Iatrogenic Cerebral Cortical Aneurysm

Case Report

M. C. Overton, M.D., and T. H. Calvin, Jr., M.D.
Medical Branch, University of Texas, Galveston, Texas

Exploration of the subdural space of infants by puncture through the anterior fontanelle is a valuable procedure which, when performed carefully, is rarely followed by complications. There are, however, several inherent dangers of the procedure. An unusual, but not unlikely complication of this procedure is the subject of this case report.

Case Report

A 9-month-old Latin American boy was referred to the University of Texas Medical Branch Hospital for management of bilateral subdural hematomas. The referring physician first saw this child after he had presumably fallen from his crib. X-rays demonstrated extensive bilateral linear fractures of the skull in the occipital and parietal bones (Fig. 1). The anterior fontanelle was full and tense. Bilateral subdural taps by the local physician produced dark red blood bilaterally and the patient was transferred to the care of a neurosurgeon in his local community. The subdural collections were believed to have been cured in a week by repeated subdural taps. Two weeks later, however, the subdural fluid reaccumulated and the local doctor referred the patient to our institution.

Examination. The general health of the child was good and growth and development had been normal. He was in no distress, ate and played happily, was not irritable, and with the exception of a protuberant anterior fontanelle showed no abnormal neurological findings. Cerebral angiography was not performed. Endeavor was made by daily subdural taps to clear the subdural space of fluid which by this time was xanthochromic with a high protein content. After 1 week of this therapy, fluid ceased to accumulate on the left side, but continued to reaccumulate on the right. A burr hole was placed over the parietal eminence and the dura opened. A translucent external subdural membrane was present which measured ½ mm. in thickness. Upon opening this membrane, 50–80 cc. of fluid drained from the subdural space. The pial surface was easily visualized and appeared normal. No internal membrane could be identified. After irrigation of the cavity with saline the distance between the cortical surface and the inner table of the skull became diminished to 3 to 4 mm. The cerebral cortex was not palpated and no trauma occurred as a result of the irrigation. A Penrose drain was left in the subdural space beneath the membrane. Postoperatively fluid drained well. The drain was removed 48 hours after operation and the space drained 1 or 2 times daily for a few days by insertion of a blunt probe between the healing skin edges. Later daily taps of the subdural space were made through the anterior fontanelle or the burr hole (anterior or posterior to the healing incision). This management was carried out for 5 weeks with only a moderate decrease in the amount of accumulated fluid. On one occasion unexplained bright red blood dripped from the subdural needle during the performance of a tap at the burr hole site. The following day, however, the fluid was much less red and by the third day only xanthochromic fluid remained.

Operation. Finally, it was considered necessary to remove the subdural membranes and craniotomy was performed on October 30, 1964. During the elevation of a large right temporo-parietal osteoplastic flap, the dura seemed to be more firmly adherent to the inner table of the skull than usual, probably because of the repeated aspirations and earlier burr hole. A large dural flap was turned anteriorly exposing an external subdural membrane 1 to 2 mm. thick which was then opened inferiorly in the temporal area. A thick inner membrane was also present. The subdural cavity covered the entire cerebral surface from the Rolandic fissure anteriorly to the tentorial edge posteriorly. In the midline, as it joined the superior sagittal sinus several large cortical veins pierced this membrane on their way to the sinus. The capacity of the subdural sac was 80 to 100 cc.

Beneath the point at which the previous burr hole had been made there was a moderately contused and lacerated cortical surface one centimeter in diameter. The trauma appeared to have been both old and recent and the area was covered by 1–2 cc. of clotted blood. At the inferior edge of this area was an aneurysm, 4 to 5 mm. in diameter, arising from a cortical artery (Fig. 2). The aneurysm was not adjacent to any bifurcation (Fig. 3). Verification of the aneurysm’s location was accomplished by replacing the bone flap over the area

Fig. 1. Right lateral skull x-ray showing multiple skull fractures.
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which localized the aneurysm at the inferior edge of the previously made burr hole. The aneurysm was then excised by coagulating the artery on either side of its base. A silver clip was left at the site of the aneurysm.

Approximately 90 per cent of the subdural membrane was removed without interrupting the bridging veins draining the parieto-occipital area. The wound was closed without drainage. During surgery 65 cc. of blood was administered.

Postoperative Course. The procedure was tolerated well, and the postoperative course was uneventful. The anterior fontanelle remained soft thereafter. A subdural tap on the third postoperative day produced 3 cc. of blood-tinged fluid but a subsequent tap before discharge 8 days later revealed no reaccumulation of fluid. No recurrence of subdural accumulation has occurred since the operation.

Discussion

Hemorrhages associated with subdural taps and the puncture of a cortical or dural vein are usually avoided by careful insertion of a properly chosen subdural needle and the avoidance of active, syringe aspiration of fluid or repeated punctures through the same site.\(^9,10\)

Although we have found no report of an intracranial aneurysm forming in a patient subsequent to needle puncture, White and his collaborators\(^21\) in 1961 demonstrated that needle puncture of the intracranial vessels of dogs as well as the introduction of various solutions into the arterial wall would produce defects in the internal elastic membrane and some replacement of the muscularis by fibrous tissue. These microscopic findings are indeed similar to those of this case in which microscopic examination of the sacular aneurysm revealed a defect in the elastic tissue and fibrous tissue expansion in the area of the media (Fig. 4).

Needle puncture of the extracranial carotid vessels has been reported to cause false aneurysm formation as well as dissecting aneurysms.\(^9,14\)

Hirsch \textit{et al.}\(^8\) and Krauland\(^22\) have both reported intracranial cerebral aneurysm formation subsequent to trauma. Taylor\(^29\) and Finkemeyer\(^7\) each reported a case of cerebral cortical aneurysm.

Fig. 3. Subdural membranes at time of craniotomy. Edges of the membrane are held by the two lateral forceps. The center bayonet forcep points to the aneurysm below which is a small area of contused brain.
apparently developing secondary to surgical trauma and hemostatic clip placement incident to the removal of cerebral tumors.

Although not reportedly caused by needle puncture, the false aneurysmal sacs of ragged or lamellar-like organization of fibrous tissue which occasionally occur on the middle meningeal arteries frequently formation following needle or surgical trauma are frequently reported. Munnell et al. extracted 47 cases dating back to Galen in the first century and Allen et al. added others. Recently renal needle biopsy has been added to the long list of causes.

Conclusions

Although there is no question in the mind of the surgeon or his assistant that this aneurysm was not visible at the time the burr hole was made 4 weeks after the injury, it can never be proved definitely that this aneurysm was not a delayed result of the trauma. The circumstances surrounding this case force us, however, to conclude that it was produced by one of the subdural taps carried out in the precise area where this malformation was later discovered.

Fig. 3. Gross specimen of the aneurysm, which measured 4×5 mm. in diameter.

Fig. 4. Microscopic section through base of aneurysm stained for elastic tissue: ×23.

Summary

The discovery of a saccular cortical aneurysm at the time of craniotomy for the removal of subdural membranes has led us to believe that this lesion was the result of needle punctures inflicted by one of multiple taps for the evacuation of subdural fluid.

Gross and microscopic examination of the aneurysm revealed findings consistent with those seen in other arteries subjected to needle puncture or other trauma.

References

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