BONE FRACTURES IN PIGS AS A CONSEQUENCE OF ELECTRICAL STUNNING

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Several types of skeletal fractures occuring in pigs as a consequence of electrical stunning have been discussed. These fractures cause economical losses since they are accompanied with haemorrhages in meat. Another point prejudicial to these fractures is that they may easily give injuries to workers engaged in boning the carcasses; especially when carcasses are involved with fractures of the scapulae. The origin of the skeletal fractures has been assigned, while the way to avoid such fractures has been discussed.

DES FRACTURES DU SQUELETTE PAR SUITE D'UN ÉTOURDISSEMENT ÉLECTRIQUE CHEZ LE PORC

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Différentes catégories de fractures du squelette par suite d'un étourdissement électrique chez le porc ont été discutées.
Ces fractures causent des déperditions économiques, puisqu'elles sont liées aux hémorrhagies musculaires. Un autre point, au détriment de ces fractures est la possibilité que ces fractures causent des blessures chez les travailleurs tarés avec le désossement des carcasses, en particulier quand il s'agit de carcasses avec fractures du scapula. La cause de ces fractures du squelette a été assignée et différentes méthodes pour éviter ces fractures ont été discutées.

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KNOCHENBRÜCHE BEI SCHWEINEN INFOLGE ELEKTRISCHER BETÄUBUNG

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Verschiedene Arten von Skelettfrakturen bei Schweinen infolge elektrischer Betäubung sind besprochen worden. Diese Frakturen verursachen wirtschaftliche Verluste weil sie mit Muskelblutungen verbunden sind. Ein weiterer Punkt zum Nachteil der Frakturen ist dass sie bei den mit dem Ausknochen beauftragten Arbeitern, leicht zu Verletzungen Anlass geben. Besonders trifft dies zu wenn es sich um Karkassen mit Scapula-Frakturen handelt.
Nachdem das Entstehen der Skelettfrakturen beschrieben worden ist, werden Wege zur Vermeidung solcher Frakturen besprochen.

ПЕРЕЛОМ КОСТЕЙ У СВИНЕЙ ВСЛЕДСТВИЕ ЭЛЕКТРИЧЕСКОГО ОГЛУШЕНИЯ

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Приведены различные виды перелома костей у свиней как следствие электрического оглушения. Эти переломы влекут за собой, во-первых, экономические потери, так как они связаны с мышечным кровотечением. А во-вторых, переломы становятся легко причиной поранения работников, занятых удалением костей из скелетов. Это явление имеет место в особенности при переломах лопатки.

После описания явлений, влекущих за собой возникновение переломов костей, указаны пути их возможного предотвращения.

BONE FRACTURES IN PIGS AS A CONSEQUENCE OF ELECTRICAL STUNNING

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INTRODUCTION

In the present study attention was paid to the importance of skeletal fractures in pigs. Skeletal fractures may result in economical losses by two different ways. Firstly, the occurrence of fractures may hamper dissecting the affected carcasses, since they are accompanied with haemorrhages in meat that has to be cut away. This procedure is time-consuming, while meat containing haemorrhages is not suitable for the production of meats, or even must be condemned. Secondly, skeletal fractures may easily give injuries to workers engaged in cutting and boning carcasses, resulting in bodily harm and in that way also in economical losses (Van der Wal et al., 1975; Van der Wal, 1976).
To reduce damage and economical losses caused by skeletal fractures it is necessary to study the different types of fractures, because only when sufficient knowledge is available measures can be taken to avoid such fractures.

MATERIALS AND METHODS

Observations concerning bone fractures were performed on normal slaughter-pigs, weighing about 100 kg.
Different types of skeletal fractures were examined and described. This was carried out at slaughtering, as far as fractures of the vertebrae were involved. Other types of fractures were studied during cutting and deboning the carcasses. Further an inquiry was made into the frequency at which shoulder blade fractures do occur in slaughtered pigs. The origin of these latter fractures was studied under experimental circumstances.

RESULTS

Types of skeletal fractures

Thoracic fractures may easily be observed while cutting through pig carcasses at slaughter. These fractures are mostly present in the 5th and 6th thoracic vertebrae; the fracture splits the corpus vertebrae in an almost transversal direction. As the frequency of thoracic fractures is low, their economical significance is rather small, in spite of diffuse haemorrhages in the longissimus dorsi muscle that may accompany them.
Sometimes other fractures do occur in hams of pigs as mentioned by Monin (1973). These fractures, localised in the head of the femur, are also accompanied with haemorrhages. Ham fractures are just like fractures of the spinal column not very often found.
The third type of fractures can be found in shoulders of electrically stunned pigs. The shoulder blades of such pigs may be broken in three different ways:

a. the spine has been broken parallel to the outer surface of the scapula. This type of fracture, however, is rather harmless;
b. the neck of the shoulder blade has been broken. In contrast to the former fracture, this one may easily give rise to injuries of the workers engaged in cutting and boning the shoulders. Further, haemorrhages as a consequence of these fractures influence meat quality unfavourably;
c. the most dangerous shoulder fractures are those in which the glenoid cavity is broken into three pieces according to a star-shaped pattern. Just like fractures of the neck of the scapula, the fractures as mentioned under c can easily cause injuries to workers, while they also produce economical losses by haemorrhages in the meat surrounding the shoulder joint.

