



Tackling “veininess”, Part one

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Fig 1: “Veininess” in neck visible in crust. Both neck wrinkles (lighter in colour and horizontal) and veins (darker and vertical) clearly visible.

The problem: Effect of veininess

Veininess usually refers to an unsightly defect visible on the grain linked to sunken veins. Nevertheless, prominent arteries too can result in downgrading of the leather, so it would be better to refer to “blood vessels”; however, for the sake of consistency the most commonly observed defect will be referred to as veininess.

Prominent blood vessels are not only unsightly, but they adversely affect the cutting yield. Once apparent in the crust stage, finishing can make veininess more pronounced. Inadvertent cutting of affected areas also can lead to problems in the final leather article. For example, the effect can suddenly become more obvious during the article production process, potentially leading to costly problems, for example, complete shoe rejection on lasting or automotive part rejection on stretching over a form or framework. Even if the defect is not visible, it will remain a point of weakness in the final leather with possible costly consequences and so must be avoided.

What is veininess? - A definition

“A prominent vein-pattern in hides (Fig 1) which becomes visible in the finished leather may be due to poor bleeding which favours bacterial growth”⁽¹⁾. Here starts the debate, with “may” because despite decades of investigations, many tanneries, even those with influence over raw stock at the point of slaughter, are still reportedly struggling with this defect despite adequate bleeding.

Histology

Blood vessels are composed of three key layers (from outside in). First, Tunica Externa (or T. Adventitia) composed mainly of collagen which also links it to the body and generally thickest in veins. Second, T. Media, rich in vascular smooth muscle and the thickest in arteries as it controls the calibre, whereas veins are not subject to high systole pressures. Third, T. Intima, the thinnest layer comprised of endothelial cells in direct contact with the blood flow. Arteries have two additional intermediate elastic

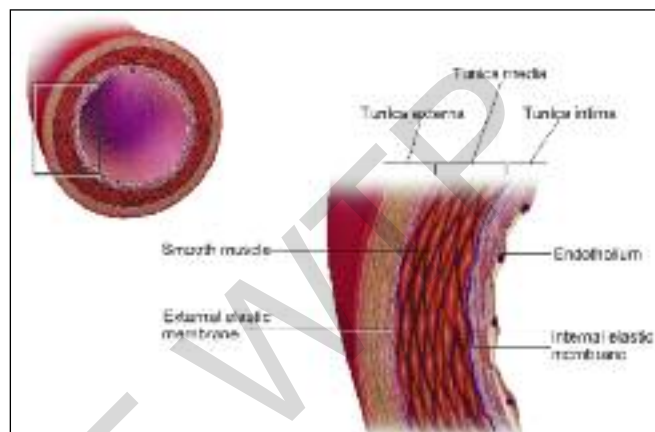


Fig 2: Typical structure of blood vessels: Arteries.

CREDIT: BRUCEBLAUS/WIKIPEDIA

membranes (internal and external E.M.) made of connective tissue proper (Fig 2). Veins could be simply considered as “tubes” and, when they are not filled with blood, collapse which leads to concave recesses, whereas arteries, with their thicker T. Media, can appear like pronounced “rods”.

The epidermal region of skin possesses relatively small veins, arteries and capillaries (Fig 3). Capillary distribution in cow hide was found to be closely related to the number of hair follicles⁽²⁾. In fact the hair bulb of each and every hair is supplied with a small capillary. These blood vessels are normally so small that they do not contribute to veininess. However, in turn these capillaries are supplied by arteries which are still relatively small in the epidermal area and blood leaves these capillaries via small veins. Because the veins readily collapse when the animal is slaughtered and are composed largely of collagen they tend to be more difficult to detect than arteries, which also contain elastic tissue that are easier to identify in skin⁽³⁾. A stain, e.g. Weigert's, can be used to highlight elastin which shows up blue/black to easily identify arteries.

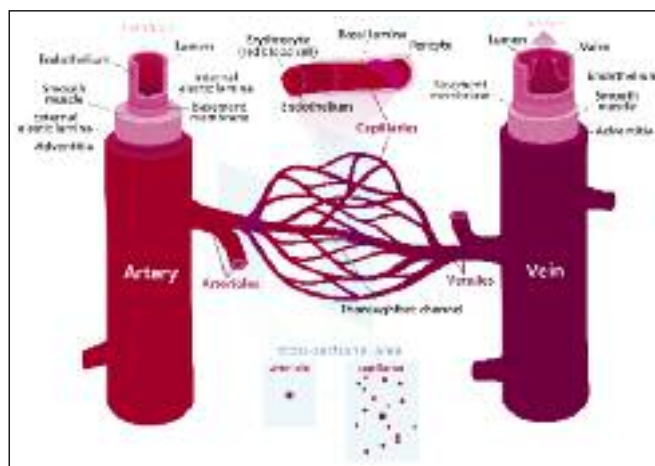


Fig 3: Vein vs. Artery with capillary network of epidermal area.

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Although blood vessels do not have appreciable peristalsis, the muscle layer supports blood pressure and circulation by regulating the inner diameter, controlled by the autonomous nervous system. Blood vessels are supported by fibrous tissues rich in elastin, which allows expansion and contraction. These histological points are important; they relate to the appearance of veininess and can be greatly influenced by processing.

What are the key factors to consider concerning veininess?

