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Original Research Paper

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BALANCING ANTICOAGULATION AND NEUROLOGICAL INTEGRITY IN TRAUMATIC BRAIN INJURY: A CLINICAL TIGHTROPE WALK

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ABSTRACT Introduction: Traumatic brain injury (TBI) poses challenges in managing complications like venous thromboembolism (VTE). Balancing VTE prevention with minimising neurological deterioration is crucial, especially in immobilised patients needing surgery. Materials and Methods: A 32-year-old male presented to ER after a road traffic accident, sustaining a head and left lower limb injury with a history of loss of consciousness, a Glasgow Coma Scale (GCS) of E4V5M6 and was hemodynamically stable. Initial NCCT brain imaging revealed contusions in the left fronto-temporal region, and X-ray confirmed a left subtrochanteric and intertrochanteric femur fracture. On post-trauma day 2, the patient was cleared for orthopaedic surgical intervention and received pharmacological anticoagulation. On day 4, patient was shifted to Operating Room for planned orthopaedic procedure. However, the surgery was deferred due to significant decline in neurological status, with repeat CT showing worsening contusions and intraventricular hemorrhage, necessitating a return to neurosurgical management. Results: This case illustrates how safety measures, such as chemical VTE prophylaxis, can become a risk factor for neurological deterioration in TBI patients, particularly those who are immobilised and undergoing surgical procedures. Conclusion: There are no universally accepted guidelines for postoperative anticoagulation in TBI patients. Management should be individualized, weighing the risks of thromboembolism against potential neurological decline. Further studies are needed to develop standardized protocols for VTE prophylaxis in this high-risk population.

KEYWORDS : Traumatic Brain injury, Venous thromboembolism, Venous thromboembolism prophylaxis, enoxaparin

INTRODUCTION

Traumatic brain injury (TBI) predominantly affects younger individuals and is associated with potentially devastating outcomes. [1-2] Patients with moderate to severe TBI are susceptible to progressive intracranial bleeding (ICB). Worsening of ICB occurs in approximately 32%–50% of patients who develop intracranial bleeding following trauma, with progression most commonly observed within the first 24 hours.[3]

Venous thromboembolism (VTE) occurs in approximately 20%–30% of patients with traumatic brain injury (TBI). [4-5] Recommendations regarding the optimal timing for initiation of pharmacological VTE prophylaxis, particularly in patients requiring operative intervention, remain variable. Enoxaparin has demonstrated effectiveness in lowering the risk of VTE in trauma patients, resulting in a 30% reduction in overall deep vein thrombosis (DVT), a 58% reduction in proximal vein thrombosis, and an overall reduction of 31%[6].

In patients with TBI, the primary concern with pharmacological VTE prophylaxis is the potential for worsening intracranial pathology.

CASE STUDY

Emergency Room Arrival: A 32-year-old male presented to the emergency department following a road traffic accident, sustaining head injury along with trauma to the left lower limb, with a history of loss of consciousness at the scene. On arrival, the patient was hemodynamically stable, and neurological assessment revealed a Glasgow Coma Scale (GCS) score of E4V5M6.

Diagnostic Imaging: Non-contrast Computed tomography (NCCT) brain revealed intraparenchymal contusions in left fronto-temporal region. (figure 1)

X-ray of left femur confirmed an intertrochanteric and subtrochanteric femur fracture. (figure 2)

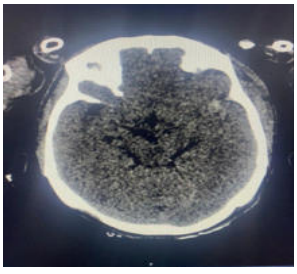

Figure 1: NCCT Brain - Left fronto-temporal contusion. (Day 1)

Figure 2: Left subtrochanteric and intertrochanteric femur fracture.

Surgical clearance and Anticoagulation: 48 hours post admission; the patient was cleared for orthopedic surgical intervention and at this point pharmacological anticoagulation with low molecular weight heparin 60 mg subcutaneously once daily was initiated as a preventive measure against Venous thromboembolism.

Figure 2: Left subtrochanteric and intertrochanteric femur fracture.

Complications and change in management: On day 4, the patient was shifted to operating room for open reduction and internal fixation. However, upon pre-operative assessment, a sudden significant decline in the patient's neurological status from E4V5M6 to E3V4M5 was observed, necessitating re-evaluation. Repeat NCCT brain revealed worsening of contusions and intraventricular hemorrhage. (figure 3)

In view of this finding, the planned orthopedic intervention was deferred, and the patient was shifted to neuro-intensive care unit for close neurological monitoring and further management.

