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# Is chemical antithrombotic prophylaxis effective in elective thoracolumbar spine surgery? Results of a systematic review

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## ABSTRACT

**Study design:** Systematic review

**Study rationale and context:** There is controversy regarding the efficacy and safety of chemical prophylaxis to prevent deep venous thrombosis (DVT) and pulmonary embolism (PE) in elective spinal procedures. Commonly performed elective spine surgeries done through a posterior approach have a very low associated risk of DVT/PE. The lack of consensus is due in part to a limited amount of quality evidence based literature dealing with this issue.

**Objective:** To compare chemical prophylaxis with no chemical prophylaxis in preventing venous thromboembolism in elective thoracolumbar spine surgery.

**Methods:** We undertook a systematic review of the literature to assess the efficacy and safety of chemical prophylaxis in preventing venous thromboembolism in elective thoracolumbar spine surgery. Pubmed, EMBASE, Cochrane, National Guideline Clearinghouse Databases as well as bibliographies of key articles were searched. Articles were reviewed by two independently working reviewers. Inclusion and exclusion criteria were set and each article was subject to a predefined quality rating scheme.

**Results:** We identified only two articles meeting our inclusion criteria. Neither study demonstrated a significant difference between chemical prophylaxis versus no prophylaxis in preventing thromboembolic events. There was an increased incidence of perioperative bleeding with low dose Coumadin in one of the studies.

**Conclusion:** The incidence of DVT and PE in commonly performed elective posterior spinal procedures is very low. While there is a limited amount of randomized literature looking at this issue, the current literature does not support the routine use of chemical prophylaxis for low risk patients undergoing these procedures.

**Keywords:** Venous thromboembolism, deep venous thrombosis, pulmonary embolism, chemical prophylaxis, spine surgery, bleeding

## STUDY RATIONALE AND CONTEXT

There is a lack of consensus regarding the utility of chemical prophylaxis in preventing deep vein thrombosis (DVT) and pulmonary embolism (PE) in patients undergoing elective spine surgery. There is also concern for the possibility of increased perioperative bleeding with chemical prophylaxis [1, 2] in these patients.

## OBJECTIVES

To compare chemical prophylaxis with no chemical prophylaxis in preventing venous thromboembolism in elective thoracolumbar spine surgery.

## MATERIALS AND METHODS

**Study design:** Systematic review

### Sampling:

- Search: Pubmed, EMBASE, Cochrane, and National Guideline Clearinghouse Databases; bibliographies of key articles
- Dates searched: 1970–February 2010.
- Inclusion criteria
  - Elective thoracolumbar spine surgery, comparative studies assessing venous thromboembolic (VTE) complications
- Exclusion criteria
  - Nonelective thoracolumbar spine surgery (trauma, neoplasm), pediatric patients
- Outcomes: risk of VTE, risk of complications from anticoagulation therapy
- Analysis: descriptive statistics

Details about methods can be found in the web appendix at [www.aospine.org/ebsj](http://www.aospine.org/ebsj).

Figure 1 Flow chart showing results of literature search

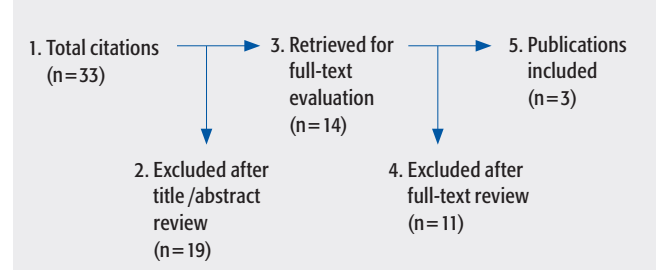


Table 1 Study characteristics

Author (year)	Study design	Study population	Condition and treatment	Intervention	Control
Rokito (1996)	Prospective cohort	N=103* Mean age: 44 years 40% male	Lumbar disorder (n=88), scoliosis (n=14), thoracic disorder (n=1). Anterior and/or posterior spinal fusions and/or decompression surgery	Compression stockings and 10 mg Coumadin on the evening before surgery and daily postoperatively (n=32)	Thigh-high compression stockings (n=38) or compression stockings and thigh-length IPCs (n=33)
Gruber (1984)	Prospective cohort	N=50 Heparin Mean age: 47 years 57% male Placebo Mean age: 45 years 65% male	Herniated lumbar disc (treatments-NR)	2500 IU miniheparin-dihydroergotamine two times daily (n=25), beginning 2 hours preoperatively and continuing at least 7 days or until hospital discharge	Placebo (n=25), beginning 2 hours preoperatively and continuing at least 7 days or until hospital discharge

NR=no report, IPCs=intermittent compression stockings

\*Study population was 110 subjects; excluded subjects with cervical disorders (n=7)

## RESULTS

We identified two small studies [3, 4] meeting our inclusion criteria (**Figure 1**). Both studies compared chemical prophylaxis to no chemical prophylaxis (**Table 1**) and were prospective cohort studies, class of evidence II. Further details on the class of evidence rating for these studies can be found in the web appendix at [www.aospine.org/ebsj](http://www.aospine.org/ebsj).

