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Cranio-Cerebral Injuries from Slaughterer's Gun

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Summary

3 patients attempted suicide by a powder-activated cattle skull impacting tool (Slauthterer's gun). While captive bolt pre-slaughter stunning in pigs and ruminants is safe, two of the patients remainded conscious after the shot and survived. Despite much lower impact velocity (less than 50 m/sec) these self-inflicted brain lesions are as serious as "low velocity" (less than 300 m/sec) penetrating gunshot wounds, mainly because of impaction of bone fragments and the dynamic energy possessed by the bolt.

Keywords: Penetrating skull wounds; captive bolt gun; self-inflicted brain injury.

Introduction

In war and civilian gunshots and in hunting animals killing or inflicting severe damage to the victim is the principal purpose. Industrial killing of animals, however, in general is obtained by exsanguination.

With respect to animal welfare and meat quality "traumatic coma" – obtained by electrical shock or cranio-cerebral injury from a club (concussion stunning) or from a penetrating stud device (captive bolt stunning) – most often preceeds the slaughtering.

Numerous cases of industrial, accidental nail- or stud-gun cranio-cerebral injuries have been reported from the last 25 years[1,14].

As only little attention has been paid since Simon[11] and Jacoby[5] enumerated and reported in detail 3 surviving and 22 non-surviving cases of self-inflicted, penetrating cranio-cerebral injuries from a "Slaughterer's gun", and as the weapon was only grossly described, another 3 cases from a 4-year period, treated in the Department of Neurosurgery, Odense University Hospital, will be reported.

The Weapon

As Fig. 1 illustrates the gun has a length of 30 cm and a diameter of 4 cm. The weight averages 2 kg. By dismounting the right end, the weapon can be loaded with blank cartridges of different forces for different species of livestock. The explosion provides the propulsive force to drive a piston and the bolt. At discharge the left end of the tool (the "muzzle") is held tightly and at a right angle against the forehead at the crossing lines from one eye to contralateral horn and inversely (where the skull is not very solid)[12], pressing the handle. The bolt, 1 cm in diameter, spherically hollowed and sharp (Fig. 2) thus penetrates the cranium 6–8 cm depending on the skull and the cartridge loading. As expanding combustion gases exhaust through holes beside the muzzle (Fig. 2), this causes the immediate withdrawal of the bolt by means of a strong spring. Maximum bolt velocity averages 50 m/sec[10].

The Patients

All three cases were males, a 34-year-old master butcher, a 34-year-old former journeyman butcher and a 47-year-old veterinary surgeon, all suffering from recurrent depressions and one from paranoia and psychomotor epilepsy (case 2).

The clinical presentation and course of the cases are listed in Table 1.

Comments: The deletary lesion in case 1 was in the right internal carotid or anterior cerebral artery, caused by a bone fragment originating in the left ethmoidal bone, propelled by the bolt ploughing down into the skull base. In case 2 bone fragments were removed between the pericallosal arteries (Fig. 3), but the damage of anterior part of the corpus callosum neither changed his "premorbid" mental behaviour nor his epileptic manifestations[13]. Contamination of the bolt (compared to a missile heat sterilized from friction in a barrel) and suspicion of infection[8,9] indicated revision of the lesion in case 3. Impaction of multiple and large bone chips (secondary missiles), mainly deviating from the main path of the bolt (Fig. 4) caused substantial morphological (Fig. 5) and functional brain damage (severely impaired short memory and concentration).

Discussion

Properly used the end of the bolt causes a mid-brain lesion, pressure shock-waves up to 30 bar[10] and local damage from impaction of bolt and bone fragments, usually resulting in immidiate coma and collapse of the animal.

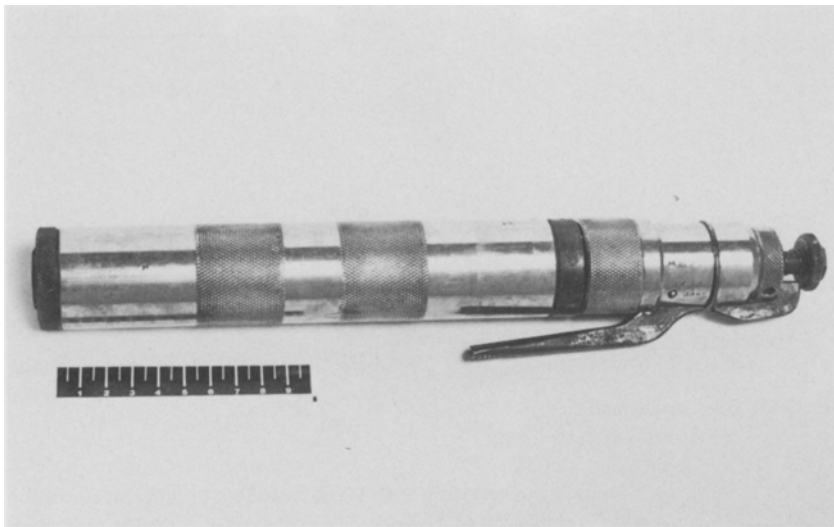

Fig. 1. Captive bolt gun model Schermer – "Slaughterer's gun"

