THE BLOOD SUPPLY OF THE INCUS

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It is generally held that the incus has a poor blood supply although it would appear that, in health, it is adequate. In disease, it has been observed that the long process of the incus is frequently necrosed and, as the result of the clinical examination of a recent case, it is interesting to consider the nutrition of this ossicle.

A boy, now aged 11, had a bicycle accident at the age of 5, was unconscious for a short time, and had slight bleeding from the right ear. Radiological examination showed no evidence of any fracture of the skull and, some time afterwards, his mother noticed that he was becoming deaf in the affected ear. On examination a year ago his right drum appeared to show a small scar just behind the handle of the malleus; he was not stone deaf in that ear but an audiometric chart, with masking of the left ear, showed that he could hear only a few notes at, approximately, 80 decibels; his caloric response on the right side was normal.

The deafness appeared to be cochlear deafness but there were some points which made one suspect that there might also be a middle-ear element in the deafness, and the middle ear was inspected by means of the stapes mobilization approach. The middle-ear mucosa was perfectly normal, there were no adhesions, no congestion, and the only abnormality found was the absence of, approximately, 3 millimeters of the tip of the long process of the incus, including the lenticular process. The alignment of the long process was not disturbed and the tip, instead of being square cut, as it were, tapered to a point, the outer surface appearing to be eroded rather more than the medial surface. The stapes was completely mobile and the normal round window reflex was present. The articular surface of the head of the stapes, instead of showing a smooth glistening surface, had a slightly congested velvety appearance. After the middle ear had been carefully inspected, the drum was replaced and held in contact with the head of the stapes by means of gelatine sponge. On examination some weeks later, it was found that the drum had apparently become firmly adherent to the head of the stapes. The drum remained mobile, but no improvement in the hearing occurred.

How can one explain the apparent atrophy of the tip of the long process of the incus, six years after a head injury? The most reasonable explanation would appear to be, that it had been deprived of its blood supply as the result of dislocation of the inco-stapedial joint. Nager and
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Nager, in a careful study of the blood supply of the middle ear, state that the incus is supplied by a branch, the ossicular branch, of the anterior tympanic artery, which enters the middle ear through the petrotympanic fissure. This artery provides a branch to the malleus and another, the incudal artery, which enters the incus usually on the lateral side of the body of the ossicle but which may show some variation. Inside the body the artery forms a vascular network, which gives rise to branches supplying the short and the long process. The mucosal network over the incus and the inco-stapedial joint is supplied by vessels which arise from the posterior branch of the anterior tympanic artery and, while a few tiny branches pass through the cortex and join the vascular network inside the narrow space, vessels in the mucosa over the long process seldom pass into the bones. A branch from the superior tympanic artery and branches from the inferior tympanic artery supply a dense vascular network over the inco-stapedial articulation and also a small vessel which enters the bone of the neck and head of the stapes. It would thus appear that the incus is supplied mainly by the incudal artery which usually enters the body of the ossicle. The findings in the case described, however, would appear to suggest that the tip of the long process, including the lenticular process, is nourished mainly from the network of vessels surrounding the capsule of the joint. It is known that the head of the femur is nourished from vessels in the capsule of the joint and that the head of this bone is also susceptible to necrosis. It may be argued that the necrosis of the tip of the long process, in the case described, may have been due to some disturbance of the incudal artery before it entered the body of the ossicle and that the terminal branch, that is the branch to the tip of the long process, would be most affected in any reduction of the blood supply. Had the body of the incus or the remaining part of the long process been, as it were, out of alignment, this would have supported that view, but no such disturbance in the position of the body or long process was apparent. Also, necrosis of the long process is frequently seen in chronic suppuration and, in a recent case, while a large part of the long process was absent, the lenticular process with, approximately, one millimetre of the long process was found to be still present and the inco-stapedial joint intact. This could not have occurred had the lenticular process and the tip of the long process been supplied entirely by the terminal branch of the incudal artery running down inside the long process. This finding would appear to strengthen the suggestion that the tip of the long process with the lenticular process is supplied mainly from the network of vessels in the mucosa surrounding the capsule of the inco-stapedial joint.

Should this prove to be correct, then a most interesting point arises in the surgical treatment of otosclerosis. During the stapes mobilization operation, it is not uncommon for the inco-stapedial joint to be dislocated...
either by accident or deliberately, in order to give access to the footplate. It is possible, however, to dislocate the joint without tearing and disrupting completely the surrounding mucosa. After dislocation of the joint it is usually relatively easy to replace the incus on the head of the stapes and one hopes that union may occur. But, does it? If the incus is completely detached from the head of the stapes, it would appear, if the blood supply is cut off, that union may not occur and that the tip of the incus may necrose. This may take a considerable time. In the case described, six years elapsed before, approximately, three millimetres of the tip of the long process had necrosed. The accident occurred in a healthy child, whose tissues would be very viable, at the age of 5, and how long it would take to produce an equal degree of loss in an adult, it is difficult to say. Gisselsson, in a recent article, describes a case where, in a male, aged 33, a few millimetres of the tip of the long process were found to be missing, eight years after an accident; the remaining part of the long process was soft and necrotic. In the other ear the long process terminated a few millimetres short of the head of the stapes but was not necrotic. It may be expected that it will be some considerable time after disruption of the blood supply to the tip of the long process before necrosis and actual loss of bone may be apparent, but it will be interesting to re-examine those cases some years afterwards, where, at the original operation, the inco-stapedial joint had been disrupted. Also, should a patient, after a successful stapes mobilization operation, become progressively more deaf, it is necessary to keep in mind the possibility that this may be due, not to further fixation of the foot-plate, but to an actual break in the ossicular chain.

REFERENCES