery cases. The incidence rate was 0.033%. There were two patients with lumbar spine surgery and one case with thoracolumbar surgery. All three cases had different underlying conditions, operations, and clinical course. One case of fatal pulmonary embolism was found in our study.

Conclusion: Although there is a very low incidence of symptomatic pulmonary embolism, this is a catastrophic condition for affected patients and their families. PE can occur in spinal surgery cases at all levels of severity and complexity, even with no apparent risk factors.

Keywords: Pulmonary embolism, Spinal surgery

J Med Assoc Thai 2014; 97 (Suppl. 9): S73-S77

Full text. e-Journal: <http://www.jmatonline.com>

Venous thromboembolic (VTE) disease is a common and serious complication in orthopedic surgery. VTE is usually evaluated as a major risk factor to improve the rate of morbidity and mortality in orthopaedic surgery, especially pulmonary embolism (PE), which is a severe clinical presentation of VTE.

From previous literature, a high incidence of VTE was reported mainly in major joint surgery, with some reports showing an incidence of VTE in up to 40% of total hip replacement and total knee replacement operations⁽¹⁾. According to Virchow's triad, which described the causes of VTE as venous stasis, endothelial injury, and hypercoagulability⁽²⁾, spine surgery also had risk factors from limited mobilization

in both the pre-operative and post-operative periods, which may increase the chance of venous stasis.

The incidence of VTE in spinal surgery has been reported at 2-15.5%⁽³⁻⁶⁾ and the incidence of PE in spinal surgery at 0.59-2.9%⁽⁶⁻⁹⁾. The researchers have postulated that a study to determine the incidence of PE, especially in cases with severe clinical presentation, may require a large study population in order to effectively evaluate and determine a highly accurate rate of incidence of symptomatic PE in the elective spine surgery patients.

Material and Method

After receiving institutional review board approval, medical records from the database of a single institution, Siriraj Hospital, were retrospectively reviewed to evaluate for symptomatic pulmonary embolism in patients who received spinal surgery from 1st January 2002-31st December 2012. Hospitalizations were selected according to ICD-9-CM procedural codes.

Correspondence to:

Chotigavanichaya C, Department of Orthopaedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.
Phone: 0-2419-7968-9
E-mail: chatupon.cho@mahidol.ac.th

Patients undergoing spinal canal decompression, without fusion (code 03.09), atlatoaxial fusion (code 81.01), anterior cervical fusion (code 81.02), posterior cervical fusion (code 81.03), anterior thoracic fusion (code 81.04), posterior thoracic fusion (code 81.05), anterior lumbar fusion (code 81.06), and posterior lumbar fusion (code 81.08), were identified. Pulmonary embolism, with or without mention of acute cor pulmonale, were identified by ICD-10 codes I26.0 and I26.9, respectively. The data of each patient who had symptomatic pulmonary embolism were analyzed to evaluate potential risk factors for symptomatic pulmonary embolism.

Results

Nine thousand one hundred and eighty-four patients were reviewed with the objective of separating out patients who were diagnosed with and documented as having symptomatic pulmonary embolism after spinal surgery.

There were three cases of pulmonary embolism from 9,184 cases of elective spinal surgery cases over the 11-year period of this study. Cervical spine patients were most often operated upon using an anterior approach. However, a posterior approach was most common for patients undergoing thoracic or lumbar spinal surgery (Table 1).

The incidence of symptomatic pulmonary embolism in the present study was 0.033% (3 in 9,184 cases). Data relating to symptomatic cases are described in Table 2. Two patients underwent lumbar spinal surgery and one underwent thoracolumbar spinal surgery. Two of the three cases involved degenerative spine diseases and one case involved chronic infection and spinal tuberculosis. The mean age was 67 (range 59-72 years). Two cases had hypertension and dyslipidemia as underlying diseases and the other had no underlying disease. All patients had normal BMI. All of the symptomatic cases received a posterior surgical approach. Two in three cases underwent decompression and instrumented fusion and the other underwent laminectomy alone. The mean operative time was 4.3 hours (range 2.5-5.5) and the mean intra-operative blood loss was 666.7cc (range 400-1,100). In

the final outcome, one patient died from pulmonary embolism; one patient developed severe hypoxemia, which required an emergency embolectomy; and the last of the three patients presented with mild complications that only improved with medication.

Discussion

The incidence of symptomatic pulmonary embolism in spinal surgery in the present study was low (0.033%); however, the mortality rate is very high. Lumbar spine surgery seems to have a higher incidence of symptomatic pulmonary embolism than cervical spine surgery⁽¹⁰⁾. The rate of symptomatic PE ranges from 0.59% to 2.4% of patients who undergo a spinal procedure⁽⁶⁻⁹⁾. Our data shows a lower incidence (0.033%) than the incidence rates described in other previous reports. The reasons may include population demographics and mongoloid race-related factors, with a low incidence of VTE as compared to Caucasian. The systematic review incidence of PE in Asian-Pacific Islanders was quite low as compared to Caucasians⁽¹¹⁾. Another reason for the low incidence of PE may be due to our approach in spinal surgery, which was mainly a posterior approach. From a previous report by Pateder et al of patients who received anterior surgery or combined anterior and posterior surgery, 3.6% had a higher risk for symptomatic PE than posterior surgery alone (0.65%)⁽⁸⁾.

