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Value of Angiography in Cerebral Nail-Gun Injuries

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A nail gun is a powder-actuated tool used widely in the construction industry. It uses powder charges to fire a variety of nails and studs into steel, wood, or concrete. Numerous injuries to the body with several deaths from the use of this tool have been reported. Twenty craniocerebral injuries have been reported in the world literature [1-13]; however, cerebral angiography has not been described in the management of these cases. In one of our patients, cerebral angiography demonstrated an injury of the transverse sinus. In the other, angiography confirmed that the nail had narrowly missed the cavernous sinus and carotid artery.

Case Reports

Case 1

A 4-year-old boy was standing on one side of a wall while a worker fired a nail gun from the other side. The nail passed through the wall

of concrete block and penetrated the child's head. The child fell unconscious to the floor. Examination revealed an entrance wound 2 cm off the midline in the left anterior parietal area. There was no exit wound. The patient was lethargic and did not respond to verbal commands. He had spontaneous movement in his left side and was hemiplegic on the right. His eyes were deviated to the left. Skull films showed a large nail lodged in the occipital area and extending into the posterior fossa. A computed tomographic (CT) scan demonstrated intracerebral hematoma along the nail tract with small bone fragments in the brain substance.

Cerebral angiography showed occlusion of the left transverse sinus (fig. 1). The patient received tetanus toxoid and antitetanic serum and was placed on antibiotics. Left occipital craniotomy and suboccipital craniectomy were performed. The transverse sinus was exposed and lacerations were found in both the superior and inferior walls. The nail was extracted and the transverse sinus was reconstructed with a graft. The entrance wound was debrided of necrotic tissue and hair and bone fragments. Postoperatively the patient was awake, alert, and stable. A small retained bone fragment was found on a postop-

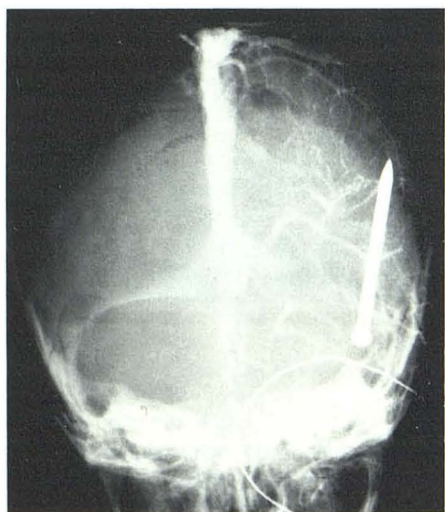
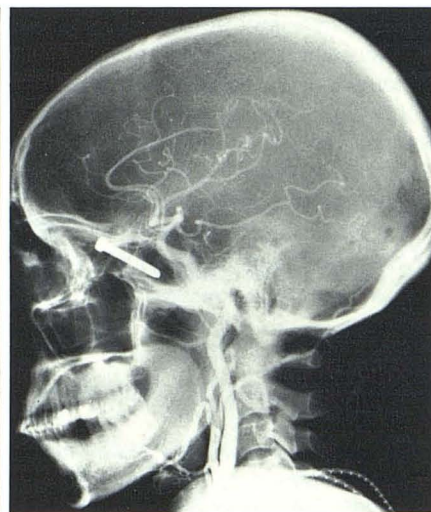


Fig. 1.—Case 1. Anteroposterior left carotid angiogram, venous stage. Occlusion of left transverse sinus.



A



B

Fig. 2.—Case 2. A, CT scan. Nail penetrates skull. B, Lateral right carotid angiogram. No injury to carotid artery.

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erative film. This bone was removed at reexploration. The patient regained his speech 7 days after surgery. At a 20 month follow-up, the patient spoke fluently but had residual spastic right hemiparesis.

Case 2

A 28-year-old right-handed male construction worker was injured by a 5-cm nail. While firing a gun to fix a piece of marble on a concrete wall, the nail ricocheted from an uneven surface and struck the patient. The entrance wound was at the inferior edge of the right medial canthus. The patient did not lose consciousness or vision in the right eye. The right eye was swollen with conjunctival congestion and eye movements were limited superiorly and laterally. Skull radiography demonstrated the nail to be lodged in the medial fossa in the vicinity of the cavernous sinus and carotid artery. CT confirmed that a curved nail was lying both in the base of the skull and in the posterior half of the bony orbit after penetrating the lateral wall of the orbit into the right temporal area (fig. 2A). Cerebral angiography did not demonstrate any vascular injury (fig. 2B). The patient received tetanus toxoid and antitetanic serum and was placed on antibiotics. Right frontal craniotomy was performed, with unroofing of the orbit and extraction of the nail. Postoperatively, the patient maintained normal vision in the right eye and regained normal eye movements within 3 months.

Discussion

Despite the incorporated safety features and the strict instructions on the use of the nail gun, this tool still presents a safety hazard. In 1959, Jacoby [3] reported two cases of craniocerebral injury from the nail gun. We found reports of 18 other craniocerebral nail-gun injury cases [1, 2, 4–13]. Our case 1 is the first reported childhood injury of this type. The location of the nail inside the cranial cavity in our patients suggested the possibility of injury to major vessels. Preoperative angiography demonstrated serious vessel compromise in one; in the other, the vessels narrowly missed injury. Many reports of low-velocity foreign-body penetrating injuries have not described preoperative angiography [14–18], while some reports have [19, 20]. The indication and value of cerebral angiography in stab wounds to the skull have also been established [21–23].

We believe that angiography in nail-gun injuries, as in any cerebral penetrating injury, will serve both to rule out acute vascular injury, which will complicate the surgical therapy, and as a baseline for future angiographic studies should traumatic aneurysms or fistulas develop.

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