The chemical VTE prophylaxis (enoxaparin) was discontinued. The patient was managed conservatively with anti-intracranial pressure (anti-ICP) measures, including head end elevation to 30°, adequate oxygenation and airway protection, strict hemodynamic monitoring, sedation and analgesia, osmotic diuretics, fluid and electrolyte balance, serial neurological assessments and repeat neuroimaging as required.

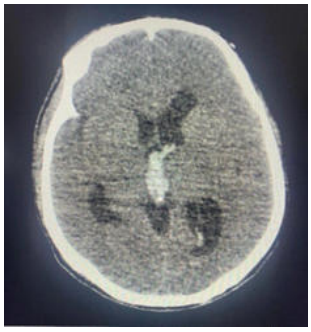

Figure 3: Repeat NCCT Brain- Intraventricular hemorrhage (Day 4)

Hospital Course and Outcome: Over the course of 20 days of hospitalization, serial CT scans demonstrated progressive resolution of the cerebral contusions and intraventricular hemorrhage. The patient showed gradual neurological improvement ultimately regaining a GCS of E4V5M6. The patient was then considered fit for definitive orthopedic management. The patient then underwent open reduction and internal fixation with proximal femoral nailing and plating. (Figure 4)

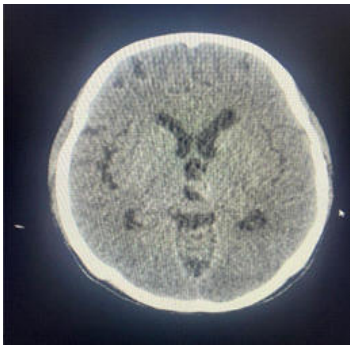

Figure 4: NCCT Brain- Resolution of Intracranial hemorrhage (Day 20)

The postoperative course was uneventful, and the patient remained neurologically stable thereafter.

Figure 5: Post operative X-ray -left femur-Open reduction and internal fixation with proximal femoral nailing and plating

DISCUSSION

Reducing the incidence of venous thromboembolism (VTE) with pharmacological prophylaxis remains an important objective in neurosurgical patients. A meta-analysis reported a 21.5% incidence of VTE in patients who did not receive prophylaxis, whereas the rate of intracranial hemorrhage associated with prophylactic therapy ranges between 1.5% and 3%.[7-8] The use of pharmacological prophylaxis for VTE in

patients with TBI remains controversial, with limited data describing its use specifically in operative cases. In 2015, the American College of Surgeons Trauma Quality Improvement Program (TQIP) released guidelines for the management of traumatic brain injury, recommending consideration of venous thromboembolism (VTE) prophylaxis within the first 72 hours of hospitalization after confirmation of a stable head CT scan.[9]

However, the latest guidelines from the Brain Trauma Foundation (BTF) state that current evidence is insufficient to establish a definitive recommendation regarding the optimal timing for initiating VTE prophylaxis after traumatic brain injury, highlighting the need for further high-quality research in this area.

The present case illustrates this clinical dilemma. Our patient, who sustained cerebral contusions along with a femoral fracture, initially demonstrated neurological stability and was cleared by the neurosurgical team for orthopaedic intervention. In view of the high risk of venous thromboembolism associated with long-bone fractures, pharmacological prophylaxis with low molecular weight heparin (enoxaparin) was initiated. However, on the day planned for surgical fixation, the patient developed a sudden decline in sensorium, and repeat neuroimaging revealed progression of the intracranial hemorrhage, necessitating further management and monitoring in the neurosurgical intensive care unit before eventual neurological recovery. This case highlights the delicate balance between thromboprophylaxis and neurological safety in patients with traumatic brain injury and underscores the need for clearer, evidence-based guidelines regarding patient selection and optimal timing of VTE prophylaxis.

CONCLUSION

This case highlights the importance of careful patient selection, close neurological monitoring, and individualized decision-making when initiating anticoagulation in patients with traumatic brain injury.

Thus, the management of TBI patients requiring thromboprophylaxis often represents a clinical "tightrope walk," where the benefits of preventing venous thromboembolism must be cautiously weighed against the risk of exacerbating intracranial injury. Moreover, absence of universally accepted guidelines for prophylactic anticoagulation and TBI patients obliges the need for standardised protocols.

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