The evidence of risk factors for pulmonary embolism are aged more than 60 years, BMI of more than 30 kg/m², genetic thrombophilia, and a history of venous thromboembolism⁽¹²⁾. However, the symptomatic PE patients in our study could presented without any risk factors for pulmonary embolism. All symptomatic pulmonary embolism patients had received lumbar or thoracolumbar spine surgery; no patients with a cervical spinal procedure presented with symptomatic PE. Instrumentation may increase the chance of severe clinical PE.

Although the incidence of symptomatic pulmonary embolism is low, the morbidity and mortality rates are very high. Mechanical prophylaxis should be performed in all cases for the prevention VTE, as there was a significant reduction in embolism with mechanical

Table 1. Location of surgery and type of approach

	Anterior approach	Posterior approach	Total
Cervical spine	755	273	1,028
Thoracic and lumbar spine	122	8,034	8,156

Table 2. Symptomatic pulmonary embolism patients

Patients	A	B	C
Diagnosis	Spinal stenosis L3-S1	Spinal stenosis L3-5 and OVCF L 1-2	Pulmonary tuberculosis and spinal tuberculosis T10-12
Age (years)	72	59	70
Underlying diseases	Hypertension and dyslipidimia	Hypertension , dyslipidimia unstable angina	none
BMI	23.85	22.5	20.3
Operation	Laminectomy + foraminotomy L3-S1	Laminectomy , posterolateral fusion with posterior instrumentation L3-5 and vertebroplasty L2	Costotransversectomy T10-12 and posterior instrumentation T9-L1
Operative time(hrs)	2.5 hrs	5.5 hrs	5 hrs
EBL (ml)	400	600	1000
Diagnosis of PE	-Hypoxemia -D-dimer - 2450 -Pulmonary CTA and CT venogram: multiple acute PE no DVT	-Hypoxemia and hypotension -D-dimer - 2400 -Echo and pulmonary CTA : clot in right atrium, right ventricle and pulmonary artery	-Hypoxia and hypotension -Cardiac arrest -Post-mortem found clot at main pulmonary artery
Date of symptomatic PE	Post-operative day 5	Post-operative day 1	Immediate post-operation
Management of PE	LMWH and warfarin	Emergency pulmonary embolectomy and clot removal and following LMWH and warfarin	None
Outcome	Survived	Survived	Death

BMI = body mass index (normal = 18.5-24.9); D-dimer = normal <500; EBL = estimated blood loss; OVCF = osteoporosis vertebral compression fracture

prophylaxis as compared to the use of no prophylaxis. Pharmacological prophylaxis for VTE, such as low molecular weight heparin or warfarin, has been used for the prevention of pulmonary embolism, as a standard guideline. Pharmacological prophylaxis may increase the risk of epidural hematoma, which could cause persistent neurological deficit. At present, there is no consensus on pharmacological prophylaxis guidelines for spinal surgery, because of the low incidence of pulmonary embolism and the range and variety of demographic variables in each study^(13,14). The design of the present study was a retrospective review, which made it hard to include all possible risk factors and it is possible that the authors may have missed some patients who had asymptomatic pulmonary embolism. There was considerable potential for under-reporting from the limitations of the present study design. In addition, the present study did not report on related conditions, such as deep vein thrombosis, because of

the varying degrees and characteristics of clinical presentation and the varying diagnostic criteria, which would largely depend on the sensitivity of the investigation.

Conclusion

There is very low incidence of symptomatic pulmonary embolism in elective spinal surgery cases at our institute (0.033%). Most of our symptomatic pulmonary embolism cases presented with at least one risk factor. All symptomatic pulmonary embolisms in the study occurred in patients undergoing lumbar surgery.

Potential conflicts of interest

None.

