

Case Report

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Multiple, Sequential, Remote Intracranial Hematomas Following Cranioplasty

The intracranial hemorrhage in regions remote from the site of initial operations is unusual but may present as fatal surgical complication. We report a rare case of multiple, sequential, remote intracranial hematomas after cranioplasty in a patient who did not have any prior risk factors. A 51-years-old man was transferred to the hospital after a head trauma. The brain computed tomography (CT) revealed acute subdural hemorrhage on the right hemisphere with prominent midline shifting. After performing decompressive craniectomy and hematoma removal, the patient recovered without any complications. However, the patient showed neurological deterioration immediately after cranioplasty, which was done three months after the first surgery. There was extensive hemorrhage in the posterior fossa remote from the site of the initial operation site. The brain CT taken soon after removing this hematoma evacuation displayed large epidural hematoma on the left hemisphere. This case represents posterior fossa hemorrhage after supratentorial procedure and sequential delayed hematoma on the contralateral supratentorial region thus seems very rare surgical complications. Despite several possible pathogenetic mechanisms for such remote hematomas, there are usually no clear cut relationships with each case as in our patient. However, for the successful outcome, prompt evaluation and intensive management seem mandatory.

KEY WORDS : Multiple · Sequential · Remote · Intracranial hemorrhage · Complication · Decompressive surgery.

INTRODUCTION

Although sequential delayed intracranial hematomas at remote area are known since Roy¹⁵⁾ first reported in 1884, the development of an intracranial hemorrhage within the posterior fossa or contra-lateral site after supratentorial surgery is a rare surgical complication^{6,11,14,18,20,22,23)}. Intracranial hemorrhages after craniotomies had been reported sporadically, normally with an incidence range of 0.5-5%^{1,3-5,13,19,21)}. Although several authors^{2,3,10,12,17,24)} reported clinical cases of intracranial hemorrhages in posterior fossa after supratentorial surgery and have proposed pathogenesis of their development, there are no clear explanations for every case. Also, to our knowledge, there has not been a case report that described sequential, multiple, remote intracranial hematomas involving posterior fossa and contralateral hemisphere after single surgery. We report such a rare case with speculation of possible mechanisms.

CASE REPORT

History and examination

A 51-years-old man was referred to our hospital after head trauma. He did not have any past medical history such as hypertension, liver disease, coagulopathy, and long term medication. Laboratory results were within normal ranges. The neurological examination was normal except mild motor weakness on the left side. Initial brain computed tomography (CT) showed acute, traumatic subdural hematoma on right fronto-temporo-parietal area and right tentorium (Fig. 1). The patient was admitted to surgical intensive care unit (SICU) for close monitoring.

First treatment and Post-operative Course

After 6 hours, the patient showed deteriorated mentality, and subsequent brain CT showed extensive subdural hematoma causing midline shift and severe brain swelling (Fig. 2). The patient underwent decompressive craniectomy and hematoma removal (Fig. 3). Post-operative course was uneventful and the patient recovered without any neurological complications.

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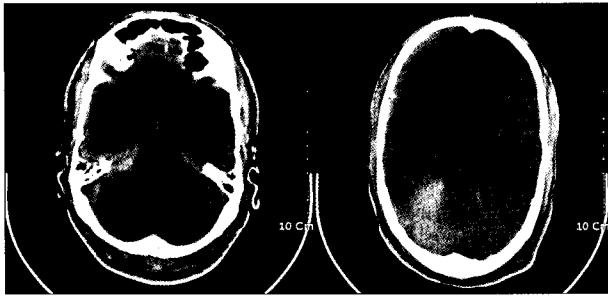


Fig. 1. Brain computed tomography at admission showing acute subdural hematoma at right fronto-temporo-parietal area and tentorium, with compressing mild ipsilateral ventricle.



Fig. 2. Brain computed tomography taken six hours later after admission showed enlargement of hematoma causing significant midline shifting and severe brain swelling.