### Risk of VTE (**Table 2**)

- In two small prospective studies of elective thoracolumbar spine surgery, the risk of DVT in patients receiving chemical prophylaxis ranged from 0–4.0% compared with 0% in patients receiving either mechanical prophylaxis or placebo. Sample sizes for this relatively rare event were small.
- The risk of PE in elective thoracolumbar spine surgery is extremely low; no cases were identified from among 153 patients in two studies, regardless of chemical prophylaxis having been administered or not.

### Risk of bleeding complications from anticoagulation therapy (**Table 3**)

- In two prospective studies, the risk of major intraoperative bleeding ranged from 0–3.1% in patients receiving chemical prophylaxis compared with 0% in patients receiving either mechanical prophylaxis or placebo.
- Minor intraoperative bleeding ranged from 3.1–24% in those receiving chemical prophylaxis and 0–28% in patients receiving either mechanical prophylaxis or placebo.
- There were no cases of hematoma in elective thoracolumbar spine surgery in patients receiving chemical prophylaxis in two prospective studies. The risk of hematomas among patients receiving either mechanical prophylaxis or placebo in two studies ranged from 0–4.0%, however, no further surgery was required.

Table 2 Risk (%) of venous thromboembolism in thoracolumbar spine surgery comparing chemical prophylaxis with no chemical prophylaxis

	Deep vein thrombosis		Pulmonary emboli	
	Chemical prophylaxis*	Control†	Chemical prophylaxis*	Control†
<b>Rokito</b>	0% (0/32)	0% (0/71)	0% (0/32)	0% (0/71)
<b>Gruber</b>	4.0% (1/25)	0% (0/25)	0% (0/25)	0% (0/25)

\*For Rokito, warfarin plus thigh-high compression stockings; for Gruber, heparin plus dihydroergotamine

†For Rokito, thigh-high compression stockings or intermittent pneumatic compression; for Gruber, placebo

Table 3 Risk (%) of bleeding complications comparing chemical prophylaxis with no chemical prophylaxis

	Minor bleeding complication		Major bleeding complication		Hematoma	
	Chemical prophylaxis*	Control†	Chemical prophylaxis*	Control†	Chemical prophylaxis*	Control†
<b>Rokito</b>	3.1% (1/32)	0% (0/71)	3.1% (1/32)	0% (0/71)	0% (0/32)	0% (0/71)
<b>Gruber</b>	24.0% (6/25)	28.0% (7/25)	0% (0/25)	0% (0/25)	0% (0/25)	4.0% (1/25)

\*For Rokito, Warfarin plus thigh-high compression stockings; for Gruber, Heparin plus Dihydroergotamine

†For Rokito, thigh-high compression stockings or intermittent pneumatic compression; for Gruber, placebo

## EVIDENCE SUMMARY

### Efficacy of chemical prophylaxis in elective thoracolumbar spine surgery

Outcomes	Strength of evidence	Conclusions/comments
1. VTE		<ul style="list-style-type: none"> <li>– The risk of DVT from thoracolumbar spine surgery ranged from 0% to 4.0% for individuals using chemical prophylaxis and was 0% in individuals receiving mechanical prophylaxis or placebo in two small studies.</li> <li>– The risk of PE from thoracolumbar spine surgery was 0% for individuals whether or not chemical prophylaxis was administered.</li> </ul>

### Bleeding complications of chemical prophylaxis in elective thoracolumbar spine surgery

Outcomes	Strength of evidence	Conclusions/comments
1. Bleeding		<ul style="list-style-type: none"> <li>– The risk of major bleeding from thoracolumbar spine surgery as reported in two small studies ranged from 0-3.1% for individuals using chemical prophylaxis and was 0% in individuals receiving either mechanical prophylaxis or placebo.</li> <li>– The risk of minor bleeding ranged from 3.1% to 24% for individuals using chemical prophylaxis and from 0% to 28% in individuals receiving either mechanical prophylaxis or placebo.</li> <li>– The risk of hematoma was 0% for individuals using chemical prophylaxis and ranged from 0% to 4.0% among those receiving mechanical prophylaxis or placebo.</li> </ul>

## CLINICAL GUIDELINES

In 2008, the Seventh American College of Chest Physicians Conference on Antithrombotic and Thrombolytic Therapy: Evidence-Based Guidelines provided recommendations for prevention of VTE in elective spinal surgery [5].

