ORIGINAL ARTICLE

Incidence of pulmonary embolism after the first 3 months of spinal cord injury

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Background: Pulmonary embolism (PE) is a significant cause of morbidity and mortality in patients with spinal cord injury (SCI). Prophylactic anticoagulation is associated with a reduction in mortality rates, but there is limited evidence regarding the incidence rate of PE following cessation of anticoagulation after the first 3 months of injury.

Study design: Single-centre retrospective study.

Objective: To estimate the incidence rate of PE after 90 days of SCI.

Setting: The National Spinal Injuries Centre at Stoke Mandeville Hospital, Aylesbury, UK.

Methods: The study includes 640 new-onset SCI patients. All computer tomography pulmonary angiograms (CTPAs) or ventilation-perfusion lung scans between 2008 and 2013 were identified. Medical notes and scans were reviewed and clinical outcomes and radiological findings were recorded.

Results: A total of 91 patients with a new-onset SCI had a CTPA or a perfusion lung scan. PE was detected in a total of 8 patients. The incidence of PE was 1.25%; 95% confidence interval (0.39–2.11) over a 6-year period. The duration of injury at the time of PE was 7 months.

Conclusion: The incidence rate of PE post 3 months of SCI remains significant, though much lower than immediately post injury.

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INTRODUCTION

Background

Pulmonary embolism (PE) is a potentially life threatening condition and a significant cause of morbidity and mortality in patients with spinal cord injury (SCI).¹ Diagnosing PE in SCI patients can be challenging as usual clinical signs and symptoms of pulmonary emboli may be obscured.²

Diagnostic imaging of PE first involves a chest X-ray to rule out any conditions that mimic PE, including lobar pneumonia or pneumothorax. More definitive imaging investigations include computed tomography pulmonary angiography (CTPA)³ and less commonly, ventilation-perfusion scintigraphy.⁴ Multislice CTPA has become the principal modality for diagnosis as it is both highly sensitive and specific.³

In the acute phase of SCI (up to 90 days post injury) the incidence of PE has been reported as 4.5% with a mortality rate of 3.5%.⁵ The introduction of prophylactic anticoagulation therapy in the first 3 months was associated with a reduction in mortality rates.⁶ Anticoagulation is usually ceased after 3 months post injury, based on autopsy evidence of rare incidences of PE in this period.^{7,8} However, the incidence of PE after the initial 3 months post injury is poorly reported in literature.⁹ In this study, over a 6-year period we examine the incidence rates of PE in SCI patients after anticoagulation was stopped.

METHODS

Study design

This is a single-centre retrospective study of SCI. The study reviewed all patients with suspected PE who had a CTPA or ventilation-perfusion lung scan.

Setting

The study setting is the National Spinal Injuries Centre (NSIC) at Stoke Mandeville Hospital, Aylesbury, UK.

Participants

We included all new-onset SCI patients admitted between 2008 and 2013. We excluded children (under 18 years).

Outcomes

Primary outcome. Incidence of PE after 90 days post SCI.

Secondary outcomes.

1. Duration of injury associated with PE.
2. Extent of paralysis associated with PE.
3. Clinical presentation of PE in SCI.

Data sources and management

All CTPA and perfusion scans were identified via Centricity Radiology Information Systems. All images were reviewed by an experienced consultant

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Table 1 Study characteristics

Age; mean (s.d.)	48 (18)
Gender (male)	77%
Injury age (days); mean (s.d.)	54 (58)
Length of stay (days); mean (s.d.)	150 (76)
<i>Level of injury</i>	
C1–C4	18.3%
C5–C8	26.9%
T1–S5	54.8%
<i>ASIA</i>	
AIS A	56%
AIS B	6.2%
AIS C	20%
AIS D	17.8%
<i>Cause of injury</i>	
Fall	31.8%
RTA	27.5%
Sport	8.3%
Assault	2.5%
Non-trauma	29.4%
Other	0.5%

Abbreviations: ASIA, American Spinal Injury Association; AIS, ASIA Impairment Scale; RTA, road traffic accident.

radiologist. The medical notes of patients with a suspected PE were reviewed and clinical outcomes and radiological findings were recorded. Microsoft Excel software (Microsoft Excel 2013, Redmond, WA, USA) was used to input admission information and collect data. Statistical analyses were performed using IBM SPSS (Version 22.0, Armonk, NY, USA) software.

Statistical methods

Incidence rate. Incidence rates post 90 days of SCI were calculated by dividing the number of new PEs by the number of new admissions in a year.

Follow-up. The follow-up of each individual patient lasted for the inpatient period only. Patients were not followed up after discharge.

RESULTS

This study includes 640 patients with new-onset SCI. The mean injury to NSIC admission duration was 54 days; 95% confidence interval (CI) (50–57). The mean length of hospital stay was 150 days; 95% CI (144–155). The population baseline characteristics are found in Table 1.

During the years from 2008 to 2013, 91 patients had a clinical suspicion for PE and subsequently had a CTPA or perfusion lung scan conducted. Eight patients had a confirmed PE 90 days post SCI. The mean duration of injury at the time of PE was 226 days; 95% CI (138.3–314.9).

The incidence of PE after 90 days post SCI was 1.25%; 95% CI (0.39–2.11) (Table 2).

Four patients of the eight patients diagnosed with PE had tetraplegia. Five patients had a complete injury (Table 3).

The most common clinical presentations of PE were dyspnoea, chest pain, hypoxia, tachycardia and haemoptysis. Other presentations included atrial fibrillation, respiratory failure and cardiac arrest.

DISCUSSION

Our analysis of pulmonary embolisms 90 days after SCI identified an incidence rate of 1.25%. The duration of SCI at the time of PE was 7 months.

Table 2 Incidence of pulmonary embolism 90 days post spinal injury

Year	New admissions	Number of CTPA/VQ	Post acute PEs	Incidence
2008	90	9	0	0
2009	143	9	1	0.69
2010	117	19	3	2.56
2011	102	18	1	0.98
2012	86	24	2	2.32
2013	102	12	1	0.98
Total	640	91	8	1.25

Abbreviations: CTPA, computed tomography pulmonary angiography; PE, pulmonary embolism; VQ, lung ventilation/perfusion scan.

Table 3 Demographic data of patients with PE

Age; mean (s.d.)	47 (15)
Gender (male)	75%
Injury age (days)	226 (127)
Length of stay (days)	212 (69)
<i>Level of Injury</i>	
C1–C4	1 (12.5%)
C5–C8	3 (37.5%)
T1–S5	4 (50%)
<i>ASIA</i>	
AIS A	5 (62.5%)
AIS B	1 (12.5%)
AIS C	2 (25%)
<i>Cause of injury</i>	
Trauma	57.1%
Non-trauma	42.9%

Abbreviations: ASIA, American Spinal Injury Association; AIS, ASIA Impairment Scale; PE, pulmonary embolism.

The incidence of PE after 90 days post SCI is lower than the 5–12% incidence rate during the acute phase (first 3 months) as reported in the literature.^{1,5} However, it is significantly higher than the PE risk in the general population (0.06% per year).¹⁰

Patients with a complete injury AIS A had a slightly higher rate of PE. There was no difference in PE rates between individuals with tetraplegia or paraplegia.

CONCLUSION

The risk of pulmonary embolism 90 days post SCI remains significant.

Limitations

This is a retrospective analysis of available SCI data at the National Spinal Injuries Centre. To be able to calculate an accurate incidence rate, a prospective multicentre cohort study would be more appropriate. It was beyond the scope of this study to determine correlation of pulmonary embolism with level of injury.

DATA ARCHIVING

There were no data to deposit.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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