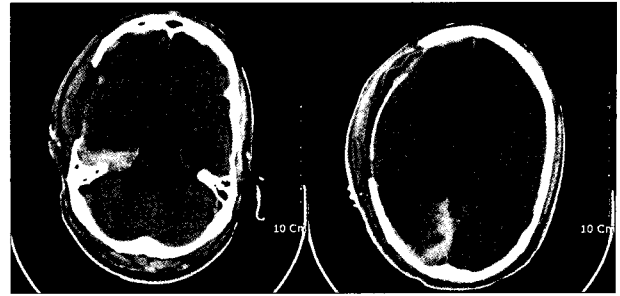


Fig. 3. Following operation, supratentorial hematoma was not evident and midline shifting and brain swelling were improved, but hematoma in the right tentorium was still seen.

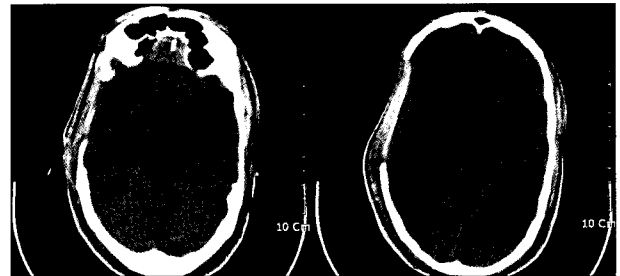


Fig. 4. Brain computed tomography taken three months after decompressive craniectomy reveals that there are no hemorrhages at the previous operation site and posterior fossa.

Second treatment and Post-operative Course

After 3 months, cranioplasty was planned for surgical bone defect. Before cranioplasty, brain CT was taken that revealed no remarkable findings except bone defect (Fig. 4). Cranioplasty was performed as usual manners. There were no bleeding, or cerebrospinal fluid (CSF) leakage during operation. Defected area was replaced with artificial bone using bone cement and meticulous hemostasis was done. There were no remarkable events during whole procedure and total operation time was 3 hours.

Third treatment and Post-operative Course

After cranioplasty, the patient showed normal recovery without any abnormal response. Post-operative laboratory results were within normal range. However, mental deterioration was noticed 8 hours later. Immediately taken brain CT revealed large posterior fossa epidural hematoma compressing brain stem remote from initial operation site (Fig. 5). Urgent operation was then performed but there were no active bleeding foci in operation field. Hematoma was removed as usual manners and there were also no remarkable events during operation.

Fourth treatment and Post-operative Course

Despite uneventful operation, the patient showed worsening of mentality during recovery period. In follow-up brain CT images (Fig. 6), large amount of epidural hemorrhage on

the contra-lateral (left) cerebral hemisphere causing midline shifting was noted. The patient underwent operation again and there were no active bleeding foci in operation field. After last operation, he was carefully monitored, including intra-cranial pressure control, and he was finally discharged after one month later without any neurological deficits.

DISCUSSION

Intracranial hemorrhages occurring remote from the site of supratentorial surgery is a rare complication that may be associated with significant morbidity and mortality. These remote hemorrhages present in various forms such as hemorrhagic contusion, hemorrhage in the posterior fossa, and contralateral epidural or subdural space. Since these are detected after operation within few hours, hemorrhages seem to accumulate during operation or after operation within short interval time. Kalfas and Little⁸⁾ reported 40 cases of intra-cranial hemorrhages after craniotomy in 4992 cases and described various clinical situations and mechanisms. Also, other authors, including KoÈnig et al.¹¹⁾, Papanastassiou et al.¹⁴⁾, and Brisman et al.¹⁾ reported its incidence to be below 1%. Our case, however, represents sequential, infra- and supratentorial hemorrhage following cranioplasty without any risk factors nor any remarkable intra-operative events.

Up to now, no exact pathogenetic factors and mechanisms have been proven to be the causes that could explain the

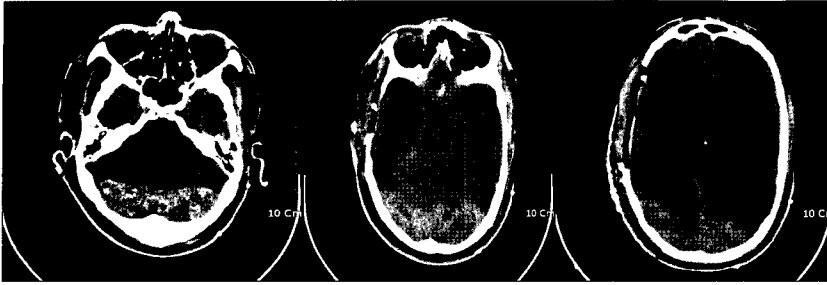


Fig. 5. Immediate cranioplasty, extensive hemorrhage was seen in the posterior fossa compressing brain stem which was remote site from initial operation site.



