STUN QUALITY IN RELATION TO CATTLE SIZE, GUN TYPE AND BRAIN HAEMORRHAGES

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SUMMARY

Data collection was made on 594 cattle to assess stun quality. Brain damage was assessed on 14 of these cattle. The brain bleedings were limited to cattle showing corneal reflex. The largest bleedings (located at the stem and base of the brain); were seen in cattle shot with a pneumatic stun gun. The results suggest that causes of poor stunning included inaccurate shooting on the skull and the use of a too weak weapon for bulls. Heavy blood haemorrhage or brain matter disintegration in the frontal regions of the brain, do not necessarily indicate unconsciousness or insensitivity to pain.

Keywords: animal welfare; stun quality; cattle; slaughter

INTRODUCTION

The captive bolt is the principle method of preslaughter stunning of cattle. It is intended to produce instantaneous insensibility until death occurs from exsanguination. However, Finnie et al (2002) studied brain damage in sheep after captive bolt stunning and found that the severity of structural brain damage varied considerably. Daly (1991) studied stun effect on 2500 cattle and found bulls were more difficult to stun than other cattle classes. The captive bolt creates a large, deep, penetrating and well defined haemorrhagic track and, although the injury is penetrating rather than perforating, the bolt frequently traverses almost the full thickness of the brain. This study aimed to macroscopically examine the skull and brains of cattle that displayed symptoms of poor or uncertain stun quality, to determine if these symptoms correlated to inferior levels of brain damage compared to properly stunned cattle. The study also aimed to compare stun quality and associated brain damage in bulls shot with a captive bolt stun gun, and bulls shot with a pneumatic stunner.

MATERIAL AND METHODS

Data collection was made in 2 different abattoirs. In total 594 cattle were observed during stunning in abattoirs A and B. In abattoir A, a captive bolt stun gun was used, manufactured by Accles and Shelvoke LTD, type Cash Magnum 9000, 0.22 calibre. The gun had finger-activated trigger and fired a 121 mm long, and 11.91mm diameter retractable bolt. Three cartridge types were used to fire the bolt pistol according to the size of the animal and colour coded accordingly. Green cartridges (3G) were used for beasts under 300kgs live weight, red cartridges (4G) for animals over 300kg (medium sized animals such as cows, heifers and steers), and black cartridges

(4.5G) were used for very heavy bulls. The firing velocity and energy values according to the manufacturer's specifications for the Cash 0.22 calibre gun are as follows:

Black cartridges – 66.8 m/s and 517 joules. Red cartridges – 56.4 m/s and 361 joules. (Accles and Shelvoke LTD 2003; Detec, 2003). The captive bolt stun gun used in abattoir B was the same type as in Abattoir A. All bulls were shot with black cartridges. In Abattoir B, a pneumatically air operated and trigger fired stunner was also used, manufactured by Jarvis products corporation, USA, type USSS-1. The specifications for this gun were as follows: Operating pressure 11–12 bar. Air consumption per cycle 41 L. Penetrating bolt diameter 15.9 mm.

Stun assessments

Each animal was closely examined immediately after stunning and continuously up to sticking. Eyeballs in a fixed stare straight forward (no movement), dilated pupils and Minimal kicking and reaction to the sticking procedure outlines the clinical symptoms used to identify animals that were considered satisfactorily stunned. Cattle that showed symptoms separating them from the above protocol were recorded and rated from 1–4 (table 1). Symptoms rated 1or 2 were considered as indicating low stun quality (rate 1 been the lowest). Rate 3 and 4 symptoms were considered as important to note, but not as serious as rate 1 or 2 reflexes.

Table 1. Displayed symptoms grouped and rated from 1–4

Rating	Symptoms displayed
1	• Corneal reflex
2	• Spontaneous blinking • Full or partial eyeball rotation up to sticking
3	• Full or partial eye ball rotation followed by pupil dilation before sticking***
4	• Gasping, groaning • Excessive struggling or kicking at sticking

***Literature suggests that properly stunned animals should not show any eye ball rotation. However this study has shown that some cattle can rotate the eyeball immediately after stunning or after some 10 or 20 seconds, after which it centres, the pupil dilates and the animal shows symptoms of being properly stunned.

Macroscopic head examinations

Brain damage was assessed on a selection of cattle only. The selection was intended to make a comparison between cattle displaying symptoms of a deep stun, and those displayed a series of other symptoms which could indicate otherwise. Each selected animal was identified and the head taken from the slaughter line after decapitation and skinning. After examination all brain material was placed in the SRM (Serious Risk Materials) container for appropriate disposal.

Brain damage

The level of brain damage was examined, firstly while still in the skull. The bolt penetration wound into the brain cavity was recorded as hitting either low, midway, or high in the brain cavity. The brain was then removed from each half of the skull and further examined for amount and location of bleeding and damage. These damages were quantitatively assessed by estimating the percentage of the brain surface with blood haemorrhage.

