Closed Cervical Cranial Trauma Associated with Involvement of Carotid and Vertebral Arteries*

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Injury of the carotid and the vertebral system may occur as a result of closed impacts to the head and neck. Injury of these vessels is more common with perforating and penetrating wounds of the neck and head. Tear or thrombosis of the carotid artery associated with perforating wounds of the neck, thrombosis of the carotid artery with fracture of the mandible, and tear of carotid and vertebral arteries caused by stab wounds have been described frequently. Injury of the vertebral artery by perforating wounds is seen less commonly. In this paper, the literature on this subject will be reviewed, and a report will be made of 5 patients who have had carotid and vertebral vessels involved as a result of closed impacts of the neck and head.

Review of Literature

The intima of the left internal carotid artery was torn and rolled in the case described by Verneuil in 1872.9 The patient had a head injury and a swelling of the left sternocleidomastoid muscle. A right hemiplegia, coma, and death resulted. There was complete occlusion of the internal carotid artery caused by a mural thrombus extending up and into the middle cerebral artery and branches. There was extensive softening of the middle third of the left cerebral hemisphere. The author ascribed the arterial tear to torsion and bending of the neck at the time of the head injury.

The patient of Northcroft and Morgan19 sustained a bruise of the left side of the neck when a rope hanging from a passing vehicle caught the patient about the neck. He became unconscious following a lucid interval and was paralyzed in the right half of the body. A possible intracranial hemorrhage was suspected, but operation was negative for the presence of such a lesion. An autopsy showed a dissecting aneurysm of the left internal carotid artery with complete occlusion of the internal carotid artery. Subintimal hemorrhage caused by an injury resulting in a complete occlusion of the internal carotid artery near the bifurcation was also described by Hutchinson and Yates.15 Schneider and Lemmen24 have discussed 2 examples of thrombosis of the carotid artery secondary to nonpenetrating injuries of the neck.

In closed injuries of the head a carotid-cavernous fistula may be caused. Such a fistula may be associated with a fracture extending into the paranasal sinuses. Occasionally, the fistula may bleed into the paranasal sinuses causing severe epistaxis. Cairns,4 Christensen,6 Davis,7 Hallberg,13 Hamilton,13 Jacques,16 and Ogura and Senturia39 have described severe epistaxis in association with a tear of the carotid artery and/or aneurysm at the base with bleeding into the sphenoid sinus. The earliest case appears to be the one described by Guibert in 1895.11 Rousseau and Spillman22 and Vandooren et al.28 have described instances of severe epistaxis following head injury caused by a tear of the internal carotid artery intracranially along a fracture line extending into the paranasal sinuses. Arteriovenous communication between the carotid and the cavernous sinus ruptured into the nose with fatal epistaxis in the case of Seftel et al.26

Angiography has been used to study patients with severe post-traumatic epistaxis. Schlosshauer and Vosteen23 found the carotid angiogram to be negative in 1 of their 2 cases.
In the case described by Denecke and Hartert the angiogram also was negative. In many cases, the epistaxis is delayed but was immediate in about one-fourth of the patients. The patients in the cases of Takeda and Kawakita, and Christensen, and in 1 of the cases of Cairns died following an epistaxis soon after injury.

Birley and Trotter in 1928 described traumatic aneurysm of the intracranial portion of the internal carotid artery treated by ligation of the common carotid artery. The patient described by Voris and Basile was treated by trapping the fistula between a ligation of the internal carotid artery in the neck and a clip on the intracranial portion of the internal carotid artery through a craniotomy. A similar case was described by Weaver et al. The triad of unilateral blindness, orbital fracture, and massive epistaxis after head injury was described by Maurer et al. The ruptured aneurysm of the carotid artery also bled into the sphenoidal air sinus through a fracture of the base of the skull crossing the sphenoid sinus. There was unilateral blindness and a fracture of the roof of the orbit in their case.

Involvement of the vertebral artery has been described following manipulation of the neck by chiropractic or other methods of management. Pratt-Thomas and Berger, in 1947, described 2 patients aged 32 and 35 who lost consciousness during a chiropractic treatment. In both instances there was thrombosis of the basilar artery and in 1 the posterior inferior cerebellar artery also was thrombosed. In the case of Ford and Clark a treatment was given the patient by his wife for a pain in the neck. Following this twisting of the neck in the 37-year-old patient there was vertigo, tinnitus, and right homonymous hemianopia. He died 60 hours later and autopsy showed thrombosis of the left posterior cerebral, the basilar, and the left posterior inferior cerebellar arteries. In a patient with thrombosis of the basilar artery seen at autopsy, there was unconsciousness and coma after an operation for a left stellate ganglionectomy. With the patient's head turned to the right, there developed a left-sided thrombosis of the vertebral artery and involvement of the basilar artery. The vertebral artery was thrombosed as it entered the dura mater in the base of the skull. The arteries in the neck lower down apparently were normal. Manipulation of the neck was not followed by death in the cases of Kunkle et al., Schwarz et al., Ford and Clark, and Green and Joynt. Thrombosis of the vertebral artery was suspected by the evidences of a lateral medullary syndrome. The thrombosis may have been caused by the rotation of the head in the region of the atlas and the atlanto-occipital membrane with compression of the artery. Yates found evidences of hemorrhage in the adventitial lining of one or both vertebral arteries in 24 out of 60 infants who died in the perinatal period. Often the hemorrhages were severe enough to cause narrowing of the lumen of the vessel and in 1 instance, 12 days post partum, there was a vertebral thrombosis.

Carpenter's patient fell 10 feet to the ground from a tree, becoming paralyzed in both lower extremities. He was rendered unconscious for about 2 minutes. Soon after entrance into the hospital, he had intense vertigo, vomiting, and a horizontal nystagmus which was made worse on lateral gaze. Roentgenograms showed a compression fracture of the 7th cervical vertebra. The C6-C7 disc had ruptured, the superior surface and the posterior two-thirds of the body of C7 was displaced downward and posteriorly so that it projected 4 to 5 mm. into the spinal canal at the midline. There was a fracture of the right lamina of the 7th cervical vertebra. The patient, the following morning, had weakness of the left upper extremity and labored respiration. He died suddenly while being prepared for tracheotomy 29 hours after injury. Autopsy revealed an infarct of the left cerebellar hemisphere and the left side of the brain stem. There was a firm thrombus in the left vertebral artery extending into the origin of the anterior spinal artery. The clot also extended into the posterior inferior cerebellar artery. The vertebral artery was thrombosed at the level of C6 transverse process and foramen. The left