Fig. 6. After hematoma evacuation in the posterior fossa, large amount of epidural hematoma was seen at the contra-lateral (left) hemisphere causing midline shifting.

occurrence of remote hemorrhage in every case. Numerous possible mechanisms related to remote intra-cranial hemorrhages after craniotomy have been postulated^{14,5,7,9,10,12-16,24} and these included; 1) coagulopathy and bleeding tendency, 2) elevated blood pressure during operation and/or after operation, 3) the site of craniotomy and surgical position, 4) disturbance of venous flow from compression of jugular vein, 5) massive CSF leakage during operation, 6) mechanical shifting of brain, and 7) rapid decrease of intracranial pressure. A relationship between abnormal coagulation test and the occurrence of the posterior fossa hemorrhage after supratentorial surgery has been demonstrated only by KoÈnig et al.¹¹. In our case, there were no abnormal laboratory results, especially coagulation parameters. Also, our patient did not have any medical illness including liver disease, medication, and other bleeding tendency. During all operations, the patient showed stable vital signs and surgical procedures were performed as usual manners without any remarkable events. Although extreme rotation and flexion of the neck during lengthy surgery may result in venous outflow obstruction on the other side contralateral to surgery, causing abrupt venous infarction especially in the elderly¹⁷, this would not be for our case because the patient was placed in supine position with gentle head turning, comfortable shoulder pad support and neutral neck positioning. Drainage of CSF may constitute important role in cases invading periorbital or fronto-temporal craniotomies because of exposure of the basal cisterns after dissection of sylvian fissure using these craniotomies^{4,12,16,17}. Yoshida et al.²⁴ proposed that over-drainage in the post-operative period

may lead to upward displacement of the cerebellum, stretching and tearing of the vessels and subsequent hemorrhages. KoÈnig et al.¹¹ also proposed that a reduction in intracranial pressure, induced by the removal of a supratentorial space occupying mass, coupled with post-operative CSF drainage, can lead to a critical increase in the transmural pressure of veins, leading to possible hemorrhage. Brisman et al.¹ has emphasized that aggressive intra-operative dehydration and CSF aspiration may predispose to shifts and mechanical vessel shear. Yacubian et al.²³ proposed that epidural space hemorrhages could be result of not only mechanical shift of brain caused by CSF over-drainage but also vessel shearing of extradural space due to sudden decompression of contra-lateral

side. But, as there were no remarkable events in our case, these possible mechanisms do not seem to have contributed remote hemorrhages in our patient. As described earlier, the causes of delayed intracranial hemorrhages in posterior fossa in our patient are still unclear, but possible predisposing factor would be previous tentorial hemorrhage. And, the pathogenesis of secondary epidural hematoma in contralateral side may have been caused by dura-skull detachment when the brain volume was strikingly reduced by a previous decompressive procedure. However, again, this theory is usually suitable in the cases of delayed hemorrhage after supratentorial craniotomy on the contralateral side.

CONCLUSION

Multiple, remote intracranial hemorrhages after cranial surgery are very rare clinical complications, and clear mechanisms causing many of these situations are still elusive. However, prompt evaluation and appropriate surgical measures seem mandatory to prevent possible serious morbidity and mortality.

