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Prophylaxis of thromboembolism in spinal injuries – results of enoxaparin used in 276 patients

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Objective: To evaluate the results of thromboembolic prophylaxis using enoxaparin in acute spinal injury patients.
Background: Deep vein thrombosis and pulmonary embolism are major causes of morbidity and mortality in patients with acute spinal injuries. A wide range of thromboprophylactic measures have been proposed. The present study describes the outcome of a regime of enoxaparin and antithromboembolic stockings in acute spinal injuries irrespective of neurological damage.
Setting: Scotland, UK.
Methods: Eighteen-month retrospective review of acute spinal injury patients admitted to a national spinal injuries unit. A thromboembolic prophylactic regimen of early mobilisation, use of antithromboembolic stockings, and subcutaneous administration of enoxaparin 40 mg once a day until patients could be mobilised for more than 4 h per day, was used. Patients with clinical suspicion of deep venous thrombosis or pulmonary embolism were investigated as appropriate.
Results: Out of 146 (53% of total) patients with spinal injuries with no neurological deficit only one patient (0.4%) developed clinical evidence of pulmonary embolism and out of 130 (47% of total) with spinal cord injury two (0.7%) developed clinical evidence of deep venous thrombosis while still on enoxaparin. Four patients (1.5%) developed deep venous thrombosis and one (0.4%) pulmonary embolism after discontinuing enoxaparin. There were no fatal pulmonary emboli and one suspected intraspinal bleeding.
Conclusions: The present study suggests that, in addition to physical and mechanical measures, low molecular weight heparin in the form of enoxaparin 40 mg administered once daily compares favourably with previous studies for thromboprophylaxis in acute spinal injuries.
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Keywords: spinal; injury; thromboembolism; prophylaxis; prevention; venous thrombosis

Introduction

Deep vein thrombosis and pulmonary embolism are potentially lethal complications of acute spinal injuries. The incidence of clinically evident deep venous thrombosis in spinal injury patients has been reported to be 16.3% increasing to 79% following investigations with fibrinogen scanning, impedence plethysmography and venography.[1,2] The incidence of fatal pulmonary embolism has been reported to be 2.7% in the same patient population.[3] Suggested prophylactic measures include early mobilisation, mechanical compression devices, elastic hosiery, graduated pressure stockings, warfarin, unfractionated heparin, low molecular weight heparins and vena caval filters.[4,5] There has been recent increasing interest in using low molecular weight heparins including enoxaparin.[1,3] We could find only one study published in the English literature describing the use of this agent in patients with spinal injuries.[1] The present study was carried out to evaluate the clinical efficacy of enoxaparin used for thromboembolic prophylaxis in acute spinal injury patients with or without neurological deficit.

Methods

All the patients with acute spinal injuries admitted to Queen Elizabeth National spinal injuries unit, Glasgow, national referral centre for spinal injuries for Scotland, between January 1998 and August 1999, were included irrespective of the gender, age, level of lesion or neurological deficit. The unit had well defined policy

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of thromboembolic prophylaxis which was applied to all the patients included in this retrospective study.

All patients had full length anti-thromboembolic stockings extending up to midthigh, from admission until discharge. The only patients excluded were those in whom leg injuries, external fixator or plaster of Paris prevented application of stockings. All patients received 40 mg of enoxaparin (Clexane^{R} Rhone-Poulenc Rorer) subcutaneously once per day from the day of injury or admission to the unit until they were able to be out of bed for at least 4 h per day for physical rehabilitation irrespective of the duration of injury. For those patients who were not transferred to our unit on the day of injury the referring hospitals were advised to start enoxaparin and use anti-thromboembolic stockings. If surgical spinal stabilisation was carried out, enoxaparin was withheld only on the day of operation. All the patients were started on passive and active mobilisation and physical rehabilitation as soon as their condition allowed. Patients with clinical suspicion of deep venous thrombosis or pulmonary embolism were investigated by venous ultrasonography/venography or ventilation perfusion scan/CT angiography as indicated by their clinical condition. The efficacy of enoxaparin was assessed by the incidence of clinical deep venous thrombosis or pulmonary embolism and its safety by the incidence of bleeding.

Results

There were 276 new admissions with acute spinal injuries of whom 146 (53% of total) were neurologically intact and 130 (47% of total) had neurological deficit, 79 with incomplete and 51 with complete spinal cord injuries. Injury details and main method of management are shown in Table 1. Eight patients (2.9% of total), seven males, developed clinical evidence of deep vein thrombosis or pulmonary embolism confirmed by venous ultrasonography/venography or ventilation perfusion scan/CT angiography. Patient characteristics are shown in Table 2. The only patient who was neurologically intact and developed pulmonary embolism had sustained injury at L1 vertebral level. He had not received enoxaparin for the first 6 days of injury until admission to our unit. He developed pulmonary embolism on the sixth day of his admission, which was the first postoperative day following operative spinal stabilisation. All of the other seven patients had incomplete or complete neurological deficit. One patient with injury at L5 and S1,2,3 levels who developed pulmonary embolism had also sus-

Table 1 Main injury and management method of 276 patients

Neurological status	*No. of patients*	*Management method*	*Cervical spine injuries*	*Thoracic and lumbar spine injuries*
With neurological deficit	130		68	62
		Internal fixation	19	62
		Non operative	44	31
		Halo jacket stabilisation	5	
With no neurological deficit	146		82	64
		Internal fixation	21	35
		Non operative	27	29
		Halo jacket stabilisation	34	

Table 2 Patients who had deep vein thrombosis (DVT) or pulmonary embolism (PE)

