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# Bleeding Defects:

## Surface Bleeding on Skin Removal

*The leakage of blood from vessels after death causes several visual defects. This Bulletin describes one such defect, surface bleeding after skin removal, outlines possible causes of this defect and suggests ways to reduce its incidence and severity.*

### INTRODUCTION

"Surface bleeding" is a bleeding defect in which blood leaks from cut or broken superficial blood vessels and dribbles over the carcass surface after skin removal. This bleeding is very unattractive and can result in a significant downgrading of the carcass value.

Surface bleeding and other bleeding-related problems such as stifle-joint bleeding are becoming more common, but have no clear cause. MIRINZ suspected that bleeding defects may be developing due to changes in slaughter and dressing procedures that have been adopted over time. Because the changes have been gradual, and varied among plants, no one procedure or combination of procedures has clearly stood out as causing a specific defect.

These various changes in slaughter and dressing procedures have tended to be small and incremental, starting with the introduction of electrical stunning in the early 1970s, followed by modifications to control post stun movement and then changes to dressing procedures, including adoption of inverted dressing and the use of the final puller for skin removal, as well as minor changes to meet individual plant needs.

### PLANT VISITS

To solve the problem of surface bleeding, MIRINZ observed stunning, slaughter and dressing procedures at a variety of meat plants, then did experiments to investigate procedures thought to be contributing to the problem.

During the plant visits, MIRINZ staff discussed the problem extensively with plant staff, to pinpoint what they thought was causing this defect.

Because changes to stunning and other electrical treatments had, in the past, reduced other bleeding-related problems like speckle bruising and blood splash, plant personnel tended to focus on these treatments as a likely cause of the problem.

In some instances surface bleeding was blamed on inverted dressing, with or without the associated effects of electrical stunning and spinal discharge; in other instances spinal discharge or low voltage immobilization themselves were thought to be the culprit. Variations in the angle at which carcasses hang during bleeding seemed to affect surface bleeding. However, the effects were variable.

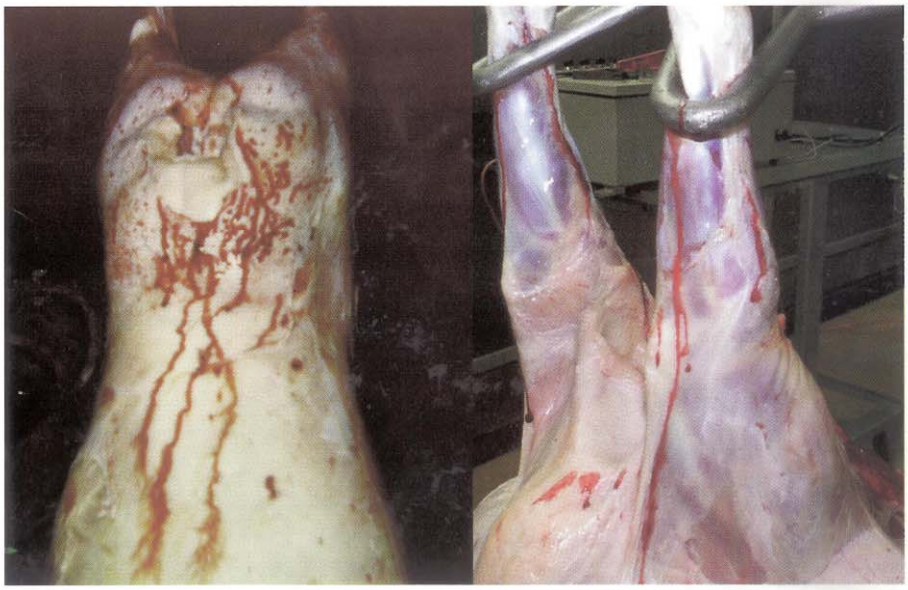
### BLEEDING IS IMPORTANT

One major finding arising from this survey is that most plants place insufficient emphasis on ensuring appropriate bleeding of carcasses. There is little awareness of the problems that poor bleeding can cause. Hence, it is not surprising that defects associated with bleeding are appearing.

### EXPERIMENTAL FINDINGS

To investigate the effect of the various processing variables thought to be causing the defect, MIRINZ carried out trials at the Ruakura experimental abattoir.

We found that when bleeding was rapid and effective, the surface bleeding defect did not occur. In other words, so long



*Two examples of surface bleeding*

as carcasses were well-bled, a variety of processing combinations, including traditional slaughter, head-only stunning followed by gash cutting, and head-to-body stunning followed by a thoracic stick, all resulted in carcasses with no surface bleeding. Spinal discharge and electrical immobilisation had little effect.

Inadequate carcass bleeding, and in particular, incorrect bleeding angle, was therefore identified as a major cause of the defect.

