

## CASE REPORT

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# A Review of Nail Gun Suicides and an Atypical Case Report

**ABSTRACT:** The nail gun was designed as a powerful industrial tool to drive nails into various hard surfaces with ease. Serious injuries associated with the tool are uncommon and deaths are rare. Unintentional injuries normally occur from misuse of the tool or from ricocheting nails. The intentional use of a nail gun to commit suicide is unusual.

This paper will review successful and unsuccessful suicide attempts by use of a nail gun. We will present an atypical case of suicide committed with a nail gun by a 46-year-old depressed male investigated by the Allegheny County Coroner's Office in Allegheny County, Pennsylvania in April 2002. This case reports for the first time a unique pathological finding of a ring of bone traveling with the nail, which has not been seen in wounds of the head caused by other types of projectiles.

**KEYWORDS:** forensic science, nail gun, suicide, ring of bone, atypical case

Technological developments in science, medicine, and industry have improved our daily lives. Advances, especially in labor, have resulted in the replacement of hand-powered tools with those powered by electricity, gasoline, air pressure and gunpowder. Included among the industrial advances was the introduction of the industrial nail gun in 1959 (1). An unforeseen consequence of the development of this tool was that it would be used to commit suicide. While various means have been utilized to end an individual's life, suicide by use of an explosive activated nail gun is extremely rare. Unintentional and intentional injuries and death associated with this tool have been cited in the medical literature (2–13). Accidental nail gun wounds have been described to almost every part of the body (2–4). A detailed review of 21 reported cases of nail gun injuries indicated that the most frequent kind of trauma was cranio-cerebral injury due to accidental discharge or ricochet (3,6–10,14). The improper use of a nail gun to commit suicide has been both unsuccessful and successful.

### Unsuccessful Suicides

The use of a nail gun to attempt suicide is extremely rare, with only two cases of unsuccessful suicide being cited in the literature (1,11). In 1982, during a bout of depression, a 26-year-old man attempted suicide by shooting himself in the chest with a nail gun while working as a packer (11). The nail passed through the left ventricle of the heart and both lobes of the left lung without producing major hemorrhage or a tamponade. The victim regularly used a nail gun to seal crates in his job. In 1991, a 38-year-old man

was the victim of an intentionally self-inflicted nail gun wound to the chest (1). Roentgenograms of the chest showed two nails located within the left thoracic area. In both of these cases, the victims had a psychiatric history. The former had a history of depression and the latter suffered from paranoid delusions. Both victims survived their suicide attempts.

### Successful Suicides

The successful use of a nail gun to commit suicide, while very rare, has been reported four times in the medical literature. The first reported case of a successful suicide by a nail gun was published in 1990 (12). The case involved a 30-year-old man with a history of three previous suicide attempts. The victim was found dead in his living room with a nail wound to the left chest. The projectile passed through the 3rd rib, heart, left lung, and the 8th rib posteriorly before exiting from the left upper back.

The second case involved a 29-year-old construction worker who had been depressed for several years (12). He illegally removed a nail gun from the construction work site and shot himself in the middle of the forehead in the family garage. The nail passed backward and downward through the brain. It produced a defect on the inner table of the skull in the occipital region, but failed to exit the skull. Radiographs of the skull revealed the image of a straight nail. A suicide note was located at the scene.

The third case, reported in 1994, was a 52-year-old self-employed joiner with an extensive history of depression and three previous suicide attempts (13). The victim shot himself in the head with a Hilti 450, cartridge-powered nail gun, with the entrance wound located in the midline 6 cm above the glabella. The entry wound measured 2 × 0.5 cm with a rectangular imprint measuring 2.5 × 1.25 cm surrounding the entry wound. A radiograph revealed a 7 cm long nail lodged in the midline in the posterior cranial fossa.

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The fourth case, reported in 1999, involved a 54-year-old construction worker who shot himself in the right temple with a high velocity cartridge-activated nail gun (15). The skull radiographs demonstrated a steel bolt in the left cerebral hemisphere with the tip protruding through the left parietal bone. The victim had a history of depression and alcohol abuse.

The finding of a straight nail on the radiograph is important to the forensic pathologist conducting the autopsy investigation. A straight nail is indicative of a suicide while a bent nail most likely will be the result of a ricochet and therefore accidental in nature (16).

### An Atypical Case Report

We report the fifth case of a successful suicide by a nail gun and present several unique features not discussed in previous cases. In the morning hours of April 2002, a public park worker noticed an unresponsive man lying on the park grounds. The Allegheny County Police and the Allegheny County Coroner's Office (ACCO) were notified. Deputy coroners went to the scene and noted an unresponsive white male on the ground with his head in a pool of blood. The individual was pronounced dead at 10:30 A.M. by the Coroner's Office personnel. A nail gun was found to the left of the body.