Patient	*Age*	*Sex*	*Vertebral lesion and other injuries*	*Neurological deficit*	*Treatment*	*Thrombo-embolic episode*	*On enoxaparin at time of episode*	*Enoxaparin discontinued at* (days)	*Interval between stopping enoxaparin and DVT/PE* (days)
A	22	M	T12	Complete	Internal fixation	DVT	No	42	28
B	26	M	T6,7	Complete	Internal fixation	DVT	No	46	14
C	52	M	L5 S1,2,3 Pelvis Fr.	Incomplete	Non operative	PE	No	56	33
D	35	M	T9	Incomplete	Non operative	DVT	No	26	8
E	65	M	L1	Complete	Internal fixation	DVT	No	42	30
F	26	M	L1	None	Internal fixation	PE	Yes		
G	32	M	T6	Complete	Non operative	DVT	Yes		
H	61	F	L3	Incomplete	Internal fixation	DVT	Yes		

tained a pelvic fracture. All the patients were started on active or passive mobilisation as part of their physical rehabilitation according to their clinical condition within 10 days of their injury. None of the patients with a cervical spine injury developed clinical thromboembolic episode.

One patient treated with enoxaparin had an increase in neurological deficit on the first postoperative day after surgical stabilisation of his T12 spinal fracture. He recovered gradually to preoperative neurological status over a period of weeks and was clinically suspected to have sustained intraspinal bleeding although it could not be confirmed by any investigative technique. At the 1-year review he was walking unaided.

Discussion

Several different regimes have been proposed and evaluated for thromboembolic prophylaxis in acute spinal injuries.[4,5] The use of low molecular weight heparins has increased recently.[1,3,4] The different forms of low molecular weight heparins are used in varying dosage and frequency[1,3] although experience in patients with spinal injuries is limited. Only one study could be found in the English literature regarding the use of enoxaparin in patients with spinal injuries. The authors of this previous study describe the use of enoxaparin 30 mg twice daily in 105 patients with no cases of clinically evident thromboembolism.[1]

The incidence of clinically evident deep venous thrombosis in the spinal injury patients has been reported to be 16.3% while the incidence of subclinical events exceeds 79% if tests including fibrinogen uptake test and venography are used for diagnosis.[1,2] The present study found six (2.2%) out of 276 patients who developed clinically evident deep venous thrombosis confirmed by venous ultrasonography and venography. Of these only two (0.7%) developed this complication while still on enoxaparin.

The rate of fatal pulmonary embolism in patients with spinal injuries has been reported to be 2.7%.[3] In the present study there was no incidence of fatal pulmonary embolism although there were two (0.7%) cases of non fatal pulmonary embolism. One of these patients had a fractured pelvis and had already stopped enoxaparin. The other patient had not received enoxaparin for the first 6 days of the injury and was the only patient with no neurological deficit who developed an episode of clinical thromboembolism.

A previous study describes the use of another low molecular weight heparin, logiparin, in a dose of 3500 anti Xa-U once daily for 8 weeks.[3] Out of 68 patients administered logiparin, seven developed thrombosis confirmed by venography. Logiparin was found to be more economic than standard unfractionated heparin.[3]

The optimum duration for administration of chemical prophylaxis in patients with spinal injuries is not known. Some authors have suggested a duration of 8 weeks.[3] While 3 months duration of chemical prophylaxis has been recommended in those with persistent paralysis,[4] investigators found a deep vein thrombosis incidence of 6% in patients whose chemical prophylaxis was stopped after 8 weeks.[4] In the present study 1.8% of patients suffered clinical thromboembolic complication after stopping enoxaparin. Four patients developed deep vein thrombosis and one pulmonary embolism, all of these developed within 3 months of injury. Authors in another study used the ASIA (American Spinal Injuries Association) neurological impairment classes as their guide to select the optimum duration for thromboembolic prophylaxis. They recommended a regimen of using compression boots in every patient with spinal injury for 2 weeks, anticoagulants while in hospital for ASIA class D, up to 8 weeks for ASIA class A, B, and C, increasing it to 12 weeks or until discharge from rehabilitation in those with complete motor deficit and associated risk factors.[5] We suggest that chemical thromboembolic prophylaxis may be needed for 12 weeks at least in high risk cases with complete neurological deficit, although a prospective controlled study would be needed to find out the optimum duration. We did not analyze the costs involved but a previous study compared the cost effectiveness of enoxaparin to unfractionated heparin in patients with spinal injuries who had developed deep vein thrombosis and concluded it to be more cost effective and less labour intensive.[6]

A major complication of using chemical thromboembolic prophylaxis is bleeding. Previous studies have reported bleeding to be associated with use of enoxaparin in three out of 60 patients,[1] and with logiparin in one out of 68 patients.[3] In the present study one (0.36%) out of 276 patients may have had an intraspinal bleed postoperatively despite stopping enoxaparin on the day of surgery. There was no other clinical evidence of bleeding problems.

The present study had some limitations. Only the patients with clinical suspicion had radiological investigations to identify deep vein thrombosis or pulmonary embolism and a number of subclinical cases could be detected if all the patients were subjected to auxiliary investigations. It is unlikely however that any clinical cases of thromboembolism were undiagnosed as patients were reviewed daily in the high dependency unit and at least twice weekly in the rehabilitation unit by an experienced clinician (AM or MF) and daily by junior medical staff. This was a retrospective study and we suggest that prospective randomised controlled trial would be needed to clarify choice and duration of thromboprophylaxis. We suggest that the administration of subcutaneous enoxaparin in a dose of 40 mg once daily along with the use of compression stockings, early passive and active mobilisation compares favourably with other regimes for thromboembolic prophylaxis in patients with acute spinal injuries.

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