FREQUENCY OF DEEP VEIN THROMBOSIS IN IMMOBILIZED PATIENTS AFTER SPINAL CORD INJURY AND SEVERE BRAIN TRAUMA

MAGDALENA MACKIEWICZ-MILEWSKA¹, SABINA LACH-INSZCZAK¹, WITOLD HRYNCEWICZ², STANISŁAW PILECKI³, WOJCIECH HAGNER¹, GRAŻYNA DYMEK⁴, IWONA SZYMKUĆ¹

Department of Physical Medicine and Rehabilitation, Collegium Medicum UMK in Bydgoszcz¹
   Kierownik: dr hab. W. Hagner, prof. nadzw. UMK

Department of General Surgery and Vessel Surgery, Collegium Medicum UMK in Bydgoszcz²
   Kierownik: dr hab. S. Molski, prof. nadzw. UMK

Laboratory of Nuclear Medicine, Department of Endocrinology and Diabetology, Collegium Medicum UMK in Bydgoszcz³
   Kierownik: prof. dr hab. R. Junik

(Department of Laboratory Diagnostics, Collegium Medicum UMK in Bydgoszcz⁴
   Kierownik: prof. dr G. Odrowąż-Sypniewska

Patients after spinal cord injury, severe brain trauma and cerebral stroke (ischemic or hemorrhagic) are often immobilized in bed or wheelchair for months or even years. One of the main risk factor for deep vein thrombosis is just prolonged immobilization.

The aim of the study was to evaluate the frequency of symptomatic and asymptomatic thrombosis among immobilized patients because of severe brain damage and spinal cord injury.

Material and methods. The study included 59 patients with tetra or paraparesis after severe brain damage or spinal cord injury, hospitalized in the University Hospital in Bydgoszcz in the Department of Rehabilitation over the period 2007-2008. All of them had lower extremities duplex-scan ultrasound as a screening examination and D-dimer testing.

Results. Thrombosis was confirmed in nine patients (15% of all examined) and two patients (23%) in his group were of asymptomatic. 77% of diagnosed patients had only low extremities edema. Full symptomatic thrombosis with low extremities edema, increased warmness and redness were observed in 22% of patients.

Conclusions. It is advisable to make periodical lower extremities venous system examination to exclude deep vein thrombosis. The risk of missed diagnosis in this group of patients is connected with increased percentage of embolism complications during the rehabilitation process. In patients after spinal cord injury, there are indications to examine the patients’ venous system periodically.

Key words: deep vein thrombosis, spinal cord injury, brain trauma

Severe brain damage as a result of brain injury, hemorrhagic and ischemic stroke or brain stem is often the cause of deep tetra, para or hemiparesis. It is connected with long term immobilization in bed or wheelchair. Another cause of patient immobilization is tetra or paraplegia as a result of spinal cord injury (SCI).

The main risk factor of developing venous thromboembolic disease such as: deep vein thrombosis or pulmonary embolism is prolonged immobilization or just injury.

The risk of developing deep vein thrombosis (DVT) in patients after spinal cord injury, in the absence of prophylaxis, is estimated to be 8 to 100% (1, 2, 3) and contained large percentage of asymptomatic DVT (1, 4). The number of venous thromboembolic events (VTE) in patients after severe brain injury fluctuates between 6 and 55% (2, 5).
Long term immobilized patients, because of the above mentioned, are often admitted to the rehabilitation facility and assuming of orthostatic position by man or other equipment for the first time after injury. They follow the intensive movement therapy. Because of the large percentage of asymptomatic thrombosis (1, 6), it is very important for all rehabilitation team whether the patient has or had DVT. It is extremely important for prophylaxis or treatment of DVT before planning the whole process of rehabilitation.

The authors find this subject very interesting because there is no strict standards how long we should continue the deep vein thrombosis prophylaxis in immobilized patients in bed or wheelchair.

The aim of the study was to: 1) evaluate the frequency of deep vein thrombosis in immobilized patients after severe brain damage or spinal cord injury; 2) evaluate the frequency of asymptomatic deep vein thrombosis in this group of patient.

