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Case Study

Perioperative Haemostatic Management in a Patient Undergoing Craniotomy for Excision of Meningioma: Role of Thromboelastography

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Abstract

Although there is a general predisposition towards hyper-coagulability during brain tumour surgery, hypo-coagulability may exist in certain cases even before surgery, detectable only when the physical characteristics of clot formation are studied by viscoelastic point-of-care tests like thromboelastography (TEG). Herein we present a case of a 66-year old male patient with left frontal convexity meningioma, scheduled for craniotomy and excision of tumor. Patient's preoperative coagulation profile (as assessed by conventional tests) was within normal limits but he was bleeding profusely from the beginning of the surgery and there was massive bleeding during tumour resection. Based on findings of TEG which revealed a severe hypo-coagulable picture (low α angle, MA value and CI value with high K value), 10 units of cryoprecipitate and 4 units of random donor platelets were transfused intra-operatively in addition to 2 units of PRBCs. Haemodynamic stability was achieved and subsequent intra-operative course was better. One more unit of PRBC was transfused in the immediate post-operative period and a repeat TEG after 4 hours showed a trend towards normalization of TEG parameters suggesting a restoration of coagulation competency which also correlated with improved clinical condition of the patient.

Keywords: Thromboelastography, Intracranial Surgery, Meningioma, Hyper-coagulability, Hypo-coagulability

Introduction

Intracranial surgery is associated with a higher incidence of coagulation disorders compared with general surgical procedures[1,2] and the incidence is related to the severity or extent of brain tissue injury, sometimes as a consequence of surgery[3]. Although there is a general hyper-coagulability during brain tumour surgery, in certain cases, a predisposition towards hypo-coagulability may exist even before surgery,[4,5] detectable only when the physical characteristics of clot formation are studied by a viscoelastic point-of-care test such as thromboelastography (TEG). TEG provides a rapid assessment of haemostasis from clot initiation and development to fibrinolysis involving both cellular and plasmatic components of haemostatic system. Here we present a case of massive bleeding occurring intra-operatively in a patient of meningioma who was successfully managed using this viscoelastic method for monitoring of coagulation profile and blood component support.

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Case Report

A 66-year old male patient with left frontal convexity meningioma with hypertension and diabetes was scheduled for craniotomy and excision of tumour. The patient was fully conscious and oriented and no sign of raised intracranial pressure was present. His pre-operative coagulation profile and other laboratory investigations were within normal limits [Hb 9.5 g/dl; PT 12.8 s (control 11.8 s); APTT 22.1 s(control 26.7s); platelet count 114x10^9/L]. Two units of packed red blood cells (PRBC) were arranged pre-operatively although platelet concentrates and FFP were not ordered as platelet count and coagulation tests were not considered to be abnormal. In fact, APTT of the patient was even less than the control value. Patient was on Tab Amlodipine 5mg once daily and Tab Phenytoin 100mg thrice daily. Both oral medications were continued on the day of surgery. General anaesthesia was induced with intravenous fentanyl 100 mcg and propofol 120 mg and the muscle relaxation was achieved using vecuronium 6 mg. The patient's trachea was intubated orally with 8.5 mm internal diameter cuffed endotracheal tube. Anaesthesia was maintained with sevoflurane in a mixture of oxygen and air along with propofol infusion and intermittent doses of fentanyl and vecuronium. Besides two large bore IV cannulas, right IJV and left radial artery were also cannulated. Intra-operative monitoring included ECG, pulse oximetry, intra-arterial pressure, body temperature, capnography, blood sugar level, blood gases, urine output and CVP. Intra-operatively, blood was oozing profusely from the surgical site from the beginning of the surgery. After some time into the surgery, when the tumour resection was being carried out, the patient started bleeding massively and haemodynamic derangement started to occur. As the calculated blood loss was significant and haematocrit had dropped to 20 % (from 30%) as seen on blood gas analysis, two units of PRBCs were transfused along with crystalloid solutions before the samples for investigations were drawn. Along with conventional coagulation tests, a TEG was also ordered. TEG was run on the kaolin activated citrated venous sample and main parameters measured were:

- **R (Reaction time)** → Time from the beginning of the trace until amplitude of 2 mm is reached.
- **K (K time)** → The time from the end of R until a fixed level of clot strength is reached.
- **α angle (clot formation rate)** → the angle of the trace from the horizontal at a point on the trace until amplitude is 20 mm.
- **MA (Maximum Amplitude)** → A measure of maximum strength of the clot and assesses the function of the platelets and to some extent fibrinogen.
- **CI (Coagulation index)** → A linear combination of above parameters. Normal values of CI are from - 3.0 to + 3.0, values < - 3.0 represent hypo-coagulable and > + 3.0 represent hyper-coagulable state.

The TEG revealed a severe hypo-coagulable picture (Figure 1):

- The α angle was low and K value high denoting poor fibrinogen activity/level.
- MA value was low denoting poor platelet function/ number.
- CI value was very low denoting an overall hypoco agulable state.

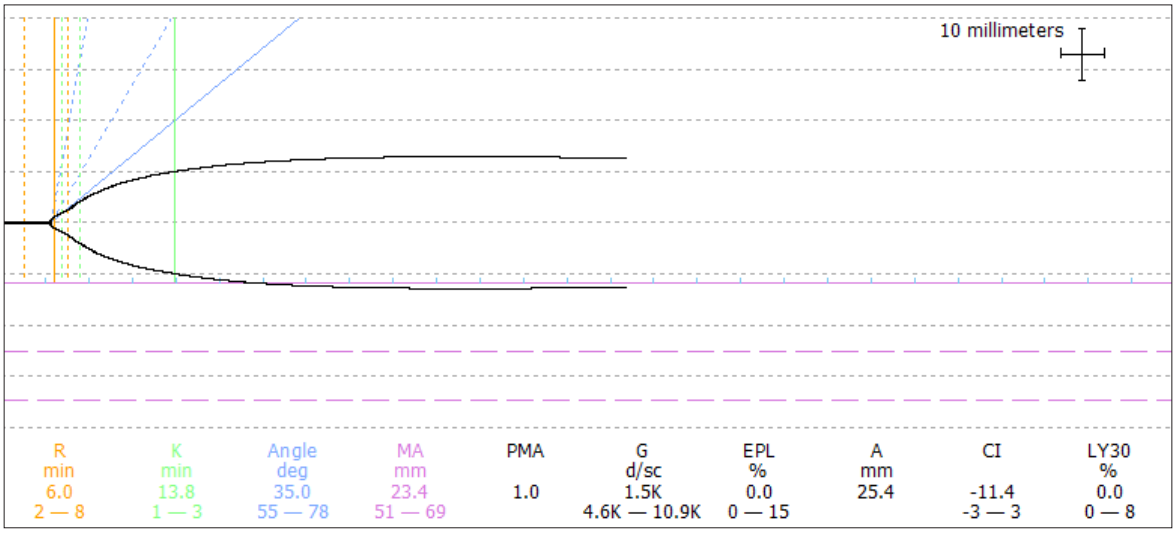

Figure 1.Intra-operative TEG showing a hypo-coagulable tracing with high K and low α Angle along with low MA

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Based on finding of TEG and in view of surgery related coagulopathy, 10 units of cryoprecipitate and 4 units of random donor platelets were transfused. Subsequent intraoperative course was better with regards to bleeding and haemodynamic stability although one more unit of PRBC was transfused intra-operatively and another unit in the immediate post-operative period. At the end of surgery, patient was haemodynamically stable and was shifted to neurosurgical ICU and was provided overnight ventilator support. A post-operative TEG after 4 hours showed a trend towards normalization of TEG parameters (Figure 2) suggesting a restoration of coagulation competency which also correlated with improved clinical condition of the patient. He was weaned off from ventilator and extubated the next morning. He had an uneventful post-operative stay and was discharged from hospital after 8 days.

