

SWELLED HEAD IN MERINO RAMS.
AN UNFINISHED DESCRIPTION OF AN ENQUIRY
INTO THIS CONDITION

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(Found amongst his papers after his death.)

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The term "Swelled Head" is applied by sheep owners to a condition occurring in young merino rams in the Western and North-Western districts of New South Wales. Whether it would occur in rams of other breeds is not known, since the merino is the breed exclusively maintained in those districts. The condition frequently terminates in death. Owners maintain that only rams are affected, but evidence shows that the special form of the disease from which it gets its local name is also seen in ewes and wethers. Furthermore, they state that the head is the only part of the body affected, whereas evidence has been obtained showing that "Swelling of the head" is only a special manifestation of a disease that is well known, and which shows itself in other forms of lesion. It is highly probable that, on account of the value of the rams, attention has been specially focussed on them while still alive or soon after death, and thus the striking and peculiar gross lesion has been observed quite readily. Rams are seen much more often than are the other members of the flock on a station; whereas ewes and wethers do not receive such close attention, so that the fact that any-

thing was wrong has not been observed until some time after death, when post mortem changes have caused bloating of the carcass. Moreover, since the number of deaths at a given period is not as a rule high, occasional deaths of ewes and wethers would not attract much attention among the thousands of sheep on a station, whereas the death of several stud rams, with a potential value running into four figures, would be discovered and commented upon immediately.

From time to time attempts have been made to ascertain the cause of "Swelled Head," and various agents have been charged by different workers with the offence. In one instance staphylococcus isolated from a case was claimed as the etiological factor. Others have considered the disease not to be microbic at all in origin, but really poisoning by some unknown plant. It is possible that the sporadic occurrence of the disease and the difficulty of obtaining suitable material, in the shape of a sick sheep, to work on, has largely accounted for the delay in arriving at a conclusion as to what the disease really was and what was the cause. On several occasions I have been asked to make some investigation into the cause of the trouble, and, before arriving on the station—some hundreds of miles from Sydney—have been informed that I should probably be unsuccessful in getting material, since no more sick or dead rams had recently been found. (It should be remembered, as already mentioned, that owners were very firm in the opinion that only rams are affected with this disease.)

The first occasion on which the writer came in actual touch with the condition was in 1923, when the representative of a large stud sheep station sought advice. He stated that young rams were dying on the station from "Swelled Head." Numerically the losses were not great,

but the value of the rams was such as to cause the owners concern. The losses had occurred annually on the station, but usually only an odd ram died from the complaint, though the numbers varied. No information could be obtained at the interview, which took place in Sydney, as to whether ewes or wethers were also affected; or whether the disease manifested itself in any other way than by swelling of the head. Once a ram showed distinct symptoms there was no recovery. The year 1923 was worse than usual as regards the incidence of "Swelled Head", and, furthermore, a local drought was being experienced, making hand feeding of the animals necessary. Again the manager considered that the disease was confined to the rams, though he stated that very few wethers were carried, and later correspondence showed that no one had troubled to ascertain closely whether any ewes were dying with similar symptoms, although it was known that ewes had died during the same period. It was the general opinion on the station that the cause of the trouble was dietetic (plant poisoning).

Upon request the head of a ram was sent to me in formalin. It presented what was afterwards found to be the typical appearance of "Swelled Head". The subcutaneous exudate was found to be only slightly tinged with blood. Occasionally a bacillus was found in the exudate, but, on account of the preservation in formalin, no culture or animal experiments could be carried out. Arrangements were made for obtaining fresh material, but, before further work could be carried out, the drought conditions necessitated the removal of the animals to other country, where the mortality quickly ceased. Nothing further was heard from this particular property, so one must conclude that the mortality had dropped to the average to which the owners had become accustomed for some years, and consequently their fears had become lulled.

In the winter the writer was approached by the breeder of valuable stud rams, situated a long distance from the above-mentioned case, with the object of discovering the cause of the trouble and endeavouring to find a means of prevention. The area of the station on which "Swelled Head" was occurring was about 400,000 acres, on which were running about 90,000 sheep. Of these about 4,500 were rams, 3,000 of the latter being young rams. The rams were run in special paddocks until the deaths had occurred that season, when they were moved. The disease had been seen for a number of years, but the number of deaths had not been such as to cause any undue anxiety, considering the number of sheep on the station. The disease did not occur in a dry year. The mortality does not continue all the year round. Losses are usually experienced in February, March and April, i.e., in the autumn. As a rule there are no losses from "Swelled Head" in October or November, but on the present occasion the losses had continued through May and June.

