The role of neomembranes in formation of hematoma around Silastic dura substitute

Case report

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The authors report the formation of a hematoma within the neomembranes encasing a Silastic dura substitute, simulating recurrence of a convexity meningioma.

KEY WORDS • dural substitute • hematoma • neomembrane • dura mater

Case Report

This 56-year-old man first presented with a history of two grand mal seizures and subsequently had a right frontal convexity meningioma excised in November, 1975. Silastic dural substitute was used in repairing the consequent dural defect. Postoperatively, he developed a subgaleal swelling at the site of operation which gradually subsided. He was discharged home 9 days after surgery.

He presented again in February, 1982, with a history of a dull right frontal headache, which came on 4 weeks before admission and lasted for about 1 week. During that same week he had two episodes of “absent-mindedness,” one occurring at a curling rink and the other at work. He had no recollection of the incidents. His memory also seemed to worsen. Colleagues said his work as supervisor on oil rigs had deteriorated.

Examination. He was conscious, alert, and well oriented, but his speech was rather slow and he was also slow to respond to questions. Neurological examination revealed no lateralizing signs. A CT scan of the brain with contrast enhancement revealed a sizable biconvex lesion in the right frontal area consistent with recurrent meningioma at the site of the previous operation (Fig. 1).

Operation. On February 26, 1982, a craniotomy was performed at the site of the previous surgery, and...
a mass, attached to the dura and obviously of fibrous tissue origin, was excised. It was lens-shaped and, during removal, old blood clot exuded from the outer surface. Adhesion to the arachnoid over the brain was minimal.

Postoperative Course. The patient’s postoperative course was uneventful, and he was discharged home 10 days after surgery. At follow-up review on April 7, 1982, he had returned to work and had no residual abnormal neurological findings.

Pathological Examination. Macroscopic examination of the excised mass showed it to be a biconvex, pale yellow, encapsulated mass, measuring $6.5 \times 1.5$ cm and weighing 22 gm (Fig. 2 left). Transverse sections revealed a thick-walled capsule, the external wall being three times the thickness of the internal wall, and there was a thin plastic sheet (Silastic dura substitute) in the middle (Fig. 2 right). The internal wall of the mass was covered with clotted blood. Microscopic sections of the wall revealed an inner layer of loose connective tissue with numerous thin-walled blood vessels. The outer layer consisted of dense, almost acellular, connective tissue. Hemosiderin particles were noted in scattered areas. Evidence of recent bleeding was presented by numerous intact red blood cells found around the rim of the inner layer of the pocket. Few eosinophils and moderate numbers of polymorphonuclear cells were present, especially in the loose inner layer. Foreign-body giant cells were seen surrounding a piece of suture material.

Discussion

Whether or not a dural defect needs to be reconstructed and if so, by what, remains controversial. Trotter observed that a neomembrane indistinguishable from the old dura mater formed within a few weeks if overlying scalp was left in contact with the brain after excision of a segment of dura mater. This viewpoint has recently been stressed by Walton and Kri- zek, who successfully utilized the scalp flap only in managing large dural defects. Dural grafting, however, remains more popular among neurosurgeons. The indications for this procedure include the prevention of cerebrospinal fluid leakage, exclusion of contamination or infection of the wound, and minimizing cortical scarring and adhesion formation.
Hematoma surrounding Silastic graft

Silastic dural substitute (Mediform) is one of the more recent additions to a long list of materials used for reconstitution of dural defects. Its use has been associated with a relatively low complication rate. Its silicone rubber coating prevents adhesion of the sheets to adjacent tissue, thus facilitating removal of the sheet if necessary. But a neomembrane, presumably arising from the adjoining dura, envelopes it, thus creating a potential space in which a hematoma can form. This complication was first reported by Banerjee, et al.\textsuperscript{3}

The basic feature of all neomembranes is an excessive proliferation of cells of the interface layer between arachnoid and dura, specifically of the dural border cells of adjoining dura.\textsuperscript{6,9} The extracellular space contains collagen and elastic fibers. Sprouting of capillaries is a prominent feature.\textsuperscript{6,9} Penfield\textsuperscript{8} reported that the thickness of the neomembrane varied according to the available blood supply. Breaching of the arachnoid over cerebral lacerations probably provides an added source for a greater blood supply, resulting in adhesions and formation of a thicker neomembrane between the brain wound and the lower layer of the envelope.\textsuperscript{6} Therefore, formation of adhesions between the inner neomembrane and the underlying brain may be insignificant where the arachnoid layer is intact.

The sprouting capillaries are fragile, and known to bleed very easily.\textsuperscript{10} This, coupled with the very little mechanical reinforcement provided the capillaries by the surrounding proliferating dural border cells and collagen fibers, has been suggested as the reason for the tendency of neomembranes of chronic subdural hematomas to undergo repetitive multifocal bleeding.\textsuperscript{6,9} The presence of fresh hemorrhages and nests of hemosiderin-laden macrophages seen in the neomembranes in chronic subdural hematomas\textsuperscript{6} and in light microscopic sections of the neomembranes in our case might suggest similar mechanisms. If, indeed, small repetitive multifocal hemorrhages frequently occur within the neomembrane around a Silastic dural substitute, one wonders why it is so rare for a hematoma to collect in that potential space with minimal or no trauma; or, maybe the complication is just under-reported.

If the thickness of the neomembranes, when the arachnoid layer is intact, is a measure of the degree of tissue reaction to Silastic dural substitute, one might suggest that an excessive tissue reaction to the graft may predispose to repetitive multifocal bleeding. The thickness of the neomembranes in our case is quite striking. Silicone rubber is very electrostatic and attracts airborne particles that could produce tissue reaction. A similar situation could be caused by the Silastic dura substitute coming into contact with bare fingers, towels, drapes, talc, and other granular or linty surfaces. Strict precautions in the handling of the material are certainly indicated, and could conceivably keep the tissue reaction to a minimum.

The complication that we have described is either very uncommon or is severely under-reported. If the former is the case and if the low complication rate reported by Collis and Meier\textsuperscript{5} is correct, the contention of Banerjee, et al.,\textsuperscript{3} that Silastic is not the optimal dural substitute may be hardly justifiable. Whether a dural substitute is required at all remains open to question.

Acknowledgments

We wish to thank Mrs. Doris Holtsman and Mrs. Chris McLean for secretarial assistance.

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5. Collis JS Jr, Meier G: The indications and technique of Banerjee, et al.,\textsuperscript{3} that Silastic is not the optimal dural substitute may be hardly justifiable. Whether a dural substitute is required at all remains open to question.

Acknowledgments

We wish to thank Mrs. Doris Holtsman and Mrs. Chris

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Manuscript received July 23, 1982.
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