References

1. Geerts WH, Heit JA, Clagett GP, Pineo GF, Colwell

- CW, Anderson FA Jr, et al. Prevention of venous thromboembolism. *Chest* 2001; 119 (1 Suppl): 132S-75S.
2. Kumar DR, Hanlin E, Glurich I, Mazza JJ, Yale SH. Virchow's contribution to the understanding of thrombosis and cellular biology. *Clin Med Res* 2010; 8: 168-72.
 3. Ferree BA, Stern PJ, Jolson RS, Roberts JM, Kahn A 3rd. Deep venous thrombosis after spinal surgery. *Spine (Phila Pa 1976)* 1993; 18: 315-9.
 4. Oda T, Fuji T, Kato Y, Fujita S, Kanemitsu N. Deep venous thrombosis after posterior spinal surgery. *Spine (Phila Pa 1976)* 2000; 25: 2962-7.
 5. West JL 3rd, Anderson LD. Incidence of deep vein thrombosis in major adult spinal surgery. *Spine (Phila Pa 1976)* 1992; 17 (8 Suppl): S254-7.
 6. Heck CA, Brown CR, Richardson WJ. Venous thromboembolism in spine surgery. *J Am Acad Orthop Surg* 2008; 16: 656-64.
 7. Epstein NE. Intermittent pneumatic compression stocking prophylaxis against deep venous thrombosis in anterior cervical spinal surgery: a prospective efficacy study in 200 patients and literature review. *Spine (Phila Pa 1976)* 2005; 30: 2538-43.
 8. Pateder DB, Gonzales RA, Kebaish KM, Antezana DF, Cohen DB, Chang JY, et al. Pulmonary embolism after adult spinal deformity surgery. *Spine (Phila Pa 1976)* 2008; 33: 301-5.
 9. Yoshioka K, Murakami H, Demura S, Kato S, Hayashi H, Inoue K, et al. Comparative study of the prevalence of venous thromboembolism after elective spinal surgery. *Orthopedics* 2013; 36: e223-8.
 10. Oglesby M, Fineberg SJ, Patel AA, Pelton MA, Singh K. The incidence and mortality of thromboembolic events in cervical spine surgery. *Spine (Phila Pa 1976)* 2013; 38: E521-7.
 11. White RH, Zhou H, Romano PS. Incidence of idiopathic deep venous thrombosis and secondary thromboembolism among ethnic groups in California. *Ann Intern Med* 1998; 128: 737-40.
 12. Sansone JM, del Rio AM, Anderson PA. The prevalence of and specific risk factors for venous thromboembolic disease following elective spine surgery. *J Bone Joint Surg Am* 2010; 92: 304-13.
 13. Schizas C, Neumayer F, Kosmopoulos V. Incidence and management of pulmonary embolism following spinal surgery occurring while under chemical thromboprophylaxis. *Eur Spine J* 2008; 17: 970-4.
 14. Nicol M, Sun Y, Craig N, Wardlaw D. Incidence of thromboembolic complications in lumbar spinal surgery in 1,111 patients. *Eur Spine J* 2009; 18: 1548-52.

อุบัติการณ์ของโรคลิ้มเลือดอุดตันในปอดหลังที่แสดงอาการหลังจากการผ่าตัดกระดูกสันหลัง

จตุพร โชติภวณิชย์, มนต์ชัย เรืองชัยนิคม, ชุมพล ปีย์วัฒน์, เอกพจน์ ก่อวุฒิกุลรังสี, ศิริชัย วิชาศรีศรี, สุรินทร์ ธนพิพัฒน์ศิริ, อารีศักดิ์ โชติวิจิตร

ภูมิหลัง: ภาวะลิ้มเลือดอุดตันในปอดเป็นภาวะแทรกซ้อนวิกฤตที่สำคัญทางออร์โธปิดิกส์ แต่โดยทั่วไปอุบัติการณ์การเกิดภาวะลิ้มเลือดอุดตันในปอดซึ่งเป็นผลพวงจากภาวะแทรกซ้อนของภาวะหลอดเลือดอุดตันจากการผ่าตัด กระดูกสันหลังพบน้อยและมีรายงานน้อย การให้ยาเพื่อป้องกันภาวะดังกล่าวไม่เป็นข้อสรุปชัดเจน

วัตถุประสงค์: ศึกษาอุบัติการณ์ผู้ป่วยที่มีอาการภาวะลิ้มเลือดอุดตันในปอดจากการผ่าตัดกระดูกสันหลัง

วัสดุและวิธีการ: การศึกษาย้อนหลังโดยเก็บข้อมูลผู้ป่วยที่มีอาการภาวะหลอดเลือดอุดตันในปอดจากการผ่าตัดกระดูกสันหลัง โดยศึกษาย้อนหลัง 11 ปี ตั้งแต่ปี พ.ศ. 2545-2555 ที่ภาควิชาศัลยศาสตร์ออร์โธปิดิกส์และกายภาพบำบัด คณะแพทยศาสตร์ศิริราชพยาบาล

ผลการศึกษา: พบอุบัติการณ์ร้อยละ 0.033 คือพบผู้ป่วย 3 ราย ที่มีอาการภาวะลิ้มเลือดอุดตันจากผู้ป่วยที่ผ่าตัดกระดูกสันหลังทั้งหมด 9,184 ราย โดยผู้ป่วย 1 ราย เสียชีวิตจากภาวะนี้

สรุป: พบอุบัติการณ์ของผู้ป่วยที่มีอาการภาวะลิ้มเลือดอุดตันในปอดภายหลังการผ่าตัดกระดูกสันหลังน้อยมาก และสามารถพบได้ในผู้ป่วยที่ไม่มีปัจจัยเสี่ยง และเป็นภาวะวิกฤตผู้ป่วยมีโอกาสเสียชีวิตได้