In New Zealand, sheep are mostly suspended from all four legs during bleeding. Hanging these carcasses at an angle will aid blood loss by gravity. We found that an angle of 30° was sufficient to give good blood loss (see figure, opposite).

In our studies, when sheep were hung approximately horizontal to the floor during bleeding, as occurs in many meat plants, surface bleeding occurred. Hanging sheep in this way allows blood to pool in the major veins, and this blood can then be moved to other places by gravity or by mechanical pressure during subsequent skin removal.

Inadequate work-up before mechanical pelting adds to the problem, because it results in greater pressures on the carcass during skin removal.

In inverted dressing systems blood is forced out of cut or torn surface blood vessels during skin removal to disfigure the leg, chump and loin areas. The blood dribbles over the clean, white carcass surface and also becomes trapped in fat and connective tissue. This blood is not easily washed off, and even if the first traces of blood are washed off, the exudation continues.

Our experiments showed that whenever bleeding was of a long duration and the bleeding angle was 30° or more, there was no surface bleeding. Although small spots were occasionally present with inverted dressing systems, these spots did not become exudative or weeping if there was good bleeding. Care in skin removal improved the situation but could not on its own eliminate the defect.

Other defects such as stifle joint bleeding are also likely to arise from inadequate bleeding. In this case, blood retained in the veins could be squeezed out of the vessels during pelting and find its way into the stifle joint.

*Example of the excellent carcass presentation that can be achieved.*

## PREVIOUSLY STUDIED BLEEDING DEFECTS

### Blood Splash

Blood splash arises from a certain type of muscle spasm caused through the stun. Some muscles supercontract and the asymmetric tension causes adjacent blood vessels to rupture. This rupture is made worse by other factors such as capillary fragility and increases in blood pressure (especially at localized sites). Blood splash seems to occur more often in young lambs, but also occurs in sheep and cattle. This bleeding defect occurs most obviously in the *rectus abdominus and intercostal* muscles, gall bladder and heart, but is not restricted to these sites. It becomes especially noticeable in other musculature during boning out. Blood splash is particularly obvious after head-only electrical stunning. Its incidence can be reduced by ensuring appropriate stunner placement, avoiding double stunning and reducing stun current and duration (Gilbert, 1993).

### Speckle Bruising

Speckle bruising appears as many red spots lying in the fat above the loin. It is particularly noticeable in sheep, but it occurs universally in sheep and cattle. It is only when speckle bruising is severe that it is a problem. In effect, speckle bruising is simply the start of a bruise. This defect is usually caused by a violent movement just before or during slaughter. It is seen with head to back electrical stunning, where a shearing action between fat and another tissue, such as muscle tissue, coincides with a momentary increase in blood pressure. In a living animal, the spots would soon be replaced by a bruise. With head-to-back stunning, speckle bruising can be reduced by avoiding high stunning currents and long stun

## OVERVIEW OF STUNNING AND SLAUGHTER IN NEW ZEALAND

### Traditional Slaughter

Traditionally, animals were slaughtered by pulling the head back, severing the throat and effectively cutting the carotid arteries, jugular veins, trachea, oesophagus (weasand) and various nerves. The animals were shackled, hung up by their hind legs, and allowed to go through post slaughter movements and to then bleed out over 5 minutes or so. This traditional method resulted in a complete bleedout; as well, animal movements during dressing were minimal. Even though death was rapid , the procedure was messy and therefore unpleasant. This procedure has been the main slaughter method used in sheep throughout human history.

### Head-only Stunning Before Slaughter

In the early 1970s, New Zealand sheep slaughter plants were required to reduce carcass contamination and to ensure humane slaughter. As a consequence, electrical stunning was adopted. The stunned animal was slaughtered by inserting a knife behind the jaw and cutting the major blood vessels - a procedure termed a spear stick. The spear stick seemed to give poor bleeding and so was replaced by a gash cut as in the traditional way. There was little space to stun, throat cut and let the animal hang to bleed out correctly. Head-only electrical stunning in itself therefore seems not to cause poor carcass bleeding; instead, compressing the procedures from stunning through to commencement of pelt removal seems to be the problem.

### Head to Body Stunning

Altering the current pathways so the current passes through the body of an animal eliminates post stun animal movements and blood splash. Stunning systems that use such current pathways, for example head-to-back or head-to-brisket stunning, were developed for both cattle and sheep. Although this type of stun stops the heart, this heart stoppage does not reduce the blood coming from the carcass. Instead, carcass bleedout is affected by the position of the carcass during bleeding and the length of bleeding time.

## CASE STUDY

Over the years many plants have changed parts of their operations without taking into account what is happening to the carcass upstream and downstream of the changed operation. For example, one plant changed from using head to back stunning to head-only stunning, for halal slaughter. The plant then installed a spinal discharge unit in the bleeding area and delayed the thoracic stick until after carcasses cleared the spinal discharge.