The body and the nail gun were transported to the ACCO for examination. An autopsy was conducted on a 46-year-old, well developed, adequately nourished white male weighing 175 lb (79.4 kg), and measuring 72 in. (183 cm). An external examination of the head revealed an irregular wound measuring  $1.1 \times 0.8$  cm on the top of the forehead, at the midline. The upper end of the wound showed two lacerations, each 0.7 cm long, and a 1.2 cm laceration extending from its lower end (Fig. 1). A collar of red contusion/abrasion was noted around the wound extending for a distance of 0.5 cm from its border. No blackening was noted around the

wound. After reflecting the skin, a nearly circular defect was observed (Fig. 1). Radiography of the head revealed the presence of a nail in the cranial cavity (Fig. 2). Upon opening the cranial cavity, an internally beveled, 1.5 cm diameter defect was noted in the frontal bone (Fig. 3). The nail perforated the right cerebral hemisphere and then implanted within the midbrain and right cerebellar hemisphere. The nail was recovered from the brainstem and right cerebellar hemisphere (Fig. 4). A ring of bone was noted in the path of the nail at the right frontal lobe (Fig. 5). The outside (external) measurement of the ring of bone was 1.5 cm with the hole 0.8 cm at its widest (Fig. 6). The inside (internal) measurement was 1.8 cm with the hole measuring 1.0 cm at its widest (Fig. 7). The ring of bone was 0.3 cm thick and composed of the outer table and attached callcellous bone (Fig. 8). The dotted lines show the general direction of the beveling of the inside of the ring (Fig. 8). The recovered aluminum nail was straight and measured  $6.304 \text{ cm} \times 0.345 \text{ cm}$  with a head diameter of 0.809 cm (Fig. 5). The head of the nail was attached to remnants of bone, soft tissue and brain parenchyma (Fig. 5). The abrasion/contusion surrounding the wound of entrance represented an impression of the nail-delivering end of the gun, indicating contact between the end of the gun and the skin of the forehead.

The nail gun used was a Hilti DX36-M (Fig. 9). The Hilti DX36-M is a single shot, explosive cartridge-activated nail gun. This type of nail gun operates through a piston pushed by an explosion, which then propels the nail. To activate the nail gun, the front of the barrel must be in direct contact with the surface, with a pressure of 110N applied before the trigger can be pulled (Fig. 9). This makes it impossible for distant discharge of the nail.

### Unique Features

This case highlights several unique pathological/anatomical features associated with head trauma caused by a nail fired from a nail



FIG. 1—An external view of the entrance wound on the top portion of the forehead (L) and the wound site with the skin reflected (R).



FIG. 2—Radiograph of the head showing the nail within the cranial cavity.



FIG. 4—Brainstem showing the nail (arrow) in the right cerebellar hemisphere.



FIG. 5—Ring of bone (top) and the nail recovered from the brain (bottom).



FIG. 3—Internally beveled defect (1.5 cm) in the frontal bone.

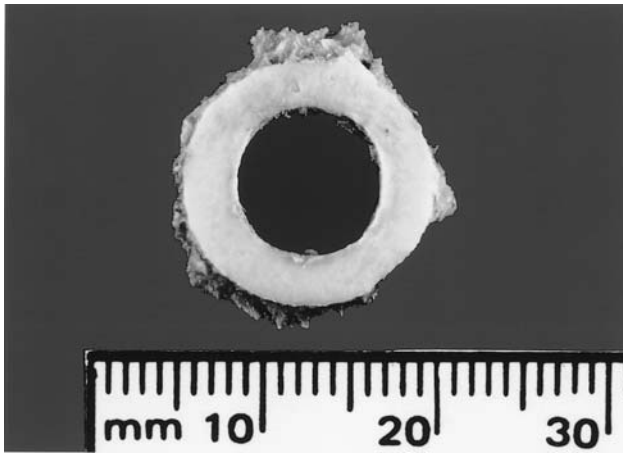


FIG. 6—Ring of bone external view.

gun. First, the presence of a ring of bone trailing the path of the nail. This feature has not been reported in previous articles. The mechanism for the detachment of a ring of bone has not been described previously. We believe that the ring of bone was formed in the following manner. The tip of the nail perforated the scalp, then impacted and perforated the skull creating a small hole in the skull out of proportion with the dimensions of the nail. When the head of the nail, which was 0.809 cm in diameter, came into contact with the skull the impact caused a ring of bone to break away from the skull. This ring of bone consisted of outer table and cancellous bone. The margins of the ring of bone was beveled inward with the outer table diameter of 1.5 cm and the attached cancellous bone diameter of 1.8 cm. The head of the nail was locked inside the ring of bone and dragged the bone a short distance prior to the head of the nail passing through the ring of bone. The hole that the head of the nail created within the ring of bone was 0.8 cm in diameter, which was slightly smaller than the diameter of the head of the nail (0.809 cm).