It was stated that the disease had seriously affected the sheep only during the past two years. But in this instance, as already pointed out, the owners were thinking mainly of the rams, and, on local investigation by the writer, circumstantial evidence was found to show that losses in ewes and other less valuable sheep had occurred from the same cause, but had been taken as a matter of ordinary station loss, or the deaths had been ascribed to some other condition. Furthermore, the owner stated that some years ago, about forty ewes had died in one paddock from what some held was the same disease as "Swelled Head". During 1922, '23 and '24 the special condition of "Swelled Head" had only been found in young rams. (Here it is again necessary to point out (i) that the condition was specially looked for only in the rams, and (ii) the huge

area of the station.) The ewes and the few wethers grazed in large paddocks, where they were only occasionally mustered; whilst the rams were kept in much smaller paddocks, where they were under constant supervision. The mortality caused uneasiness; but it was really on account of the value of the animals rather than the numbers; so that one can readily understand the opinion that the *disease*—not merely a particular symptom of it, namely, “Swelled Head”—was confined to the rams.

When the sheep were removed to other paddocks the deaths gradually ceased. This was also the case with the 3,000 young rams in 1924.

The country was flat, open, black-soil plains.

SWELLED HEAD AS SEEN IN RAMS.

The disease is most prevalent in rams of from ten to fourteen months of age, but it has been seen in ram lambs six months old. The mortality varies from year to year, but as a rule is not heavy, though the potential value of the young animals makes the financial losses appreciable. During 1923 and 1924, however, the death rate from this condition had been unusually heavy. In 1923, out of 4,000 rams, over 100—i.e., 2.5%—died from “Swelled Head”; whilst in 1924, in a flock of 2,500 rams, more than 70—i.e., 2.8%—died from the same cause. In the latter year the great majority of the animals were found dead; but in 1923 death did not occur so rapidly, so that more of the affected rams were seen alive.

SYMPTOMS.

These agree with those observed by the writer and with the descriptions given by owners of other properties. They may, therefore, be taken as typical of “Swelled Head”.

The affected animals walk with a stiff gait, the head being held in the air and the back arched. If they are

seen in an early stage there is no visible swelling of the face. (In this connection it should be observed that only parts of the face of merino rams are bare, most of it being covered with very thick wool, so that any swelling of the latter parts would not be observed visually until it had become very pronounced.) The next day the head is visibly swollen. The swelling appears to start about the arch of the nose, and then spreads around the face, lips and jaws. (Again, these areas are noticed particularly, perhaps, because they are bare.) It may extend to the orbits and render the animal unable to see. One manager, however, has seen the swelling affect the nose only. The swelling is very doughy and apparently not painful. In 1924 the rams died within 24 hours of discovery, but the previous year the disease took a more prolonged course. Unless the animal showed signs of a swelling about the head, it was considered to be affected by some other condition.

Animals had been autopsied by the owners, and the following were the points to which their attention was drawn:—

When the skin over the swelled head was incised, abundant fluid escaped. If the incision is made before death, this fluid is straw coloured, but if the incision is made immediately after death, the exudate is blood tinged. No particular odour has been observed. Both the thoracic cavity and the pericardial sac contain a considerable amount of blood-tinged fluid. No particular changes elsewhere have been noticed; but they were not specially looked for.

No systematic post mortem examination of any sheep on the station had been made, save of those dying from "Swelled Head". Consequently other lesions or dead sheep showing other lesions, have escaped observation. (This is important, in view of the writer's personal observations.)

At the time of the interview in Sydney, already mentioned, the mortality among the rams had dropped and the deaths were occurring at irregular intervals, but a visit was paid to the station at the first opportunity, and fortunately during that period enough fresh material and information were obtained to enable the elucidation of the problem as to the cause of the trouble.

In view of the expressed opinion, both professional and lay, that "Swelled Head" was due to poisoning by plants, special attention was paid to that feature. But the information given by the owners, and a close examination of the paddocks in which the disease had occurred in various years, as well as some in which it had never been seen, showed that the vegetation, which was what is known in Australia as "herbage", there being little or no grass, was the same in all of them. Moreover, the plants growing on the station in any appreciable quantity were all well known, and could not be implicated as being responsible for the trouble. There were a number of other factors also which indicated strongly that the condition was not one of plant poisoning, but they need not be explained further here.