At spinal discharge only 30 seconds of bleeding from the carotid arteries had occurred. During spinal discharge, which stops the heart, there was no bleeding from the carotid arteries. By the time the thoracic stick was carried out, the carcasses had left the bleeding area. No further bleeding occurred, as the carcass angle was negative (the carcass sloped toward the tail end), to allow normal Y-cut dressing to take place. As a consequence blood remained in the carcasses. Delaying the thoracic stick would have exacerbated problems with bleeding. With such a delay, blood may begin to coagulate and thicken in the major veins, and so may not leave the carcass even if the bleeding channels are later clear.

Therefore, not only must the bleeding angle be appropriate, but the surrounding processes must allow good blood loss. Stunning must be quickly followed by slaughter, and this must be followed by appropriate carcass suspension (appropriate bleeding angle). Bleeding must occur before the blood begins

***Above:*** *Poor bleeding angle that allows blood pooling.*

***Right:*** *Engorged veins with just a small amount of surface bleeding.*

***Above:*** *Acceptable bleeding angle.*

***Right:*** *Excellent presentation possible through the use of the acceptable bleeding angle, above.*

to pool and starts to thickening and clot, and the bleeding duration must be long enough to ensure blood leaves the veins.

## HOW TO MINIMISE SURFACE BLEEDING

1 There must be a single application of the electrical stun (as short in duration as possible).
2 Effective carcass bleeding is essential:
   - There should be minimal delay between stunning and bleeding. Blood flow must be established within 3 minutes and all bleeding must be effectively completed once begun.
   - During bleeding, the animal MUST be suspended with both hind legs markedly higher than the sticking cut, with no "hammocking". A bleeding angle of 30° or greater gave good blood loss in our studies.
   - The bleeding duration should be as long as possible.
3 If there is still surface bleeding after skin removal, the bleeding duration should be increased, or the bleeding angle increased.
4 Careful work-up before mechanical pelting will help reduce the severity of the problem but will not, on its own, eliminate it.

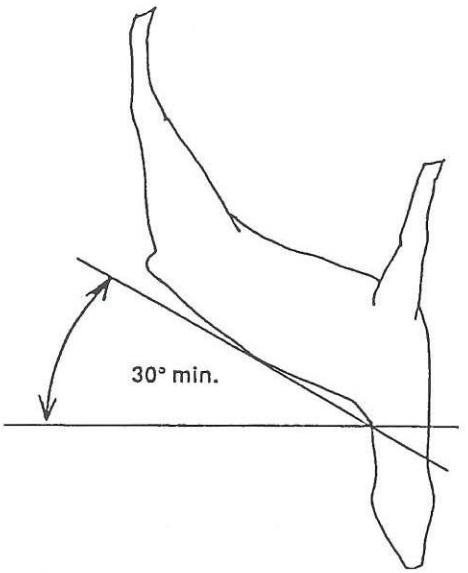



*Diagram of an acceptable bleeding angle.*

## WORK IS STILL NEEDED

Changing the bleeding angle is likely to require substantial plant modification, and so it is unlikely to be done on a "look-see" basis unless the correct parameters can be established conclusively. MIRINZ observations indicate that the problem of poor bleeding angle is widespread, and that resolving the problem may well be costly in some circumstances. Experimental work is needed to establish a model system that can be widely adopted, thus avoiding the possibility of ineffective *ad hoc* solutions.

The following questions still need answers:

- What is the minimum bleeding angle?
- Is there a maximum bleeding angle beyond which bleeding is not further improved?
- What is the minimum duration of bleeding and when is the latest time bleeding can start after stunning?
- Do inverted dressing or spinal discharge/immobilization have any effect on surface bleeding when bleed-out is good?

## SUMMARY

1 Our studies found the primary cause of surface bleeding to be poor bleeding angle and short bleeding times. This allowed blood to accumulate in veins.
2 To overcome the problem, it is necessary to redesign the operation, including the bleeding angle.
3 Further work is needed to redesign the sticking and bleeding areas, to minimise problems with bleeding and therefore enhance the final product presentation.
4 The surface bleeding defect is influenced by other factors, such as the quality of pre-pelting work-up.

## FURTHER READING

AMT (1995) Surface blood spots in the fat of sheep and lamb carcasses - inverted dressing. AMT Meat Research Newsletter no. 95/5. Australian Meat Technology.

Devine, C.E., Gilbert, K.V., and Ellery, S., (1983) Electrical stunning of lambs: The effect of stunning parameters and drugs affecting blood flow and behaviour on petechial haemorrhage incidence. *Meat Science* **9**, 247-256.

Gilbert, K.V. (1993) Electrical stunning and slaughter in New Zealand. MIRINZ Technical Report no. 908.

Leet, N.G., Devine, C.E. and Gavey, A.B. (1977) The histology of blood splash in lamb. *Meat Science* **1**, 299-234.



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