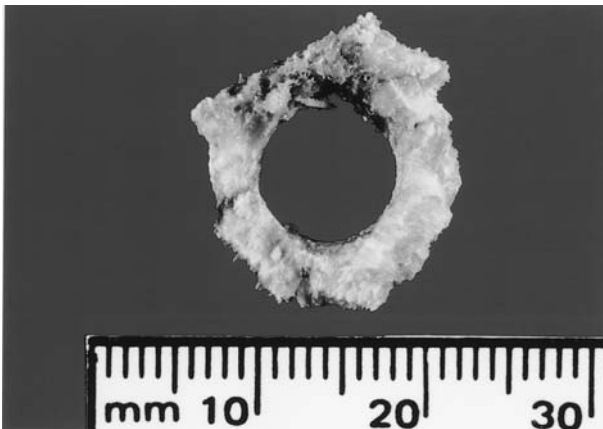


FIG. 7—Ring of bone internal view.

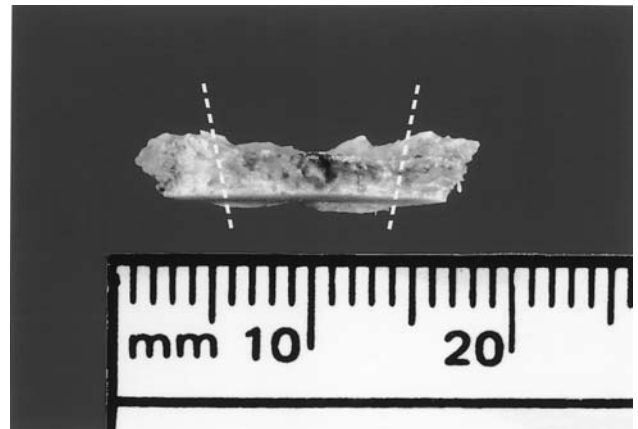


FIG. 8—Ring of bone (side view).



FIG. 9—Hilti DX36-M nail gun and front of barrel (inset).

As the nail traveled through the parenchyma it would wobble. The nail additionally was pulling the ring of bone along with it, which would significantly increase the resistance to its movement through the brain. These two factors led to the head of the nail becoming dislodged from the bone and traveling further through the brain. This feature, the ring of bone, has not been previously reported in cases of gunshot wounds of the head. Bullets cause bones to fragment and because they lack a trailing head no ring of bone is formed. If this feature proves to be solely the result of a nail passing through the skull, it would be an important clue for forensic pathologists in identifying the cause of the injury, especially in cases where the nail exits the skull and is not located at the scene; or if the nail gun and nail was removed in the case of a homicide. Second, the site of entry lacks soot around the point of entrance due to the absence of discharge of gases trailing the nail.

The victim in our case was atypical from previously reported suicides by nail guns in several ways. He did not have direct access to a nail gun through his place of employment, as he worked as a gas station attendant. Also, he committed the act outdoors as opposed to committing the act at his place of employment or at his residence. However, our case did fit the profile of the previous cases in that there was a history of depression. According to the next of kin, the deceased was depressed and had attempted suicide in the past.

## Discussion

Suicides by nontraditional methods have been reported within the medical literature and have included suicide by chain saws (17), electric drills (18), and nail guns (12,13,15). The use of an explosive cartridge-activated nail gun is common in most construction sites. The ease of use of the tool, coupled with the speed that it projects the nail (100–150 m/sec) (1), greatly increases the likelihood of traumatic injuries. The vast majority of unintentional injuries caused by nail guns are caused by either improper training or from nail ricochets. However, a very small percentage of successful suicides are committed using a nail gun. A review of these types of suicides reveals that all the victims suffered some form of depression. We cite the first reported case of suicide by the use of a nail gun in an open public location. This is in contrast to the previous four cases where the act was committed either at the job site or at the decedent's residence. This case also demonstrated the unique feature of a ring of bone associated only with trauma caused by a nail gun. This ring of bone is not seen in any other type of projectile injury to the head. This type of suicide, while representing a

very atypical method, highlights the fact that individuals with psychiatric disorders will use whatever means is available to them to commit self-harm.

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