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The incidence of venous thromboembolism in neurosurgical patients: A retrospective quantitative analysis between 2007 and 2013 at Mater Dei Hospital, Malta

[1] Marija Agius, [2] Shawn Agius, [*3] Karl Camilleri, [*4] Stephanie Azzopardi, [*5] Audrey Micallef

[1] Otorhinolaryngology Head and Neck Surgery Department Mater Dei Hospital, Malta
[2] Neurosurgery Department Mater Dei Hospital, Malta
[3, 4, 5] Department of Medicine Mater Dei Hospital, Malta

Abstract
Aim: Venous thromboembolism (VTE) causes increased morbidity and/ mortality to patients. Neurosurgical patients are at a particularly increased risk of deep venous thrombosis. The aim of this study was to establish a local venous thromboembolism rate and compare to international data.
Method: Clearance from patients' consultants and data protection officer was obtained. A list of all the patients admitted between 1st January 2007 and 31st December 2013 was obtained. Patients were screened for ultrasound doppler, lower limb venogram, CT pulmonary angioram and ventilation perfusion scan results using iSOFT. The files of patients with positive imaging were reviewed.
Results: There were a total of 1927 admissions between 2007 and 2013, sixteen (16) of whom had venous thrombosis and/or embolism. Eleven were females and five were males. Out of these, seven patients had undergone emergency cranial surgery – these included polytrauma patients. Five patients had elective spinal surgery. Thromboembolic prophylaxis had been prescribed in four of the seven patients who underwent cranial surgery and in three of the five patients who underwent spinal surgery. The timing of VTE was: two patients developed VTE 3- 5 days postoperatively, two patients between days 6-7; three patients one week post operatively, and nine patients presented with a VTE two or more weeks postoperatively. Eleven of the sixteen patients had been mobilised early, four had been prescribed thromboembolic deterrent (TED) stockings while one patient had an inferior vena cava (IVC) filter inserted. Postoperatively, low molecular weight heparin (LMWH) had been prescribed to ten patients while un-fractionated heparin was prescribed to one patient. Two patients suffered from a major postoperative bleed. One of these patients died within thirty- days of VTE diagnosis.
Conclusion: Over the last seven years, the overall incidence of thromboembolic phenomena in the neurosurgical unit at Mater Dei Hospital was of 0.83%. This audit showed that the local incidence of thromboembolic events is comparable to that of other neurosurgical units which range from 0.29-7%.

Keywords: Venous Thromboembolis, thromboembolic prophylaxis, cranial surgery, spinal surgery

1. Introduction
Neurosurgical patients are at particularly increased risk of venous thromboembolism namely because of long operating times, reduced mobility after intervention, hypercoagulable state of cancers as well as circulating volume loss either from cerebral salt wasting (e.g. following subarachnoid haemorrhage) or from therapies to reduce vasogenic oedema (mannitol) which increase blood viscosity resulting in an increased risk for thrombosis [4, 3]. The aim of this study was to establish a local venous thrombo-embolism rate and compare to international data [4, 3].

2. Method
Clearance from the neurosurgery consultants at Mater Dei Hospital was obtained and granted. Data protection clearance was granted by the data protection officer at Mater Dei Hospital. IT personnel involved with the uploading of patient data on the computer system were contacted and a list of all the neurosurgical admissions between 2007 to 2013 was obtained. The list of patients was distributed equally among the authors. The patients' identification number was used to serially check the investigations on the local software program, iSOFT. The data looked at included ultrasounds of the lower limbs, Computed Tomography pulmonary angiography (CTPA), nuclear medicine perfusion scan (NM lung scan). The results of the aforementioned investigations were checked and the files of the ones which were positive, meaning that a patient had a DVT/ PE, were requested from the medical records department to look up the history and series of events. The data sought included patient gender, type of surgery, histology, whether there was a record of DVT prophylaxis given and at what stage, the type of prophylaxis, how this affected discharge date and mortality.

3. Results
The time period studied was between 2007 and 2013, which represent the years from migration from the old to the new state-of-the-art hospital till the date of the study. There were a total of 1927 admissions under 6 local consultants – patients operated by visiting consultants were listed under local consultants on the system used so these could not be distinguished. A total of 16 neurosurgical patients (n= 16) had venous thrombosis and/or embolism over a 7-year period (between 2007 and 2013). Majority (11 patients) were females; five were males. Eleven patients underwent cranial surgery of which seven were elective and four had emergency surgery. There were five patients who underwent a spinal operation, all of which were elective.

The histology results of the cranial surgery patients showed malignancy while spinal surgery patients showed four benign histologies and only one malignant.

Venous thromboembolic prophylaxis was prescribed in four of the cranial surgery patients and three of the spinal patients. One of the spinal surgery patients had had already a DVT in the past.

