Venous thromboembolic complications following surgical treatment for degenerative spinal disease

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ABSTRACT

INTRODUCTION: A venous thromboembolism (VTE), i.e., deep vein thrombosis (DVT) or pulmonary embolism (PE), is a potentially lethal complication to surgical procedures. The aim of this study was to evaluate the incidence of symptomatic VTEs in a large consecutive Danish cohort treated surgically for degenerative spinal disease.

METHODS: This was a retrospective, consecutive, one-centre cohort study of patients treated surgically for either cervical or lumbar degenerative disease. According to the local treatment protocol, patients with an increased risk of VTE received rivaroxaban as thrombosis prophylaxis. VTE events within six months from the surgical procedure were identified via the Danish National Patient Register and confirmed by patient chart review.

RESULTS: A total of 6,145 surgical procedures were included – 808 cervical and 5,337 lumbar procedures. Twelve patients (0.2%) were examined on suspicion of symptomatic VTE, ten for DVT and two for PE. VTE was confirmed in eight patients (0.1%), seven DVT and one PE. One patient died within six months, producing a mortality rate of 0.01%.

CONCLUSIONS: VTEs are an uncommon but potentially lethal complications in patients who undergo surgery for a degenerative spinal disease. Incidence and mortality were low in a consecutive cohort where rivaroxaban was used as thrombosis prophylaxis in patients with an increased preoperative risk of VTE.

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A venous thromboembolism (VTE), i.e., deep vein thrombosis (DVT) or pulmonary embolism (PE), is a well-described complication following surgery [1], including surgery for degenerative spinal disease [2-9]. The clinical presentation of a VTE ranges from asymptomatic to fatal. Thrombosis prophylaxis may be administered to patients who are undergoing surgery to lower the risk of VTEs. The incidence of a symptomatic VTE following spinal surgery where thrombosis prophylaxis is administered is reported to fall in the 0.2-1.1% range [5, 6].

No previous Danish study has reported VTE complications following surgery for degenerative spinal disease. The aim of the present study was to evaluate the incidence of symptomatic VTEs in a large consecutive, one-centre, Danish cohort treated surgically for degenerative disease in the cervical or lumbar region.

METHODS

Between 1 August 2008 and 31 December 2013, a total of 6,276 surgical procedures were performed at the Spinal Section at the Aleris-Hamlet Hospital, Copenhagen, Denmark. In all, 131 procedures for other conditions than degenerative spinal diseases were excluded. Thus, 6,145 consecutive procedures for either cervical or lumbar degenerative disease were included, predominantly herniated disc, spinal stenosis and/or degenerative disc disease. All patients who were treated surgically at the Spinal Section at the Aleris-Hamlet Hospital had an American Society of Anesthesiologists Classification (ASA) score of three or less.

The surgical procedures in the cervical spine used the conventional anterior approach including discectomy, neural decompression and intervertebral fusion using cage stabilisation. In the lumbar region, all procedures were performed using a conventional, minimal open posterior approach, subperiosteal dissection and neural decompression with or without fusion. The fusion was either uninstrumented or instrumented with pedicle screw fixation.

In the period studied, all patients identified to have an increased risk of VTE (**Table 1**) received thrombosis

TABLE 1

Local protocol for venous thromboembolism prophylactic.

Patients considered at risk of venous thromboembolism	Previous venous thromboembolism Disposition for thromboembolic disease Current malignant disease Morbus cordis Cardiac arrhythmia Age 〉 75 yrs BMI 〉 40 kg/m^2 Individual indication: prolonged surgery time, unpredicted surgical trauma, etc.
Venous thromboembolism prophylaxis	10 mg p.o. rivaroxaban

p.o. = per os.

ORIGINAL ARTICLE

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TABLE 2

Information on surgical procedures and number of hospital admission due to suspicion of complications to venous thromboembolism.