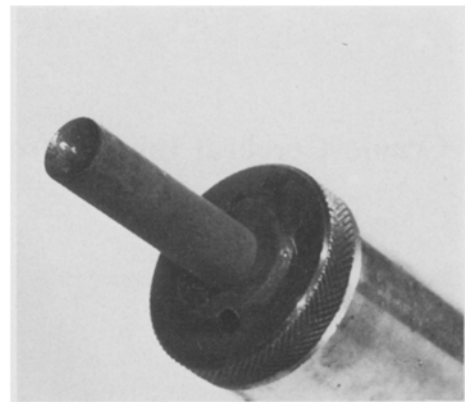

Fig. 2. "Muzzle" and bolt of "Slaughterer's gun". Note the hollowed and sharp end of the bolt and exhaust openings for expanding combustion gases

Fig. 3. Case 2. Lateral skull film revealing sharp-edged defect in vertex and location of impacted bone fragments

Fig. 4. Case 3. Lateral skull film revealing small defect in frontal theca externa and impaction of several fragments of theca interna and wall of frontal sinus. Note the deep fragment and the air in lateral ventricle

Regarding suicide, however, evidently the procedure and the weapon are inappropriate and in two of the cases inadequate. Studies on penetrating gunshot skull wounds under civilian[6] and recent military[4,8] conditions as well as animal experiments[2] have stated, that the extent and severity of brain damage depend predominantly on the material, shape, weight and particularly impact velocity of the missile. Still, wound ballistics cannot evaluate the brain lesion in the cases presented, as the weapon in question is different from firearms in certain important aspects.

The perfect spin of a bullet from a rifle often converts into more or less tumbling after penetration of the skull[3,6], while yaws of the bolt are impossible.

Table 1. *Clinical Presentation and Course in Three Cases of Self-inflicted Cranio-cerebral Injury from a "Slaughterer's Gun"*

Case	Entrance of captive bolt	Neurological presentation	Clinical course	Outcome
1	Frontal region	Comatous, hemiplegic	2 hours survival	
2	Vertex	Awake, hemiplegic	Unchanged postoperatively	Hemiplegic, independent in self-care
3	Frontal region	Deeply somnolent	Unchanged postoperatively	Independent in self-care

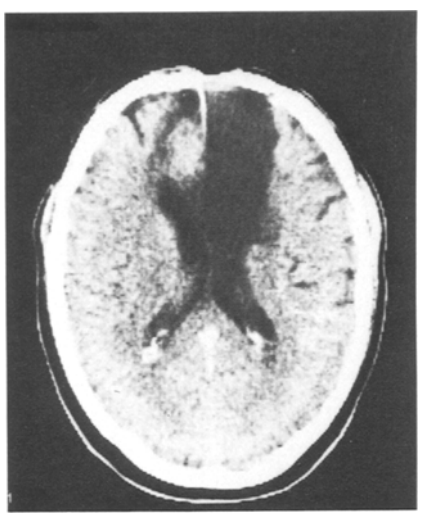

Fig. 5. Case 3. CT scan some 3 years after lesion from a "Slaughterer's gun" in right frontal region. Note the cortical atrophy in both hemispheres frontally

Depending on the impact velocity, missiles from fire-arms (and nail-guns) often remain intracranially after penetration[14], sometimes ricocheting several times[3], while the present bolt is withdrawn as soon as increasing elastic power of the return spring overtakes decreasing power from the expanding but escaping gases from combustion of the propellant.

The present bolt is neither a missile travelling at decreasing speed determined mainly by the muzzle velocity and the distance from the muzzle. On the contrary, even after penetration of the skull and dissipation of part of the energy, the bolt may still accelerate intrathecally, particularly if the piston area is four times the end of the bolt (as in the weapon shown in Fig. 1 and 2).

While combustion gases escape from the "muzzle" in the cattle-impacting bolt gun, conventional gunshot wounds from discharge at very close quarters or contact wounds also often provide a blast effect in the missile tract from explosive gases emanating from the barrel[2].

Of course the "muzzle velocity" of the present bolt cannot be defined (in fact it is 0 m/sec), but the maximum velocity after skull penetration can only be estimated. Whatever the deepest fragments in case 2 and 3 – literally plugs consisting of skin, scalp and bone – have been accellerated by or pushed in front of the bolt, the cerebral pathway is only 6–8 cm[11]. As a small steel ball, entering the brain at only 56 m/sec, still possesses energy to penetrate bone after passage through 6 cm of brain tissue[2], the maximum impact velocity of the captive bolt must be less, possibly only half of that (*i.e.* 100 km/h) – virtually only little more than that of a penetrating dagger[3].

Thus, despite marked differences in the wounding mechanism, penetrating brain lesions from captive bolt guns in man with regard to their extent and severity are similar to conventional cranio-cerebral missile injuries and the treatment is identical. The best prognostic sign with respect to survival also seems to be the level of consciousness in the early postinjury period[3].

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