The botanical examination of the station took some days, during which one or two deaths were reported, the young rams having been found dead in the morning. In view of the necessity in the case of sheep, where a disease of unknown cause was being investigated, of making sure that any organism found was present in the tissues or fluids of the body before death, these animals found dead were ignored for bacteriological purposes. It was then decided to round up the sheep every day, and, after examining them carefully in yards, to hold them there until the evening, when they could be released again. This procedure was successful. Two typical cases of "Swelled Head" were found, as well as one showing no swelling

of the head, but lesions typical of the organism to be described. Thus three rams were found affected with disease under which post mortem bacterial invasion was out of the question. Although the men riding the boundaries of the paddocks in which the ewes were living had instructions to report any found dead, none were observed during my stay at the station. This was not proof, however, that none had died in that period, for, in the case of very large paddocks, such as those in question, a sheep may die and its body lie for weeks without being seen, unless its presence is betrayed by the carrion crows, and no loss observed until the monthly muster and count, unless the number of dead is considerable.

The following are the protocols of the animals found affected:

RAM No. I.

Merino ram, aged about 12 months; in very good condition. Apparently quite well when last seen the previous night and in the morning. (The rams were not examined individually, that being impracticable in the case of several thousand, but they were closely observed as they were moving out of the yard and about the paddocks grazing. Such observation, however, by a skilled observer is quite sufficient to locate a sheep when it is distinctly ill.)

On the morning in question, whilst the rams were being driven to the yards, a ram was observed ill, but the driver did not particularly look for any swelling of the head. The ram quickly became so ill that it was left lying in the paddock some distance from the yards.

When the sheep was seen by the writer, it was practically comatose. It made no attempt to move on being handled. Its temperature was 105.4 Fahr. The respirations were very shallow. Pulse could not be felt. Mucous membranes

very congested. Its faeces were very loose and offensive in odour. The animal was brought to the yard, where it died a few minutes later. A post mortem examination was made immediately.

AUTOPSY.

The lower part of the head was considerably swollen and oedematous, i.e., especially around the nose, cheeks, upper and lower jaws and the intermaxillary space. On incision of the skin over these parts, the subcutaneous tissues were found greatly thickened and saturated with a blood-stained, odourless fluid, which drained away in large quantity. The submaxillary and pharyngeal lymphatic glands were deeply congested. The masseter muscles of the left side of the head were very dark in colour from haemorrhages, but they had no very distinct abnormal odour. The masseters of the right side were neither dark nor haemorrhagic. The gums of the lower jaw were of a leaden colour. No undue amount of fluid in the thoracic, abdominal or pericardial cavities. Lungs normal. A few endocardial petechiae in the right heart, but none in the left. Abdominal lymphatic glands congested. Kidneys, spleen and liver normal. There were a few petechiae on the mucous membrane of the fourth stomach, but no congestion. The first part of the duodenum was moderately congested, but the remainder of the intestine was normal.

The skin over the swollen face was thoroughly seared before incision with a sterile knife. Smears of the oedematous liquid showed an occasional bacillus. Smears from the affected masseter muscles showed a fairly large number of the same type of bacillus. Cultures from these parts, and from the heart blood, resulted in pure cultures of the bacillus to be described. No bacilli could be detected microscopically in the smear from heart blood or lymphatic glands. Pipettes of the oedematous fluid and heart blood

and portions of the masseter and organs were obtained after very strict precautions to prevent contamination, and reserved for laboratory examination.

An aged ram was inoculated subcutaneously on the inside of the thigh with 20 c.c. of blood taken straight from the heart of the dead ram within a few minutes after death. A large amount of blood was injected because it was more of a speculative inoculation.

On the next morning this ram was found lying down and refused to move. Its temperature was 105.6 Fahr. The inoculated leg was moderately swollen and oedematous, and the skin on the inside of the thigh very livid. At 4.0 p.m. the animal was killed. The swelling of the leg had become greater. Immediately before being killed the animal was unable to move, but was still conscious.

AUTOPSY.

The inoculated leg was swollen and oedematous from the thigh to the fetlock. The skin on the inside of the thigh was very livid and in parts had ruptured, a blood-tinged fluid escaping in droplets. On incision of the skin of the thigh, a good deal of blood-stained but odourless liquid escaped. The subcutaneous tissues of this region were saturated with this same fluid. The muscles underneath the affected part appeared little affected. Material was obtained under strict asepsis for further work.

RAM No. II.

On another morning, whilst the sheep were being mustered for bringing into the yards for classification, a ram was seen to be amiss. He did not move like a healthy sheep. When singled out from the flock he was seen to be lame in a hind leg. After a time he became so lame that it was difficult to get him along, and consequently he was left behind. On being examined about an hour

later, he was found to be dead. A post mortem examination was made at once.