The occurence of shoulder fractures

As shoulder fractures are the most common type of skeletal fractures in electrically stunned pigs, an inquiry was made to gather information about frequency in occurence and possible causes for these fractures.
No circumstances previous to the slaughtering process, like transport of the animals and way of unloading at the slaugter house, could be made responsible for the origin of shoulder fractures. On the other hand their frequency still varies between 0 to about 3 %, while in extreme cases this percentage even can rise to above 10 %.
A remarkable fact appeared at our inquiry. The number of carcasses with shoulder fractures was reduced to zero in slaughter houses using a restraining apparatus at stunning. This was the case both in slaughter houses using electrical stunning with 70 volts as well as in those using 180 volts (Table 1).

Table 1. Percentages of carcasses showing scapula fractures after electrical stunning.

number of factories	voltage used at stunning	number of animals slaughtered weekly	percentage of carcasses with shoulder fractures	restraining apparatus used
3	70 volts	11700	1.5 %	no
1	70 volts	5000	0.0 %	yes
4	180 volts	6700	2.2 %	no
2	180 volts	16000	0.0 %	yes

The use of a restraining apparatus at stunning offers advantages over stunning pigs without such equipment as

shown in the table.

Laboratory experiments

Observations made at slaughter houses showed that in pigs, stunned electrically, a sudden and violent stretching of the forelimbs occurred at the moment the electric current was applied. Slaughtermen in charge of stunning reported that they sometimes could hear the fracturing of the bones in the animals just at the moment stunning started. Mostly the skeletal fractures were localized in the scapulae, but sometimes thoracic vertebrae were affected. The data mentioned above gave rise to laboratory experiments in which shoulder blades were exposed to a pressure that was administered suddenly. This procedure was carried out by giving a hard blow on a piece of metal that was placed into the glenoid cavity of the scapula. The shape of this piece of metal resembled that of the head of the humerus. The consequences of such treatments were star-shaped fractures in the glenoid cavities of the scapulae, just like those that were found at dissection of affected shoulders. The shape of these fractures and also the other types of shoulder fractures agreed with that of the fibres that can be found in the compacta of the bone tissue of the scapulae. This structure was visualized by a technique developed by Benninghoff (1925). For this procedure bone tissue was decalcified with nitric acid (4 %) and afterwards the spongeous material was pricked with needles drenched in indian ink. The result was such that oval holes arose which were filled with ink according to the structure of the compacta.

DISCUSSION

During electrical stunning we see first of all that pigs suddenly stretch their forelimbs very violently at the moment the electric current is passed through their heads. Slaughtermen sometimes hear a cracking sound in the animal at this moment. Dissecting these carcasses after slaughtering confirmed the assumption that electrical stunning caused bone fractures. The fractures as mentioned above sometimes could be found in the thoracic vertebrae, but also and more frequently in the scapulae. Especially the shape of the fractures of thoracic vertebrae was identical with the type that was sometimes found in humans after electro-shock treatment and which was described as a compression fracture (Van der Beek, 1955). Shoulder fractures also can be provoked artificially as was done in laboratory experiments. To get a similar effect in the living animal a sudden violent contraction of shoulder muscles, synergistic as well as antagonistic ones, is necessary. Such muscular contractions really exist as could be shown by the presence of diffuse haemorrhages in different muscles of the shoulder girdle (Van der Wal et al., 1975; Van der Wal, 1976). The reason why shoulder fractures only arise in pigs while standing on the floor at the moment of stunning and not in animals being in a restraining apparatus, may be explained by the fact that when the forelimbs are stretched they meet with a counter pressure from the floor. This pressure only can be discharged via the shoulder joint, which often has a too low resistance in slaughter pigs in comparison with full-grown animals. The effect of the evoked pressure may be a shoulder fracture. In pigs being in a restraining apparatus such schoulder fractures do not occur. An explanation for this is that no counter pressure arises at stunning, because the animal's forelimbs are free from any contact to the floor.

CONCLUSIONS

- Skeletal fractures may be caused in pigs by electrical stunning.
- The occurrence of fractures of the scapulae in the course of electrical stunning may be prevented by the use of a restraining apparatus.

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