Timeframe of onset of VTE post procedure ranged from 3 days post operatively up to 2 or more weeks postoperatively. There were two patients who developed a VTE between days 3- 5, two patients who developed a VTE between days 6-7, three patients one week post op, and nine patients who presented with a VTE 2 or more weeks postoperatively.

None of these patients were previously taking anti- coagulation treatment such as coumarin.

Eleven patients were mobilised early, four were prescribed TED stockings while one patient had an IVC filter.

Low Molecular Weight Heparin was prescribed in 10 patients, while one patient was prescribed the unfractionated heparin postoperatively.

There were two patients who suffered from a major bleed postoperatively.

Ultrasound findings: Seven patients had a left sided DVT's while two patients had a right sided DVT.

CTPA/ VQ Scan were used to diagnose PE in all patients.

14 patients were discharged on warfarin. Three patients were discharged within one week, three patients were discharged between 1-2 weeks, 10 patients were discharged between 4-8 weeks postoperatively. There was only one thirty- day mortality.

Table 1 shows the main results in a tabular form.

Table 1: Results of Incidence of Venous Thromboembolism at Mater Dei Hospital between 2007- 2013

n=	16
Females	11
Males	5
Elective Cranial Surgery	7
Emergency Cranial Surgery	4
Elective Spinal Surgery	5
Histology results	
Cranial- Malignant	11
Cranial- Benign	0
Spinal- Malignant	1
Spinal- Benign	4
VTE Prophylaxis	
Early mobilisation	11
TED stockings	4
IVD filter	1
Timeframe of VTE onset postop	
Days 3-5	2
Days 6-7	2
One week	3
Two weeks or more	9
LMWH	10
Unfractionated Heparin	1
Major post- op bleed	2
US findings	
Left sided DVT	7
Right sided DVT	2
Discharged on warfarin	14
Discharge date	
Within one week	3
Within 1-2 weeks	3
Within 4- 8 weeks	10
30- day mortality	1

4. Discussion

Over the last 7 years the overall incidence of thromboembolic phenomena in the Neurosurgical Unit at Mater Dei Hospital was of 0.83% (16/1927). To date there is no publication of incidence of overall thromboembolic events in a neurosurgical unit. The studies available discuss incidence in patients with traumatic brain injuries, patients undergoing cranial surgery and those undergoing spinal surgery or suffering from spinal trauma. The latter group were excluded since spinal trauma is under the care of the orthopaedic team in our hospital.

A retrospective study similar to this audit found an incidence of 7% of thromboembolic phenomena in 492 craniotomy patients. 5% had DVT, 4% developed PE and 1% died from a massive PE [1].

In another study of 1703 patients the incidence was 1.59%. In this study, tumour specific incidence was calculated: meningioma – 3.09%, glioma – 0.97%, and metastasis 1.03%. The authors suggested that this difference might reflect the difference in surgical time or because the meningioma itself might chemically predispose to thrombosis.[5,] On the other hand in observational studies the episodes of thromboembolism in traumatic head injury patients has been quoted as 11 to 39% [7, 2]. Half of these patients developed pulmonary embolism. In a study involving 1,111 elective spinal surgery cases, the incidence of thromboembolic events was 0.29% [6].

Locally the patients are encouraged to mobilise as early and as safely tolerated by patients. Those who cannot be mobilized out of bed are prescribed physiotherapist-guided exercises in bed. Patients who undergo extradural spinal surgery are prescribed LMWH postoperatively. This is stopped once the patient has regained independent mobility. On weekends the physiotherapy service at Mater Dei is decreased however the patients who are most at-risk are seen by the on-call physiotherapists.

Intraoperatively particular care is taken to avoid pressure points by using specific devices e.g. Wilson frame and using padding and gel pads over pressure-prone areas.

At the time when this study was started there were only two pneumatic compression devices (PCD) in theatres. Our team was prescribing them for every operation. Now the PCD are also available on the ward. As expected vigilance increased after this audit i.e. the threshold for Doppler investigation lowered. This resulted in an increased detection of superficial DVT episodes – these patients were thus managed to prevent worsening of the thrombosis.

Patients who have had cranial surgery are rarely prescribed chemical thromboprophylaxis because of the possible devastating consequences of postoperative bleeding. During this audit the literature has been reviewed which showed that

the risk of significant bleeding attributable to chemical thromboprophylaxis is low. This has lowered our threshold for prescription of thromboprophylaxis especially for polytrauma patients.

5. Limitations

- This was a retrospective audit. The data depended on medical professional notes which might not have been comprehensive.
- Patients investigated privately would not have been detected by our method.
- If a patient died because of an undiagnosed thromboembolic event which might have been discovered post mortem, he/she would not have been detected in this audit.
- Asymptomatic DVTs and PEs would have been missed.

6. Conclusion

This audit found our local incidence of thromboembolic events to be comparable to that of other neurosurgical units abroad. Nonetheless it motivated the neurosurgical team to enforce good practices and improve the service available to our patients in the prevention and early treatment of thromboembolism.

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

7. References

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