Arterial Erosion and Hemorrhage During Graded Carotid Ligation with the Crutchfield Clamp

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For several years, ligation of the carotid artery has been accepted as a definitive method for the treatment of certain intracranial aneurysms, in particular those located on the internal carotid artery. Gradual closure of either the internal or common carotid artery can be accomplished during a several day period by means of a small metallic clamp designed for this purpose. Gradual, rather than acute, ligation of the carotid artery is generally preferred since the neurological complications are less frequent.

From July, 1955, to July, 1966, 312 patients having a diagnosis of intracranial aneurysm were treated at either Duke University Medical Center or Durham Veterans Administration Hospital by gradual ligation of the common carotid artery with a Crutchfield clamp. In the majority, the aneurysm was located on the internal carotid artery. Over this period of time, three patients developed erosion of the common carotid artery with resulting hemorrhage during postoperative closure of the clamp. In each case, the arterial erosion occurred at the site of the clamp and in association with a wound infection. These three cases form the basis for this report.

Case Reports

Case 1. A 35-year-old man was admitted to another hospital on March 9, 1964, several hours following a subarachnoid hemorrhage. Bilateral carotid arteriography revealed an aneurysm of the anterior communicating artery and a subdural hematoma on the right side. On March 19, the subdural hematoma was evacuated through a right temporal trephine opening. The patient failed to improve and on March 23, a right temporoparietal craniotomy was done and the remaining subdural hematoma evacuated.

Following the second operative procedure, he improved slowly. On August 8, 1964, he was transferred to the Durham Veterans Administration Hospital for definitive treatment of the anterior communicating aneurysm.

Examination. The patient was moderately alert and oriented. A postoperative skull defect in the right temporoparietal region and a left homonymous hemianopsia were present. The general physical and neurological examinations were otherwise normal.

On August 15, bilateral percutaneous carotid arteriograms revealed a large anterior communicating artery aneurysm which filled from the left. In addition, an aneurysm on the right middle cerebral artery was demonstrated. Injection of the right common carotid artery with contrast medium during simultaneous compression of the left common carotid resulted in visualization of the anterior communicating aneurysm.

Operation. On August 17, a left frontotemporal craniotomy was performed, and the left anterior cerebral artery proximal to the anterior communicating artery was occluded with a Mayfield clip. Immediately thereafter, a right neck dissection was carried out and the carotid vessels exposed. A Crutchfield clamp was applied around the right common carotid artery; from August 20 to 29 it was tightened approximately one-half turn each day.

Course. On August 27 there was purulent drainage from the wound and Staphylococcus aureus (coagulase positive) was isolated from this material. On August 30, there was bright red bleeding from the wound, which ceased when light pressure was applied. Bleeding recurred approximately 2 hours later, and at this time the patient was taken to the operating room and the wound explored. A 4.0 mm rent was found in the common carotid artery directly beneath the footplate of the clamp. Distal to this point,
the common carotid artery was occluded with a fresh thrombus. Definitive treatment consisted of ligation of the common carotid artery 3.0 cm proximal to the arterial rent and removal of the clamp. A biopsy of the artery adjacent to the rent revealed necrosis of the entire arterial wall with numerous gram positive cocci present in all layers of the vessel. There was no change in the patient’s neurological status immediately following surgery. The remainder of his postoperative course was unremarkable.

On October 6, a right retrograde brachial arteriogram demonstrated the right internal and external carotid arteries through anastomoses between the muscular branches of the right vertebral and the right occipital arteries. There was filling of the middle cerebral artery aneurysm on the right, but the anterior communicating aneurysm was not visualized.

Case 2. A 55-year-old man entered the Durham Veterans Administration Hospital on May 2, 1965, 24 hours after a subarachnoid hemorrhage.

Examination. The general physical and neurological examinations were normal except for a blood pressure of 180/80 mm Hg and nuchal rigidity.

Lumbar puncture performed on the day of admission revealed an opening pressure of 320 mm H2O and grossly bloody fluid. On the following day, bilateral percutaneous carotid arteriography disclosed a large aneurysm on the right middle cerebral artery.

Operation. On May 4, a right neck dissection was performed and a Crutchfield clamp was placed around the common carotid artery. Occlusion of the right common carotid artery produced a 60% reduction in the distal intravascular pressure. The clamp was partially closed at the time of surgery, and from May 5 through May 8 it was closed one-half turn each day.

Course. On May 8, the patient was lethargic, and for this reason, no clamp adjustments were made. Throughout the day, his reactions became more sluggish, and he developed a left hemiparesis. At this time, a percutaneous right carotid arteriogram revealed that the common carotid artery was patent. Immediately following the arteriogram, the clamp was opened completely and left in this position until May 25. During this period, the left hemiparesis showed progressive improvement. On May 25, the clamp was closed three turns. At this time, a small quantity of purulent drainage from the wound was noted and Staphylococcus aureus (coagulase positive) was isolated from this material. Twelve hours later, there was bright red bleeding from the wound. The bleeding ceased spontaneously, but recurrent as preparations were being made for reopening the wound. Surgical dissection revealed a 3.5 mm tear in the carotid artery immediately beneath the footplate of the clamp. There was a fresh thrombus in the distal common carotid artery. The common carotid artery was ligated 4.0 cm proximal to the tear, and the neck wound was closed. The patient’s neurological status was unchanged immediately following surgery. Over the ensuing days, there was gradual improvement in the left hemiparesis.

On June 17, 1965, a right retrograde brachial arteriogram was performed. There was filling of the right internal and external carotid arteries through anastomoses between the muscular branches of the right vertebral and the right occipital arteries.

Case 3. This 62-year-old woman entered Duke University Medical Center on August 16, 1965, 7 hours following a subarachnoid hemorrhage.

Examination. The patient was apathetic but was oriented when aroused. Blood pressure was 160/90 mm Hg. Neurological examination revealed bilateral subhyaloid hemorrhages, nuchal rigidity, and a left extensor planter response. The general physical and neurological examinations were otherwise normal.

Lumbar puncture revealed grossly bloody cerebrospinal fluid and a pressure of 500 mm H2O. On the day of admission bilateral percutaneous carotid arteriograms disclosed an aneurysm of the right internal carotid at the site of origin of the posterior communicating artery.

Operation. Following the arteriogram, a right neck dissection was performed, and a Crutchfield clamp was applied about the common carotid artery. Occlusion of the common carotid produced a 54% reduction in the distal intravascular pressure. The