MATERIAL AND METHODS

59 patients after severe brain damage or spinal cord injury were admitted to the University Hospital CM UMK in Bydgoszcz, Department of Physical Medicine and Rehabilitation and recruited to this study. In the examined group, 19 women and 40 men were in average age, i.e. about 36 years old. 33 of 59 patients (59%) were after spinal cord injury (SCI) (17 after cervical SCI and 18 thoracic and lumbar SCI), 12 of 59 examined subjects (20,5%) were after brain injury, 9 patients of 59 (16,5%) after ischemic cerebral stroke and 5 subjects of 59 (4%) after hemorrhagic stroke. The mean time from the date of injury to hospitalization was 19 months (from 1 to 120 months). In clinical examination, 63% had tetraplegia, 23% had spastic plegia, 8% had flaccid plegia and 7% had hemiparesis or hemiplegia. None of patients were able to walk, all stay in bed or wheelchair.

All patients were diagnosed by lower extremities duplex-scan ultrasound in the Department of General Surgery and Vessel Surgery Collegium Medicum UMK. All group of patients had laboratory findings: D-dimmer in the Department of Laboratory Diagnostics Collegium Medicum UMK. Clinically, we assessed the presence of low extremities swelling, redness, increased warmness and pain. Before admission to the rehabilitation ward, only 22 patients used low molecular weight heparin (LMWH) as the deep vein thrombosis prophylaxis.

RESULTS

In duplex-scan ultrasound nine patients were found to have deep vein thrombosis and
three patients have post-thrombotic syndrome. Six of them were found calf DVT (3 subjects after cervical SCI, 2 subjects after thoraco-lumbar SCI and 1 patient after brain stroke). Two patients of 9 had deep vein thrombosis in left femoral vein (1 patient after thoraco-lumbar SCI and 1 subject after cerebral hemorrhage), in one patients of nine were found to have bilateral deep vein thrombosis in femoral and calf veins. Post-thrombotic syndrome (PTS) has been found in 3 of 59 patients as forms of trophic lesion. They had DVT in the past confirmed in ultrasounds.

The average laboratory findings are not significantly different from the normal value: D-dimer 257 µg/l (from 55 to 1201 µg/l). We regarded the laboratory value as a normal one, no more than 228 µg/l. The authors divided all the subjects into four groups because of large discrepancy and to emphasised enlarge in D-dimer assay:

group 1: D-dimer assay 55 –227 µg/l; 31 patients,
group 2: 228-500 µg/l; 19 patients,
group 3: 500-1000 µg/l; 4 patients,
group 4: above 1000 µg/l; 2 patients.

In examined group 25 had increased D-dimer values. Increased D-dimer values had only 5 patients with recognized DVT in duplex ultrasounds.

In group 3 and group 4 with enlarged values of D-dimer only five subjects had DVT confirmed in duplex-scan. Four patients had DVT confirmed in duplex ultrasounds despite low values of D-dimer.

Before admission to the Rehabilitation Department in the University Hospital in Bydgoszcz, eight of 59 patients (14%) had DVT (7 after brain injury and 2 after SCI). Twenty two subjects of 59 (37%) had pharmacological deep vein thrombosis prophylaxis (low molecular weight heparin). Despite this option for prevention of VTE, four patients had DVT during hospitalization confirmed in duplex-scan. In this group, two subjects were after thoraco-lumbar SCI, one patient after cervical SCI and one patient after ischemic stroke. The mean time from date of injury to DVT diagnosis was five months. The authors have to emphasise that all patients during the process of rehabilitation had both options for prevention of VTE: mechanical (graduated compression stockings, intermittent pneumatic compression stockings) and pharmacological (low molecular weight heparin LMWH).

Clinically, we assessed the presence of lower extremity swelling in thirty two of 59 patients (54%), redness and increased warmness was assessed in four subjects (7%) and pain was assessed in one patient (2%). In the whole group of 59 patients nine subjects had newly diagnosed DVT (16%), seven of them had low extremity swelling (77%), 2 patients had incre-

<table>
<thead>
<tr>
<th>The kind of injury</th>
<th>Cervical spinal cord injury</th>
<th>Thoraco-lumbar spinal cord injury</th>
<th>Brain injury</th>
<th>Cerebral ischemia and hemorrhage</th>
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<tr>
<td>DVT in Duplex scan</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
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<tr>
<td>Paraparesis</td>
<td>0</td>
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<td>Tetraparesis</td>
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<td>Hemiparesis</td>
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<tr>
<td>The average time from injury to diagnosed thrombosis (months)</td>
<td>54</td>
<td>4</td>
<td>12</td>
<td>18</td>
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Fig. 1. The clinical symptoms analysis in the group of subjects
ased redness and warmness (22%), none of them reported pain.