AUTOPSY.

Ram aged two years. Condition very good. Rigor mortis marked. A green fluid running from the nostrils. There was no swelling of the head or its neighbourhood. The muscles of the face and throat were normal. On skinning, the right shoulder showed some discolouration with a moderate amount of subcutaneous blood-stained exudate. The skin on the inside of both thighs showed a moderately livid discolouration. Some of the muscles on the insides of both thighs were markedly discoloured and haemorrhagic, others were normal. The subcutaneous tissues of these areas were infiltrated with a blood-stained exudate with a distinct odour, but one hard to define. It was not putrid. On incision of the affected muscles they were found to be very dark in colour—some almost black—and haemorrhagic, but there was very little evidence of gas formation as shown by sponginess. The same indefinable odour was more pronounced, but it was not distinctly rancid.

On the left flank, and extending inwards to the peritoneum, was a lesion about the size of a hand, resembling a bruise. The abdominal viscera were normal. There was about 200 c.cs. of a blood-stained fluid in the pleural cavity, and the pericardium was moderately distended with the same kind of fluid. The lungs were normal. A number of endocardial haemorrhages were present in the right ventricle. Smears were made from various parts after thoroughly searing the skin before incision. Material was taken from exudates, muscle lesions, organs and heart blood under aseptic precautions, for bacteriological and cultural examination. The same bacillus was found as in Ram No. I in purity, from the lesions and subcutaneous exudate of

Ram No. II; but the heart blood was found to be contaminated with other organisms (agonal p.m. invaders). There was some doubt about the purity of the pleural exudate. Consequently that was not used for experimental work.

RAM No. III.

Aged about 14 months. Discovered ill when being mustered for inspection in the morning. When observed the animal was visibly ill. Its movements were listless, and it did not resent the blows of other rams or attempt to move out of the way. That part of the face which was free from wool was distinctly swollen, especially around the nose. Closer examination and palpation showed that the swelling extended practically all over that part of the head below the eyes, including the jaws and intermaxillary space, but not the orbits. The swelling was very doughy, not tense anywhere. There was only a little discolouration of the overlying skin, and some slight evidence of pain on palpation. Temperature, 104.5 F. Respirations hurried. By the late afternoon the animal had become so seriously ill that it was evident that it would not last out the night. Consequently it was killed and a post mortem examination was made at once.

AUTOPSY.

On incision of the skin of the face, copious fluid, odourless and only slightly blood-tinged, drained away. The subcutaneous tissues of the part were greatly thickened and saturated with the same fluid. The swelling did not extend beyond the head. The masseter and buccinator muscles of the left side were almost black and showed innumerable small haemorrhages. The gums and buccal mucous membrane of the left side were of a deep leaden colour. The affected muscles were rather dry and showed evidence of some gas formation by the dissociation of the

muscle fibres. There was a very distinct odour on incision of the affected muscles, but not particularly of a rancid nature. The other muscles of the head were apparently unaffected. The lymphatic glands of the head and throat were deeply congested, but those of the rest of the body showed no striking change. The pericardium was moderately distended with a straw-coloured, odourless liquid, but there was no abnormal amount in the pleural or peritoneal sacs. A few endocardial haemorrhages were present in the right ventricle. The lungs and abdominal organs appeared normal. Smears of liquid pipetted from the facial exudate, pericardial fluid and heart blood, as well as portions of the affected muscles and normal organs were obtained under the usual strict attention to details to avoid contamination.

Only a few bacilli were found in the facial exudate by microscopical examination, and none in the heart blood, pericardial fluid or organs. They were numerous present apparently in purity in the masseter and buccinator muscles. Cultures, both aerobic and anaerobic, from the heart blood, pericardial fluid and organs remained sterile. But from the facial exudate and the affected muscles the same bacillus as was obtained from Rams I and II, was obtained in purity.

In view of the amount of material obtained, not only from the three naturally affected cases, but also from the inoculated ram, it was concluded that sufficient had been obtained to conduct laboratory work upon. A few more deaths occurred after my departure from the station.

With the material obtained, most of which reached the laboratory uncontaminated, cultures, both aerobic and anaerobic, were made; animal inoculations were carried out with the original material and with cultures, as well

as the ordinary routine of microscopical examination. Aerobic cultivation was in all cases, except some obvious contaminations, negative. But anaerobic cultivation of material from the facial exudates and the affected muscles and heart blood resulted in the isolation in purity of a bacillus with which a series of animal experiments and cultural tests was carried out.



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