References

1. Brisman MH, Bederson JB, Sen CN, Germano IM, Moore F, Post KD : Intracerebral hemorrhage occurring remote from the craniotomy site. *Neurosurgery* 39 : 1114-1122, 1996
2. Driesen W, Elies W : Epidural and subdural haematomas as a complication of internal drainage of cerebrospinal fluid in hydrocephalus. *Acta Neurochir (Wien)* 30 : 85-93, 1974
3. Fiskin RD, Kurze T : Acute epidural haemorrhage complicating resection of acoustic neurinoma. *J Neurosurg* 21 : 58-61, 1964
4. Frera C : Supratentorial extradural haematomas secondary to ventricular decompression. *Acta Neurochir (Wien)* 20 : 31-35, 1964

5. Fukamachi A, Koizumi H, Nagaseki Y, Nukui H : Postoperative extradural hematomas : computed tomographic survey of 1105 intracranial operations. *Neurosurgery* 19 : 589-593, 1986
6. Greenwald DL, Kim DH, Day AI : Remote posterior fossa hemorrhage as a complication after supratentorial craniotomy. *J Neurosurg* 86 : 441A, 1997
7. Harders A, Gilsbach J, Weigel K : Supratentorial space occupying lesions following infratentorial surgery. Early diagnosis and treatment. *Acta Neurochir (Wien)* 74 : 57-60, 1985
8. Kalfas IH, Little JR : Postoperative hemorrhage : a survey of 4992 intracranial procedures. *Neurosurgery* 23 : 343-347, 1988
9. Kalia KK, Swift DM, Pang D : Multiple epidural hematomas following ventriculoperitoneal shunt. *Pediatr Neurosurg* 19 : 78-80, 1993
10. Kim SG, Koh YC, Um CS, Kim CH, Lee HK, Hwang DY : Acute epidural hematoma following ventriculo-peritoneal shunt operation. *J Korean Neurosurg Soc* 25 : 861-865, 1996
11. KoEnig A, Laas R, Hermann HD : Cerebellar haemorrhage as a complication after supratentorial craniotomy. *Acta Neurochir (Wien)* 88 : 104-108, 1987
12. Koller M, Order M, Langmayr J, Twerdy K : Posterior fossa haemorrhage after supratentorial surgery-report of three cases and review of the literature. *Acta Neurochir (Wien)* 141 : 587-592, 1999
13. Lee SH, Eoh W, Lee KH, Chung BS : Clinical experience of delayed post-traumatic contralateral epidural hematoma. *J Korean Neurosurg Soc* 24 : 1361-1365, 1995
14. Papanastassiou V, Kerr R, Adams C : Contralateral cerebellar hemorrhagic infarction after pterional craniotomy : report of five cases and review of the literature. *Neurosurgery* 39 : 841-852, 1996
15. Roy GC : Fracture of the skull : extensive extravation of blood on dura matter, producing compression of the brain : trepanning partial relief of symptoms, death. *Lancet* 2 : 319, 1884
16. Seiler R, ZurbruEgg H : Supratentorial intracerebral hemorrhage after posterior fossa operation. *Neurosurgery* 18 : 472-474, 1986
17. Sinar EJ, Lindsay KW : Distant extraudral haematoma complicating removal of frontal tumors. *J Neurol Neurosurg Psychiatry* 49 : 442-444, 1986
18. Toczek MT, Morell MJ, Silverberg GA, Lowe GM : Cerebellar hemorrhage complicating temporal lobectomy. *J Neurosurg* 85 : 718-722, 1996
19. Tsugane R, Sugita K, Sato O : Supratentorial extradural hematomas following posterior fossa craniectomy. *No Shinkei Geka* 4 : 401-403, 1976
20. Van Calenbergh F, Goffin J, Plets C : Cerebellar hemorrhage complicating supratentorial craniotomy : report of two cases. *Surg Neurol* 40 : 336-338, 1993
21. Waga S, Shimosaka S, Sakakura M : Intracerebral hemorrhage remote from the site of the initial neurosurgical procedure. *Neurosurgery* 13 : 662-665, 1983
22. Wolfsberger S, Gruber A, Czech T : Multiple supratentorial epidural hematomas after posterior fossa surgery. *Neurosurg Rev* 27 : 128-132, 2004
23. Yacubian EM, de Andrade MM, Jorge CL, Valerio RM : Cerebellar hemorrhage after supratentorial surgery for treatment of epilepsy : report of three cases. *Neurosurgery* 45 : 159-162, 1999
24. Yoshida S, Yonekawa Y, Yamashita K, Ihara I, Morooka Y : Cerebellar hemorrhage after supratentorial craniotomy : report of three cases. *Neurol Med Chir (Tokyo)* 30 : 738-743, 1990