- For patients with no additional risk factors, recommendations are against the routine use of any thromboprophylactic modality beyond early and frequent ambulation.
- For patients with additional risk factors, any of the following prophylaxis recommendations are recommended:
  - Postoperative low-dose unfractionated heparin (LDUH) alone,
  - Postoperative low molecular weight heparin (LMWH) alone,
  - Perioperative intermittent compression stockings (IPC) alone,
  - Alternate considerations include perioperative graduated compression stockings (GCS).
- For patients with multiple risk factors for VTE, it is suggested that a pharmacologic preventative treatment (ie, LDUH or LMWH) be combined with the optimal use of a mechanical method (ie, GCS and/or IPC).

North American Spine Society Evidence-Based Guideline on Antithrombotic Therapies in Spine Surgery (2009) has provided evidence-based recommendations regarding antithrombotic therapies in elective spine surgery [6].

- Mechanical compression devices in the lower extremities are suggested, initiated just prior to surgery and continuing until the patient is fully ambulatory.
- Chemoprophylaxis may not be warranted in most common elective spine surgeries performed through a posterior approach.
- LMWH or LDUH may be used postoperatively following elective combined anterior-posterior spine surgery or in patients identified as having high risk for VTE, such as multiple trauma, malignancy or hypercoagulable state.

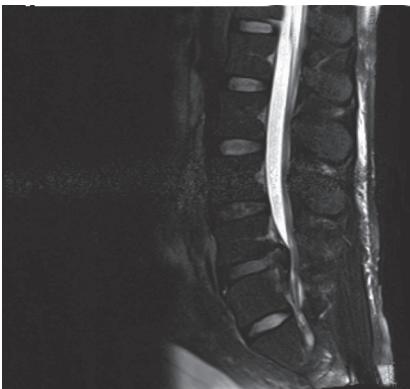
## DISCUSSION

- This systematic review is limited by the small number of studies comparing chemical prophylaxis with no chemical prophylaxis in preventing VTE in elective thoracolumbar spine surgery. Additional limitations included disparate assessment of VTE between studies and inconsistent definitions and assessment of minor and major bleeding complications [7].
- Based on the available literature, there is little evidence to support the routine use of chemical prophylaxis in addition to mechanical prophylaxis devices in posterior approach elective spine surgeries. Chemical prophylaxis can be considered on a case by case basis in patients at higher risk for DVT such as those with advanced age, history of malignancy or previous VTE, presence of a neurologic deficit, inability to mobilize postoperatively, or an anterior thoraco-lumbar surgery. This approach is supported by the published guidelines of the North American Spine Society and American College of Chest Physicians [6].
- A comparison between the risks and benefits of chemical prophylaxis in this population would require more studies that are consistent in their study methodology.

## ILLUSTRATIVE CASE

The patient is a 32-year-old otherwise healthy man with a left L5 radiculopathy. His sagittal (**Figure 2**) and axial (**Figure 3**) MRI scans show an L4–5 disc herniation consistent with his symptoms. He has had persistent symptoms despite conservative measures including epidural steroid injections. He is scheduled for a lumbar microdiscectomy. Compression stocking and pneumatic compression devices will be placed bilaterally after induction and left in place until the patient is out of bed ambulating. Because he has no other risk factors, no chemical prophylaxis is required.

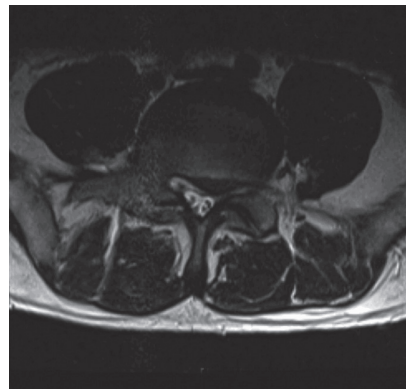
Figure 2 **Sagittal MRI**



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Figure 3 **Axial MRI**



**EDITORIAL STAFF PERSPECTIVE**

*Thromboembolic events can lead to significant morbidity and mortality. Although this systematic review suggests the incidence of DVT and PE may be low in elective posterior spinal procedures, keeping in mind the major risk factors for thromboembolism is important. Some of the major risk factors for thromboembolism in general include:*

- *Spinal cord injury*
- *Fractures of hip or leg*
- *History of prior venous thromboembolism*
- *Polytrauma*
- *Neoplasia*
- *Major anterior lumbo-sacral surgery*
- *Hormone replacement therapy/oral contraceptive use*
- *Immobility (time period unclear)*
- *Increasing age*
- *Obesity*

*While this is not an extensive list, it provides a reminder that consideration of clinical circumstances in addition to consideration of the evidence is a necessary part of quality patient care.*