CASE REPORT

**Disseminated Intravascular Coagulation Developing After Cranioplasty**

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**ABSTRACT**

Disseminated intravascular coagulation (DIC) developing after cranioplasty, a skull reconstructive surgical procedure, is very rare. The presently reported patient underwent cranioplasty for cranial trauma under general anaesthesia using titanium prostheses. Her laboratory data was unremarkable. She underwent three operations, each complicated by excessive postoperative bleeding. Although the patient received massive blood transfusions, but no cryoprecipitate coagulum was given during the first two re-operations, and excessive bleeding was evident. Laboratory data showed PT prolongation, APTT prolongation, thrombocytopenia and elevation of the D-dimer level, suggestive of DIC. After the third re-operation, the patient received cryoprecipitate coagulum, and there was no apparent bleeding. Administration of cryoprecipitate coagulum for excessive bleeding postcranioplasty may be required in view of this rare complication.

**Key Words:** Disseminated intravascular coagulation. Skull reconstructive surgical procedures. Cryoprecipitate coagulum. Titanium mesh. Cranioplasty.

**INTRODUCTION**

Cranioplasty after decompressive craniectomy, is a very common neurosurgical procedure.¹ The usual complications that may develop after such surgery include infection, haemorrhage, subgaleal fluid collection, and seizure etc. DIC is a disorder characterised by widespread activation of coagulation, which results in intravascular formation of fibrin and thrombotic occlusion of small and midsize vessels.² It may trigger both multiple organ failure and excessive bleeding.

DIC has not previously been reported as a complication of cranioplasty. We present the case of a patient who developed excessive bleeding through drainage tube.

**CASE REPORT**

A 30-year female patient was admitted to our hospital after a traffic accident. She underwent three craniectomies: The first for right frontotemporal subdural hematoma; the second for left occipital epidural hematoma; and the third for left temporal subdural hematoma. She recovered well and was scheduled for cranioplasty to correct the three skull defects after 5 months. Her physical examination was unremarkable, as were her laboratory data (prothrombin time PT, activated partial thromboplastin time APTT, and international normalised ratio INR).

The original incisions were reopened, and titanium prostheses were placed on the deficit area and the edges were attached to the bones with screws. Three drainage tubes were then placed on the prostheses and the scalp was sutured.

The procedure was uneventful until the point at which the last suture was placed prior to extubation. Excessive bleeding (about 50 mL/minute) was evident through the right frontal drainage tube. The right frontal incision was reopened. Multiple mild bleeding were observed on the bone surface. Bone wax was used to stop this bleeding. A drainage tube was placed before closing the incision. Eight units of packed cells (1,600 mL in total) and 2 units of frozen plasma (400 mL in total) were transfused. After the first reoperation, excessive bleeding (about 100 mL/minute) was still evident through the right frontal drainage tube for 4 hours from the time that the operation had concluded. The right frontal incision was reopened once more. Multiple mild bleeding was observed on the scalp surface. Thorough bipolar electrocoagulation was applied to stop this bleeding. A new drainage tube was placed before closing the incision. Eight units of packed cells (1,600 mL in total) and 2.5 units of frozen plasma (500 mL in total) were transfused. After the first reoperation, excessive bleeding (about 100 mL/minute) was still evident through the right frontal drainage tube for 4 hours from the time that the operation had concluded. The right frontal incision was reopened once more. Multiple mild bleeding was observed on the scalp surface. Thorough bipolar electrocoagulation was applied to stop this bleeding. A new drainage tube was placed before closing the incision. Eight units of packed cells (1,600 mL in total) and 2.5 units of frozen plasma (500 mL in total) were transfused. The patient was sent to our neurosurgical ward. The drainage volume was normal during the first 4 hours of stay in the neurosurgical ward. Her neurological condition then began to rapidly deteriorate. She exhibited hypotension (70/40 mmHg), a rapid heart rate (about 110 beats/minute), and a reduction in central venous pressure (CVP) of about 1 cm H₂O.

Laboratory data obtained just before surgery had revealed PT prolongation (20.6 s) and APTT prolongation (>200 s); thrombocytopenia (platelets <40,000 mm³); and elevation of the D-dimer level (>0.5

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DIC usually occurs after infection, multiple organ failure, poisoning, tumor resection, or severe brain injury. DIC developing after cranioplasty is very rare. Prior studies have indicated that most plasma-contained coagulation factors are labile during storage. Although our patient received massive blood transfusions during the first two re-operations, bleeding through drainage tubes was still evident. After the third re-operation, bleeding stopped, after the patient received cryoprecipitate coagulum. This was administrated due to the laboratory profile: PT prolongation, APTT prolongation, thrombocytopenia and elevation of the D-dimer level, suggesting DIC. This indicates that the reduced levels of coagulation factors rendered it difficult to stop the bleeding and the transfusion of cryoprecipitate coagulum resolved the problem.

It is well known that re-operation significantly increases the risks of surgical incision and intracranial infection. However, economic and social factors are always in play. Thus, the surgeon chose to retain the expensive prostheses, thereby minimising both cost and surgical pain. Daily dressing changes and antibiotic therapy eliminated possible wound and intracranial infections during the hospital stay. The incisions resolved (albeit with scarring). However, the authors were of the view that the decision to retain the titanium prostheses was questionable.

Surgeons are relatively isolated when operating. When massive postoperative bleeding first occurred, we should have considered that DIC was in play. However, it was assumed that precise bleeding points could be defined. Furthermore, it was expected that such bleeding points could be eliminated by application of our tried-and-true techniques, eliminating the risk of further haemorrhage. The patient was reopened thrice but any obvious bleeding point was never found. Finally, the error was realised, and dealt with. The final outcome was acceptable, and she remained well at the 1-year follow-up.

The authors do not wish to imply that titanium mesh should not be used in cranioplasty. Rather, it is emphasised that overlooking the possibility of postoperative DIC, triggered unintended consequences that could have been avoided.

REFERENCES