	Procedures, n (%)	Duration of surgery, median (IQR), min	Post-surgery admission, median (IQR), days	Reoperation, n (%)	Deep venous thrombosis, n (%)	Pulmonary embolism, n (%)
Cervical decompression and fusion	808 (13)	47 (39-57)	1 (1-2)	16 (2)	1 (0.1)	–
Lumbar						
Prolapsed disc	1,425 (23)	33 (27-44)	1 (1-2)	19 (1)	1 (0.07)	–
Spinal stenosis	2,741 (45)	45 (36-57)	1 (1-2)	46 (2)	6 (0.2)	2 (0.07)
Spondylodesis without fixation	711 (12)	62 (48-77)	2 (1-3)	16 (2)	2 (0.2)	–
Spondylodesis with fixation	460 (7)	68 (53-83)	2 (1-2)	6 (1)	–	–
Total	6,145 (100)	–	1 (1-2)	103 (2)	10 (0.2)	2 (0.03)

IQR = interquartile range.

prophylaxis in the form of 10 mg rivaroxaban orally 6-10 hours after the procedure according to national guidelines for thrombosis prophylaxis [10-14]. All patients were planned for early mobilisation within a few hours following the procedure. In patients with prolonged mobilisation, rivaroxaban 10 mg was administered once daily until full mobilisation. Compression stockings were not part of the thrombosis prophylaxis regime.

Patients receiving anticoagulant medication prior to their procedure paused this treatment according to Danish recommendations [15].

Retrospectively, we electronically collected data on person identity number, date, type of procedure and

TABLE 3

Data on procedure and preoperative medical status for each patient with confirmed venous thromboembolic complication in chronological order, and a chronological overview of the patients admitted on an unconfirmed suspicion of venous thromboembolism.

Date of surgery	VTE	Procedure	Sex	Age, yrs	BMI, kg/m^2	Tobacco	Alcohol
Confirmed VTE							
10/12/2009	Confirmed DVT	Fixation, lumbar spondylolisthesis	F	52	23	Yes	No
15/02/2011	Confirmed DVT	Fixation, lumbar spondylolisthesis	M	51	26	Yes	No
24/06/2011	Confirmed DVT	Fixation, lumbar spondylolisthesis	M	66	34	No	No
27/07/2011	Confirmed PE	Lumbar spinal stenosis	M	80	27	No	No
29/08/2011	Confirmed DVT	Cervical decompression and fusion	F	44	21	No	No
21/09/2011	Confirmed DVT	Lumbar spinal stenosis	M	58	33	No	No
28/02/2012	Confirmed DVT	Lumbar spinal stenosis	F	53	22	Yes	No
17/12/2012	Confirmed DVT	Lumbar prolapsed disc	F	74	23	No	No
Admitted on suspicion of VTE, the suspicion was not confirmed							
14/10/2010	–	–	F	74	–	–	–
30/03/2011	–	–	F	74	–	–	–
17/01/2013	–	–	M	71	–	–	–
11/04/2013	–	–	F	56	–	–	–

DVT = deep venous thrombosis; F = female; M = male; PE = pulmonary embolism; VTE = venous thromboembolism.

duration of surgery as well as days admitted. By use of the unique person identity number, the cohort was cross-linked with the Danish National Patient Register to retrieve information on hospital admission for VTEs for a period of six months after the date of surgery (International Classification of Diseases, tenth version (ICD-10) codes: DI260, DI269, DI802, DI803, DT817C, DT817D). Patients who underwent more than one procedure were considered to be at risk for a VTE following each procedure. A patient chart review was performed in the patients who were identified with VTE in the Danish National Patient Register and further supplemented by personal communication with each patient in order to confirm a VTE. The study was approved by the Danish Data Protection Agency (2013-41-1955).

Trial registration: not relevant.

RESULTS

In total, 808 cervical and 5,337 lumbar procedures (51.5% females) were included (**Table 2**). The median age was 58 years (interquartile range: 46-69), 14% were older than 75 years of age.

Twelve patients (0.2%) were admitted on suspicion of a symptomatic VTE, ten for DVT and two for PE.

A VTE was confirmed in eight patients (0.1%), seven DVT and one PE. Patient characteristics and procedures performed are presented in **Table 3**. In one patient, a high preoperative risk of VTE was identified according to the treatment protocol. One other patient, a 66-year-old male, received thrombosis prophylaxis because he underwent instrumented fusion for a spondylolisthesis and had a Body Mass Index of 34. All the other VTE occurred in patients without increased risk.

One patient died resulting in a mortality rate of 0.01%. The patient was an 80-year-old male with ischaemic heart disease. Preoperatively, he was considered to be at risk of developing a VTE and received prophylaxis according to our protocol. The patient underwent spinal decompression for spinal stenosis. He had a prolonged recovery and died 69 days post-operatively. The PE was identified at autopsy.

