Even though the facial nerve is the most commonly injured cranial nerve, penetrating trauma through the external auditory canal leading to facial nerve paralysis is extremely rare. Transtympanic facial nerve paralysis is well known to otolaryngologists as “slag injuries” in which molten metal or hot sparks enter the ear during welding. Iatrogenic injuries to the facial nerve are also well documented and can occur during otologic surgery and when removing a foreign body from the ear. However, only a few cases of nonthermal, noniatrogenic transtympanic damage to the facial nerve have been reported. We present a rare case of facial nerve paresis caused by accidental penetrating trauma and review the literature on this uncommon mechanism of injury.

### CASE REPORT

A 46-year-old white woman was wading in waist deep ocean water in Queensland, Australia, when a garfish jumped out of the water and struck her left ear. On presentation to the emergency department, she complained of otalgia, bloody otorrhea, left-sided hearing loss, and facial weakness. On examination, she was found to have left-sided House–Brackmann grade III facial nerve paresis because of a garfish penetrating her tympanic membrane and causing direct damage to the tympanic portion of her facial nerve. On follow-up after 12 months, her facial nerve function has largely returned to normal. Transtympanic facial nerve paralysis is a rare injury but can have a favorable prognosis if managed effectively. (Plast Reconstr Surg Glob Open 2015;3:e388; doi: 10.1097/GOX.0000000000000360; Published online 6 May 2015.)

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penetrated the facial canal anterior and superior to the oval window, in the perigeniculate ganglion region. The facial nerve was able to be stimulated with 0.2 mA. The alignment of the ossicular chain was maintained despite the close proximity of the foreign body to the body of the incus (green arrow).

An audiogram performed after 4 months revealed a mild to moderate conductive hearing loss present at 750 and 1000 Hz. On follow-up after 12 months, her facial nerve function has largely returned to normal and only gives her minor problems when she is fatigued.

DISCUSSION

Garfish Injuries
Garfish, also known as needlefish, long tom, alligator gar or aiguille, are surface predators found in the Indo-Pacific ocean. They have 2 narrow jaws and a long, spear-like beak and are prone to leaping from the water while swimming if they are frightened or attracted to bright lights. Garfish can cause serious and occasionally fatal penetrating puncture wounds, and involvement of the brain, orbit, chest, abdomen, upper limb and lower limb has been reported in the literature.

Anatomical Considerations
The facial nerve is prone to transtympanic penetrating trauma as it courses through the tympanic segment of the facial canal. Here, only the thin lateral wall of the facial canal separates the facial nerve from the tympanic cavity of the middle ear. The only connection between the middle ear and external auditory canal is the tympanic membrane, which, as seen in the current case, is easily breeched by penetrating trauma. Accidental penetrating trauma leading to tympanic membrane perforation is not uncommon, and objects such as a cotton-tipped applicator, key, bicycle wheel spoke, coat hanger, and twig have been reported.

Review of the Literature
The first reported case of transtympanic facial nerve paralysis occurred in 1930, in which the tip of

Fig. 1. Computed tomography showing a 2-cm linear foreign body (yellow arrow) extending from the external auditory canal through the tympanic membrane (blue arrow). The distal segment is located near the tympanic portion of the facial nerve (red arrow). The alignment of the ossicular chain is maintained despite the close proximity of the foreign body to the body of the incus (green arrow).

Fig. 2. Garfish beak removed from the patient’s external auditory canal.
a pair of scissors was found embedded in the facial canal of a 4-year-old girl, having completely transected the facial nerve. Since then, only a few other cases have been reported in the literature (Table 1).

There are 2 mechanisms by which transtympanic facial nerve paralysis is sustained. The first mechanism involves a person intentionally inserting an object into their external auditory canal and accidentally advancing it into their middle ear because of a slip of their hand. Gaillard et al described such a case in 1959 of a patient who accidentally gave herself a complete facial nerve paralysis with a knitting needle while attempting to scratch her external auditory canal. On surgical exploration, a fracture was found overlying the tympanic segment of the facial canal. After the bony fragments were removed, she had a complete recovery of her facial nerve function. Accidental transtympanic facial nerve paralysis with a button hook, hairpin, and the rib of an umbrella has also been reported in the literature.

The second method by which a person can sustain transtympanic facial nerve damage involves the introduction of a foreign object into the external auditory canal through a non-self-inflected mechanism. Kettel reported the case of an 8-year-old boy who was hit in the head with a metal pole. A large nail was protruding from the end of the pole, which entered the patient’s right external auditory canal and caused an immediate and complete facial nerve paralysis. Decompression of the facial canal occurred 5 months later, which improved the patient’s facial nerve function but a slight defect remained.

Arora et al described a case of a 17-year-old male who sustained a facial nerve paralysis after a wooden twig perforated his tympanic membrane. On exploration, this patient was found to have a congenital anomaly in which the facial nerve was exposed in the middle ear, instead of being protected by a thin sheet of temporal bone. This is in contrast to the current case in which the facial canal had to be fractured to injure the nerve.

Management

The development of an immediate facial nerve paralysis after penetrating trauma to the external auditory canal indicates that there is structural damage to the facial canal. Thin-cut temporal bone computed tomography should be performed to determine the extent of the damage and to exclude the presence of a retained foreign body. If a foreign body is excluded, facial nerve paralysis because of penetrating trauma can be managed expectantly if the paralysis is not complete, as this may recover spontaneously. Daily assessment of facial nerve conductivity should be performed, and if excitability is shown to decline, surgical decompression should be performed without delay.

Complete facial nerve paralysis requires surgical intervention as it indicates that the nerve is transected or has been injured to such an extent that a portion needs to be removed. These cases can undergo reanastomosis or grafting, with both options having favorable results. Through analysis of the literature, it seems that although rare, these injuries can have a favorable prognosis if managed effectively.

**Table 1. Cases of Nonthermal Transtympanic Facial Nerve Paralysis**

| Author          | Year | Penetrating Object    | Ossicular Disruption | Surgery Performed | Recovery of Facial Nerve Function |
|-----------------|------|-----------------------|----------------------|-------------------|----------------------------------|
| Wood            | 1930 | Metal scissors         | NR                   | Yes               | NR                               |
| Aloin           | 1934 | Hairpin               | NR                   | NR                | NR                               |
| Falcao          | 1936 | Rib of an umbrella    | NR                   | NR                | NR                               |
| Cawthorne       | 1946 | Button hook           | NR                   | NR                | NR                               |
| Kettel          | 1959 | Nail                  | NR                   | Yes               | Yes                              |
| Gaillard et al  | 1959 | Knitting needle       | No                   | Yes               | Yes                              |
| Laumans         | 1962 | Knitting needle       | NR                   | Yes               | Yes                              |
| Arora et al     | 1971 | Wooden twig           | No                   | Yes               | Yes                              |
| Present case    | 2012 | Garfish               | No                   | Yes               | Yes                              |

NR, not reported.

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