

Decompressive Hemicraniectomy as a Lifesaving Procedure in Severe Acute Ischemic Stroke

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Acute ischemic stroke results from acute occlusion of major cerebral arteries. This event causes cellular changes and leads to a breakdown of the blood-brain barrier. When acute ischemia occurs in the complete territory of the internal carotid artery or middle cerebral artery, malignant cerebral edema may develop, causing brain swelling with increased intracranial pressure. Subsequently, there is a rapid neurologic deterioration, leading to coma and even death with a mortality rate of up to 80% [1,2].

Patient Description

A 55 year old right-handed, previously healthy woman presented to the emergency room one and a half hours after brief loss of consciousness followed by global aphasia, right hemiplegia and gaze deviation to the left. Neurologically the patient opened her eyes spontaneously, pupils were equal and reactive to light; she had gaze deviation to the left, global aphasia and right hemiplegia, and moved her left side spontaneously. She had hyperreflexia and Babinski sign on the right.

An axial computerized tomography of the head without contrast, 34 minutes after admission, demonstrated no hemorrhage and no infarction [Figure A,B]. Due to the fact that acute carotid artery occlusion was suspected clinically, the patient was evaluated for urgent intraarterial thrombolysis. Four hours after the acute stroke onset and two and a half hours after admission, cerebral angiography demonstrated a complete occlusion of the left internal carotid artery by a thrombus in the supra-clinoid segment extending from above the left posterior communicating artery (p-ComA)



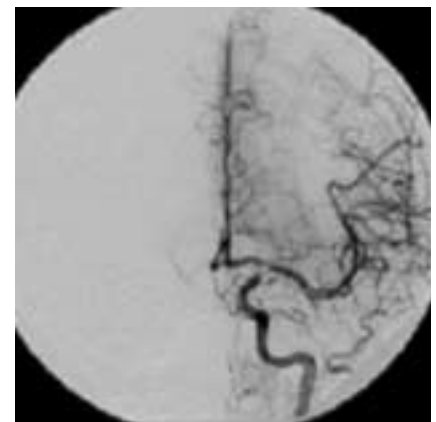
[A] CT scan demonstrating no hemorrhage and no infarction.



[B] CT scan demonstrating no hemorrhage and no infarction.



[C] Cerebral angiography demonstrating an occlusion of the left internal carotid artery by a thrombus at the supra-clinoid segment.

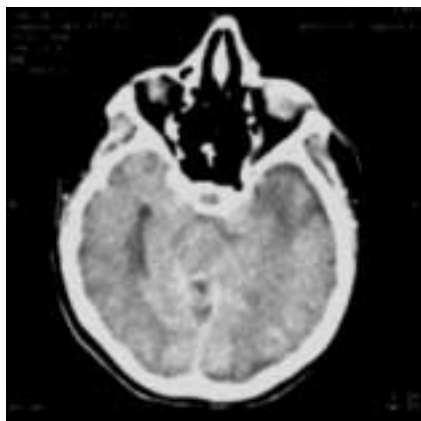


[D] Cerebral angiography following intraarterial thrombolysis demonstrating restoration of flow in the left hemisphere.

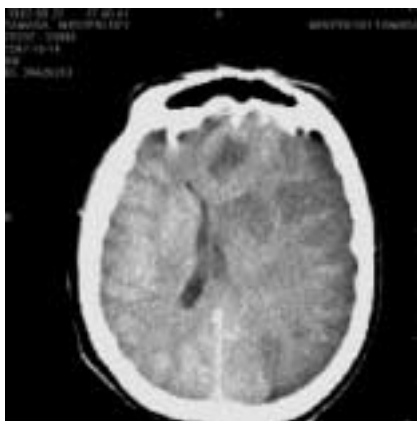
up to the ICA bifurcation and into both proximal A1 and M1 segments [Figure C]. The right A1 segment was noted to be hypoplastic. Intraarterial thrombolysis was administered using a total dose of 1,100,000 units of urokinase. Although the

ICA = internal carotid artery

thrombus was still visible, flow was fully restored in the left hemisphere [Figure D]. Seven hours following the acute stroke, an axial computerized tomography of the head without contrast demonstrated a small hypodense area compatible with early acute ischemic left middle cerebral artery stroke, without significant cerebral edema



[E] CT scan demonstrating left uncal herniation due to left MCA infarction.



[F] CT scan demonstrating midline shift to the right due to left MCA infarction.



[G] Postoperative CT scan demonstrating the resolution of the left uncal herniation after hemicraniectomy.



[H] Postoperative CT scan demonstrating the resolution of the midline shift after hemicraniectomy.

or signs of increased intracranial pressure. The patient's neurologic status remained unchanged.

Thirty hours following the onset of stroke, further acute neurologic deterioration occurred. The patient became comatose and her left pupil dilated and was unreactive to light. The patient did not open her eyes to pain; she localized pain on the left and there was decerebrate posturing on her right side. Her Glasgow Coma Scale score was 7. An axial CT of the head without contrast demonstrated a large hypodense area compatible with acute left MCA territory stroke. There was a significant midline shift to the right and left uncal herniation [Figure E,F]. She was rushed to the operating room and underwent a left decompressive hemicraniectomy. A large bone flap was removed and

the dura was left open. Postoperative axial CT demonstrated an immediate resolution of the midline shift and the uncal herniation [Figure G,H].

A few hours after the decompressive craniectomy the patient became alert, she opened her eyes spontaneously, her pupils became equal and reactive to light, she moved her left side spontaneously, and there were minimal movements of her right limbs.

After this manuscript was submitted, the patient died from sepsis.

Comment

Following a complete MCA territory infarction, patients often develop malignant space-occupying cerebral edema with a mortality rate of up to 80%, despite intensive medical therapy. Over the past years, two alternative treatments have been developed for the therapy of space-

occupying MCA infarction: decompressive hemicraniectomy and moderate hypothermia. Several reports indicate a beneficial effect of decompressive hemicraniectomy in this situation. Decompressive hemicraniectomy effectively decreases intracranial pressure and reduces mortality rates, based on case series, to less than 20% [3]. The treatment with moderate hypothermia results in a mortality rate of 38–47% in different series. Furthermore, decompressive hemicraniectomy has been suggested to be superior to moderate hypothermia in the treatment of severe ischemic stroke and was associated with lower mortality and a lower complication rate [4].

There are no clear guidelines for the treatment of patients with severe ischemic stroke and malignant space-occupying cerebral edema. Randomized clinical trials assessing decompressive hemicraniectomy are currently underway (HeadFIRST – hemicraniectomy and durotomy for deterioration from infarction-related swelling trial, sponsor NINDS, National Institutes of Health). The probable future chronic debilitated state of the patient following a left dominant hemisphere stroke was taken into account; nevertheless, we decided not to deny the patient a lifesaving procedure. This case study supports other reports that advocate decompressive hemicraniectomy as a lifesaving procedure in selected patients [1–4].

References

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MCA = middle cerebral artery