Comorbidities	Previous surgical procedures	VTE risk	Thrombosis prophylaxis	Comments
Hypertension	Appendicitis	No	No	–
		No	No	–
Mb Parkinson	Knee replacement Lumbar surgery	No	Yes	–
Ischaemic heart disease with ejection fraction 35%		Yes	Yes	Died 69 days post-operatively
Chronic pain, high-dose morphine	Shoulder × 4 Lumbar surgery	No	No	Later diagnosed with Factor V Leiden heterozygous
–	–	No	No	–
Rheumatologic disease, prednisolone treatment resulting in diabetes type 1, high cholesterol, cured ovarian cancer	Ovarian cancer × 2	No	No	Symptoms of DVT started after flight to Spain
Hypertension	–	No	No	
–	–	–	–	Had a hip alloplastic changed 4–8 mo.s following the spinal procedure Suspicion of PE was not confirmed Later diagnosed with depression
–	–	–	–	Suspected DVT was not confirmed No other explanation was found
–	–	–	–	Suspected DVT was not confirmed No other explanation was found
–	–	–	–	Suspected DVT was not confirmed No other explanation was found Treated on suspicion of DVT Underwent additional check-ups and was diagnosed with arthritis in Oct 2013 because of continued symptoms

DISCUSSION

In this large, consecutive, single-centre cohort, we found an overall low incidence of diagnosed VTEs of 0.1% and a mortality rate of 0.01% following elective surgery for degenerative spinal disease.

In patients with an increased preoperative risk of VTE, thrombosis prophylaxis (rivaroxaban) was administered in accordance with a local treatment protocol. This regime produced a low incidence of diagnosed VTEs. However, the only fatal VTE in the entire cohort occurred in the subgroup with an increased risk of VTE, although the patient had received rivaroxaban. This confirms that VTE, although rare, is a potentially lethal complication, also in benign, elective spinal procedures. It also indicates that VTE must be taken into consideration when treatment is decided.

The main limitation of our study is its retrospective design. Patient-chart review was performed only in patients who were referred on suspicion of VTE identified via the Danish National Patient Register. Thus, silent VTEs were not identified. Although symptomatic VTEs treated by general practitioners have not been included, we believe that only very few cases may have been missed because the practice in Denmark is to confirm all VTEs by ultrasound. The low number of events excludes any meaningful analysis of risk factors for developing VTEs, as such patient-chart review was performed only in patients who had been identified in the Danish National Patient Register. Finally, we lack information on post-operative bleeding, which is a potential concern following thrombosis prophylaxis.

The reported incidence of VTE events following surgical procedures varies 0.5-14.7% [1, 5-8, 16, 17]. The incidence of VTEs in surgery for degenerative spinal disease is reported to be 0.5-8.3% [5-9]. In a register cohort study, including 357,926 patients who underwent decompression and/or fusion, symptomatic VTE within 90 days of the procedure was reported in 1.4% [9]. The study design excluded information on thrombosis prophylaxis. A single-centre study including 5,766 patients undergoing surgery for degenerative thoracolumbar disease reported a 1.5% incidence of symptomatic VTE [7]. Thrombosis prophylaxis consisted of thigh high thrombo-embolic deterrent hose and sequential pneumatic compression devices intra- and post-operatively. A retrospective cohort study including 3,870 patients undergoing elective spinal surgery who received thrombosis prophylaxis at their surgeon's discretion reported a VTE incidence of 0.5% [5]. The incidence of asymptomatic, subclinical VTEs is reported in the 3.3-8.3% range [6, 8]. Both prospective studies, including 548 patients, used a combination of lung perfusion scintigraphy, duplex ultrasonographic and computed tomography to assess VTE events following surgery for degenerative spinal disease.

Risk factors for VTE include previous VTE, cancer, advanced age, hormone treatment, musculoskeletal disease, neurological defects, female sex and spinal level [8, 17-19]. Currently, there is no agreement about the use of thrombosis prophylaxis in spinal surgery because of the concern for bleeding and spinal epidural haematoma [6]. Although we cannot comment on bleeding or SHE in our cohort, we found a low incidence of VTEs when using our local treatment protocol, which uses a broader indication for thrombosis prophylaxis than the described risk factors for VTE following spinal surgery. The present study represents a cohort of patients who underwent elective surgery for degenerative spinal disease and who were considered to have a low risk of anaesthesiological complications – i.e. ASA scores up to 3. Thus, our results do not elucidate the risk of VTE following emergency spinal surgery or the risk in patients with higher ASA scores.

CONCLUSIONS

VTE is an uncommon but potentially lethal complication in patients undergoing surgery for degenerative spinal disease. The incidence and mortality were acceptable in a consecutive cohort where rivaroxaban was used as thrombosis prophylaxis only in patients with an increased risk of such events.

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