DISCUSSION

Deep vein thrombosis (DVT) and pulmonary embolism (PE) are called venous thromboembolic disease (VTE). This illness is common and, statistically, one in forty persons in Poland every 40 persons has DVT (7), in the USA, over 200 000 new cases are diagnosed annually (8). Thirty per cent of these patients die within 30 days (8). The most dangerous is pulmonary embolism (PE) which develops in 12-20% patients with untreated deep vein thrombosis and 0.7-2% of them suddenly die (5, 8). One-fifth of all patients die suddenly because of PE.

The long term complications of DVT are: recurrence of ipsilateral DVT 7-20% or post-thrombotic syndrome (PTS) 20-50% (9, 10, 11). PTS is characterized by edema, telangiectasias, hyperpigmentation, eczema, varicose collateral veins and in severe cases lipodermatosclerosis and ulceration (7, 9).

The main and strong predictors for VTE are: brain trauma, spine injury, hip fracture, lower extremity or pelvic fracture, thoracic trauma, malignancy, coagulopathy, obesity, age over 45 years, surgical procedure and long term immobilization (1, 5, 7, 8, 10, 12).

Patients after severe brain damage (brain injury or stroke and spinal cord injury) are the highest risk group of VTE because of long term immobilization and event of trauma. Experience shows that directly after the trauma, the patients first remain in the intensive care unit, neurosurgery and surgery departments; DVT is diagnosed only when the patients are fully symptomatic (edema, redness, increased warmness and pain which is often not reported) or increased D-dimer value.

Distal deep vein thrombosis in this group of patient is often asymptomatic and possible to diagnose only by duplex-scan and D-dimer testing. None of these methods is fully successful in proximal DVT diagnosis (2, 5, 8, 13). According to Sharm, approximately 20-25% untreated calf vein thrombi extend to popliteal and femoral veins leading to proximal DVT. Deep vein thrombosis is asymptomatic of 68% patients according to cited author. Piotrowski et al. investigated 3154 trauma admissions and diagnosed DVT in 5.8% patients and 85% of them were unsuspected clinically (5), according to Cipole, asymptomatic DVT was found in 77% of trauma (2).

In our group of patients asymptomatic DVT was diagnosed by duplex-scan ultrasounds in 22% of subjects. 77% of diagnosed patients had only low extremities edema. Fully symptomatic thrombosis with low extremities edema, increased warmness and redness were observed in 23% of patients. According to only fully symptomatic DVT, asymptomatic DVT had 78% of examined patients what is similar with other investigations. The pain is not a symptom in our group of patients because the subjects did not feel it. Lower extremities edema is a common symptom in immobilized patients. We recognized it in 57% of examined patients, probably because of vasomotor disorders or post-thrombotic syndrome. The enlarge D-dimmer assays were diagnosed in 55% of patients with DVT.

We believe that DVT screening by duplex ultrasound is very important. It is a cheap, noninvasive and widely available technique (2, 9).

In the USA, a number of large clinical studies to evaluate the frequency of DVT in trauma patients were carried out. The diagnosis was confirmed by screening duplex ultrasound examination. DVT was diagnosed in 5.8% of patients (3154 trauma patients) in Piotrowski et al. study (5), in 6% of subjects T. Jones study (16240 patients after SCI) (1), and 6.3% of patients in Sharm trial (2173 trauma patients) (8) and 11.6% of patients after SCI (189 group of patients) in Simons study (14). According to Geerts (15) study, the frequency of thrombosis after acute trauma patients were 58% of subjects and after spinal cord injury 62% of patients. These patients had no mechanical or pharmacological prophylaxis and diagnosis of DVT was confirmed by venography. In our study, DVT was diagnosed and confirmed by duplex-scan in 16% of cases. In 19% of patients after cervical spinal cord injury with tetraparesis, 12% of subjects after thoraco-lumbar injury with paraparesis. According to Geerts study (62% of patients with thrombosis after spinal cord injury) our patients were diagnosed after several months from injury. The thrombosis is usually diagnosed after 3 months from injury (1). In other studies DVT after injury were diagnosed in lower percentages.
In our group of subjects with prophylaxis (22 patients) DVT was diagnosed in 18% of subjects. In group of patients without prophylaxis (36 patients) DVT was found in 14% of patients. Interesting is such a large percentage of DVT in patients who used low molecular weight heparin. Those four subjects were the highest risk group of VTE. Two of them had DVT and one patients had PE (one patient after spine injury and one after stroke) before they were admitted to the Department of Physical Therapy and Rehabilitation in Bydgoszcz. Another two of four patients had spine injury less than three months before admission to our department. Jones et al. diagnosed DVT in 88% of patients during the first three months after spine injury. Piotrowski et al. investigated trauma patients who used prophylaxis and diagnosed DVT in 6% of subjects (10). In Sharm study DVT was diagnosed in 9% of patients with prophylaxis and in 13% of patients without prophylaxis.