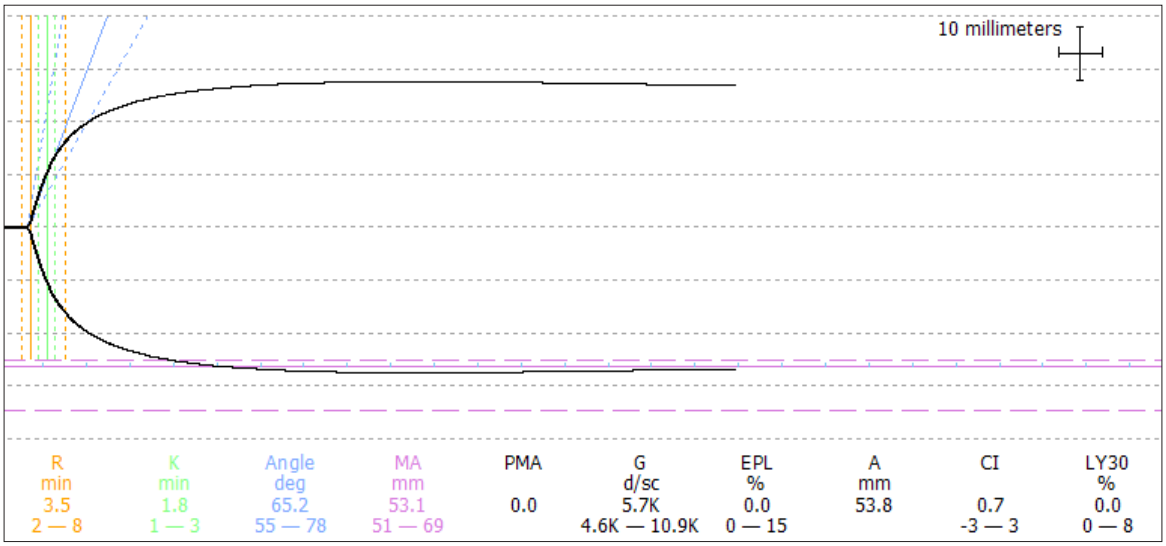

Figure 2.Post-operative TEG showing a normal tracing after blood component therapy

Discussion

The risk of post-operative haematoma is highest after surgery for meningiomas (6–8%)[6,7] and a common association with coagulopathy and thrombocytopenia or platelet dysfunction is seen. So, in life-threatening neurosurgical emergencies, aim should be to achieve full clotting capacity in order to avoid secondary brain damage due to progressive haemorrhage or re-bleeding. Point-of-care tests such as TEG enable contemporary detection of the underlying haemostatic disorders in a timely manner, and thereby facilitate a fast and targeted therapy with haemostatic drugs and coagulation factor concentrates, such as cryoprecipitate, fibrinogen, PCC, factor XIII or rFVIIa. Thrombelastography was first described by Hartert in 1948 as a method to assess the global haemostatic function from a single blood sample. It provides a rapid assessment of haemostasis involving both cellular and plasmatic components of haemostatic system. A hypo-coagulable profile on TEG can foretell about increased blood requirement as was the case in our patient. Similarly, hyper-coagulable states on TEG have been observed in neurosurgical patients which are difficult to be diagnosed by traditional coagulation assays[8]. Thus, by early intra-operative detection and identification of the haemostatic abnormality, appropriate measures can be initiated to prevent postoperative complications.

Conclusions

TEG may be a useful adjunct in overall haemostatic management of patients with brain tumour. Judicious replacement of clotting factors, platelets, and antifibrinolytic agents should be considered intra-operatively if the TEG is abnormal, without waiting for standard laboratory test results which may be misleading at times.

Conflicts of Interest: None

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