A) Pre-slaughter factors

I) GENETICS / SEX

The location and appearance of blood vessels in animals obviously varies. However, we most commonly see them as veininess in the neck and belly regions in cattle. If an hereditary condition exists, unless the tanner has influence over the farmer, he can only deal with the consequences, if he cannot source elsewhere. It is no coincidence that in all tractable animals, including cattle, vets generally use blood vessels of the neck, for example I.V. drug administration⁽⁴⁾, as they, despite the skin being probably at its thickest, are prominent and close to the surface of the skin. Sex of the animal plays a role in, for example, dairy herds specifically selected and bred to increase their milk production correspondingly have very obvious and pronounced blood vessels especially in the belly region to supply their all-time record sized udders.

II) FEEDING

Feeding practices have also been referred to, but little supporting evidence given, but it is quite likely that animals with inadequate food (during drought) will be more likely to grow thinner skins and thus blood vessels to become more pronounced. At the other extreme, cattle raised in the US and other large beef-producing countries are now larger than they were just 10 years ago. This is the result of advances in feeding technology (as well as genetics and animal husbandry) and it may also be having an impact on the quality of the hide⁽⁵⁾.

III) AGE

Older animals will have larger blood vessels and upon collapse greater risk of concave channels and with an increased likelihood of hardening in later life ("varicose veins"). However, the trend with animal farming seems to be faster raising and younger slaughter. Fast meat development would suggest blood supply and thus vessels would play an important role, although no references could be found confirming a link between this and veininess. However, the increasing challenge of processing more immature collagen, upon which the blood vessels are also based should be kept in mind, especially in beamhouse processing.

IV) STRESS / THERMOREGULATION

When the animal is distressed or hot when slaughtered this directly affects blood flow and thus veininess. In preparation for slaughter it is important to consider the degree of vasodilation and vasoconstriction which is used by the animals antagonistically for both fight-or-flight response and/or thermoregulation. The response may be intrinsic (due to local processes in the surrounding tissue) or extrinsic (due to hormones or the nervous system). In addition, the response may be localised to a specific organ, such as the skin (depending on the metabolic needs of a particular tissue, as during strenuous exercise), or it may be systemic (throughout the entire systemic circulation). At Brazilian packer and tanning group JBS, the cattle are given a cool shower prior to slaughter "which reduces stress on the animal"⁽⁶⁾. Two obvious outcomes from this cool shower:



Fig 4: A shower can help prevent an animal from overheating at slaughter and thus reduce the likelihood of veininess in the hide. CREDIT: ISTOCK

1) **Reduction in stress.** Stress leads to the release of hormones that affect the cardiovascular system. During the stress response, the animal also breathes faster in an effort to distribute oxygen and blood quickly to the body core and the heart also pumps faster. Stress hormones cause the blood vessels to constrict (vasoconstriction) and raise blood pressure. All that helps get oxygen to the brain and heart so the animal will have more strength and energy to react. If vasoconstriction pronounces the appearance of blood vessels then by reducing stress veininess should be less likely. Other anti-stress measures taken by JBS have been reported, from careful trucking, reduced transport distances, separation of cows and bulls in pens to reduce aggression, curved walkways and to the use of flags instead of sticks or prods⁽⁶⁾. It is quite likely that all anti-stress measures pre-slaughter help in reducing the stress response and veininess.

2) **Relaxed blood vessels.** Cattle being corralled in an hot climate induce a thermoregulation response (vasodilation). There are different types of vasodilation including sympathetic nervous system and cold-induced vasodilation and directly affects the relationship between mean arterial pressure, cardiac output and total peripheral resistance (TPR). TPR depends on several factors including most relevant to veininess, the diameter of the blood vessel, which is also key in determining resistance. An increase in either cardiac output or TPR causes a rise in the mean arterial pressure⁽⁷⁾. Vasodilation works to decrease TPR and blood pressure through relaxation of smooth muscle cells in the tunica media layer in blood vessels. When blood vessels dilate, the flow of blood is increased due to a decrease in vascular resistance. Vasodilation occurs in superficial blood vessels of cattle when their ambient environment is hot; this process



diverts the flow of heated blood to the skin of the animal, where heat can be more easily released to the atmosphere. A cool shower will increase the rate of heat loss from the skin and prevent the animal from overheating and should lead to a reduced likelihood of veininess (Fig 4).

B) Slaughter factors

EXAMPLE: INADEQUATE BLEEDING

Veininess has been often reported to be the result of inadequate bleeding of the animal after slaughter, followed by coagulation of blood in the vessels of the skin. Remaining blood could arguably have at least two negative effects on vessels (a) physically – it could leave the vessels in a stretched or distended state as it sets hard and (b) blood represents a highly attractive point of early microbial decomposition which would lead to subsequent attack of blood vessels and their collapse. However, for the vast majority of modern industrialised slaughterhouses, such an occurrence should be increasingly less likely especially as post-mortem electrical heart stimulation can be applied to remove far more blood than in the past.

C) Post-slaughter factors

I) RIGOR MORTIS

Post death, rigor mortis sets in so all muscle tissue is unable to relax, including that in the T. Media of especially arteries. Rigor mortis is very important in meat technology as it can influence the tenderness of meat. If post-slaughter meat is immediately chilled to 15°C, "cold shortening" occurs, where the muscle

tissues effectively shrinks. Electrical stimulation has been deployed to counter this, especially in beef carcasses and this could have a positive effect on rigid muscle tissue in arteries, but it is usually applied after skinning.

II) MICROBIAL ATTACK

Putrefaction can accentuate the natural loose structure around the blood vessels, causing the grain surface to sink and making veininess more likely. "When bacteria attack blood vessels then they can produce veininess. Autolysis by enzymes which diffused through the walls of the blood vessels of the reticular layer and which were active before the skins were salted"⁽⁸⁾.

Part two of this study of the best way to address the problem of veininess in hides will appear in the Feb-Mar 2017 issue of *World Leather*. 🌐

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