When prophylaxis is used in patients after brain and spinal cord injury, the number of DVT significantly decreases (1, 2, 16). Many patients after trauma unfortunately have contraindications to low molecular weight heparin because of high bleeding risk (5, 8, 13). However a lot of authors recommend mechanical form of prophylaxis for example: graduated compression stockings, intermittent pneumatic compression stockings (2, 6, 8,13). Application of intermittent pneumatic compression stockings as a DVT prophylaxis method is not well proven. Skillman et al. made a study on 98 patients with and without intermittent pneumatic compression stocking, it showed that those with this kind of mechanical prophylaxis had DVT in 8.5% and without in 25% (13).

Graduated compression stockings and intermittent pneumatic compression stockings are rarely recommended in Poland as DVT prophylaxis of deep vein thrombosis. We had only one patient with graduated compression stockings as prophylaxis, his therapy was recommended in Germany where the subject had an accident. Patients with tetraparesis hospitalized in Rehabilitation Department are all advised to wear graduated compression stockings.

Another method of deep vein thrombosis prophylaxis is vena cava filter. It is considered in patients with the highest VTE risk: age over 45 years, contraindications to LMWH, multiple brain and spinal trauma, pelvic and lower extremities fractures. In this group although vena cava filter was used still 15-23% of patients had DVT (1, 2). In the group of the subjects there was only one patient with vena cava filter. He was a 40-years-old male after cervical spinal cord injury and DVT plus PE just two months after accident. Also, DVT was diagnosed once again five months after injury in our clinic.

There are no strict indications how long should DVT prevention in patients after brain trauma or spinal cord injury be kept. In the literature, we concluded that the majority of deep vein thrombosis cases are diagnosed during the first three months after injury. This was not confirmed it in our study (1, 2, 8).

The D-dimer assay is a simple, cheap test that may be useful in VTE diagnosis. It has good sensitivity for DVT but poor specificity (5, 9, 13, 16). The references indicate that D-dimer sensitivity is higher for proximal than distal DVT (5, 9).

It is good to remember that D-dimer value can be also higher not only in DVT patients, but also after surgery operations, systemic trauma, cancer disease and in patients over 80 years old (17).

In the conducted study, D-dimer test allowed to diagnose DVT in five out of nine patients. The rest of them had normal values of D-dimer assay. These values were also increased in patients without deep vein thrombosis.

CONCLUSIONS

1. Deep vein thrombosis in patients after spinal cord injury and brain trauma is often not established because of asymptomatic course.
2. The risk of missed diagnosis in this group of patients is connected with increased percentage of embolism complications during the rehabilitation process.
3. In patients after spinal cord injury with tetra or paraparesis, there are indications to examine the patients’ venous system periodically.
REFERENCES


Received: 22.10.2008 r.
Adress correspondence: 85-094 Bydgoszcz, ul. M. Skłodowskiej-Curie 9

COMMENTARY

The problem described in the commented paper is significant because in Poland at least several persons each year have an irreparable damage to the spinal cord, occurring at different levels and connected with a permanent para – or tetraplegia. It is known that many of them have a deep vein thrombosis while being bed ridden and this thrombosis is followed by the pulmonary artery embolism in some of them. These patients are being treated at the beginning in the departments of surgery or in the accident wards but are transferred later on to the departments of rehabilitation and taken care of in these departments afterwards for a long time. The description of thromboembolic complication during this long-term rehabilitation is not often found in the surgical journals and, therefore, the report of Magdalena Mackiewicz-Milewska and co-workers is worth to be published in this issue of Polish Journal of Surgery.

Prof. dr hab. Maciej Szczepański