RESULTS

The stunning of cattle in abattoir A and B when using the captive bolt guns resulted in poor stun quality in 1.9% of cows and 18% of the bulls studied. The use of a pneumatic stun in abattoir B resulted in a poor stun quality in 0.4% of the cows and 1.3% of the bulls. Table 4 shows a summary of the reflexes seen in both abattoirs for both gun types used. In total, 7% of the bulls shot with the captive bolt stun gun showed corneal reflex symptoms, while none of the pneumatic gun shot bulls had corneal reflexes.

Table 4. Summary and comparison of symptoms rated 1 or 2 in abattoir A and B with captive bolt weapon use in abattoir A, and captive bolt and pneumatic stun gun use in abattoir B

Abattoir	Gun type	Reflex rating 1		Reflex rating 2		Reflex ratings 1& 2	
		Cows	Bulls	Cows	Bulls	Cows	Bulls
A	Captive bolt	0/150 (0%)	3/100 (3%)	3/150 (2%)	12/100 (12%)	3/150 (2%)	15/100 (15%)
B	Captive bolt	0/10 (0%)	5/20 (25%)	0/10 (0%)	2/20 (2%)	0/10 (0%)	7/20 (35%)
B	Pneumatic gun	0/240 (0%)	0/74 (0%)	1/240 (0.4%)	1/74 (1.3%)	1/240 (0.4%)	1/74 (1.3%)

Large brain bleedings were considered to occur when there was bleeding down the centre of the brain and at the brain stem area. Minor brain bleedings were considered to occur when there was no or very little bleeding at the brain stem area, and down the central path of the brain. All cattle that showed corneal reflex symptoms (reflex rate1), had minor brain bleedings (figure 1), even though they were shot more than once. The brain bleedings were the least in cattle showing corneal reflex, and the largest brain bleedings at the stem and base of the brain were seen in cattle shot with the pneumatic stun gun (figure 2).

Figure 1. Captive bolt shot bull, shot 3 times.

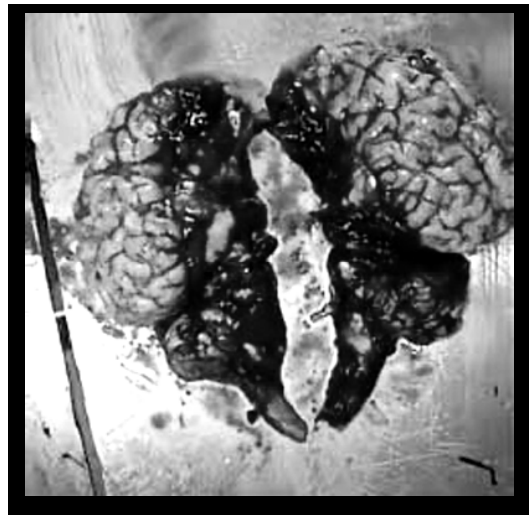

Figure 2. Pneumatic bolt shot bull, shot once.

The results suggest that the causes of poor stunning were inaccurate shooting on the skull and the use of a too weak weapon for bulls.

DISCUSSION AND CONCLUSIONS

In routine stunning at slaughter, a significant proportion of cattle, mainly large bulls, show signs of poor stun. The brain damages seen by the pneumatic gun tended to be larger, with more and heavier bleeding areas at the back of the brain. This suggests that the brain is shaken more vigorously with the use of the pneumatic gun at shooting, contributing to better stun quality. Bleedings on the brain as a result of a hit, tend to occur on the opposite part of the brain where the impact occurred ("contre-coup"-effect). To create a rapid and massive bleeding it is favourable to cause an arterial bleeding in the subdural or subarachnoidal areas around the brain stem and basal parts of the brain. As the arteries enter the brain at the base, that area is an important target to cause disruption and bleeding. Heavy blood haemorrhage or even brain matter disintegration in the frontal regions of the brain, do not necessarily indicate certain unconsciousness or insensitivity to pain. However, if there are bleedings around the brain stem and subarachnoid haemorrhaging at the base of the brain, there will be definite unconsciousness and a high probability of death. To reduce the risk of poor welfare at slaughter, the stunning of bulls with the use of guns must aim at resulting in such brain stem haemorrhages.

REFERENCES

Daly, C.C. (1991) Captive bolt stunning of bulls. Ministry of Agriculture, Fisheries and Food Report. Tolworth, England.

Finnie, J.W., Manavis, J., Blumbergs, P.C. and Summersides, G.E. (2002) Brain damage in sheep from penetrating captive bolt stunning. Australian Veterinary Journal: 80: 67–69.