Professor Neil Sargison
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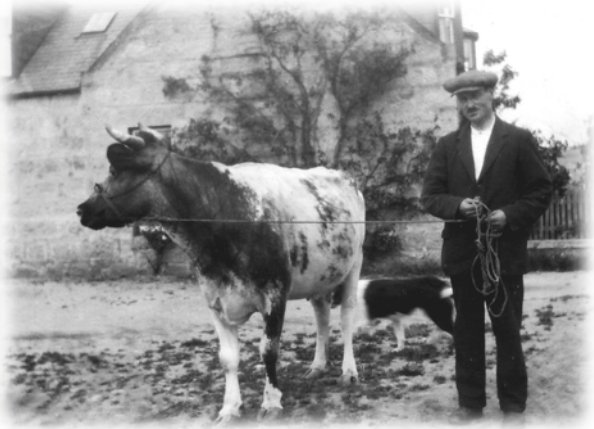
Periparturient deaths of lambs -

backgrounds, diagnostics, measures and prophylaxes.

Swedish sheep farmer seminar.
Gyllene Uttern
Friday 25th October

Neil Donald Sargison
Where does my interest in small ruminants come from?

Great, Great, Grandfather
John Donald c.1890



Great Grandfather
Robert Duthie Donald c.1930

Stoer, Sutherland

Aquithie, Kemnay, Aberdeenshire c. 1920

Great, Grandmother
Mary Anne Donald c.1930

Manor Farm, Studham c. 1965

Marypark, Keith, Banffshire c. 1985

Opportunities for improved animal health management?

- The lambing percentage.
- Lamb growth.
- Ectoparasitism.
- Ill thrift in ewes.
- Lameness.
- Lamb deaths.
- Specific disease problems …

The lambing percentage.

- The number of lambs born and surviving until a definite event such as marking or weaning per 100 ewes mated.
- Targets vary depending on the sheep breed and production system.

The lambing percentage.

- Optimisation is critical to the profitability of most sheep flocks (and kidding percentage in goat herds), irrespective of the production system.

Events that determine the lambing percentage.

- Oestrus behaviour.
- Ovulation rate.
- Fertilisation.
- Conception.
- Foetal development.
- Foetal survival/abortion.
- Ewe deaths.
- Perinatal lamb mortality.
- Lamb losses from 1 week old to weaning.

Events that determine the lambing percentage.

- oestrus behaviour
- ovulation rate
- fertilisation
- conception
- foetal development
- foetal survival/abortion
- ewe deaths
- perinatal lamb mortality
- lamb losses from 1 week old to weaning

The mating period.

Late pregnancy.

Lambing.

Perinatal lamb mortality.

- Lamb deaths within the first week after birth.
- Between 80% and 90% of lamb deaths occur during the perinatal period.
- Perinatal lamb losses range from 3% to 30% (average 15% - 20%)
- Few reliable survey data.

'Slinks' awaiting collection in New Zealand.

Perinatal lamb and mortality rates your Swedish flocks?

Lamb losses are easy to quantify in lowground flocks lambing in sheds or in ‘easy’ flat fields.

Dead lambs are seldom counted in extensive-lambing hill flocks.

How can we know what the perinatal lamb mortality rates are in extensive hill flocks?

Perinatal lamb mortality.

- Difficult to quantify in hill and extensively managed flocks.
- Comparison of scanning and marking data.

Reasons for perinatal lamb mortality.

- Most newborn lamb deaths are a consequence of different combinations of
  - under-nutrition of the pregnant ewe.
  - dystocia (birth stress).
  - under-nutrition of the newborn lamb.
- These causes must first be addressed in order to enhance the survival of newborn lambs.

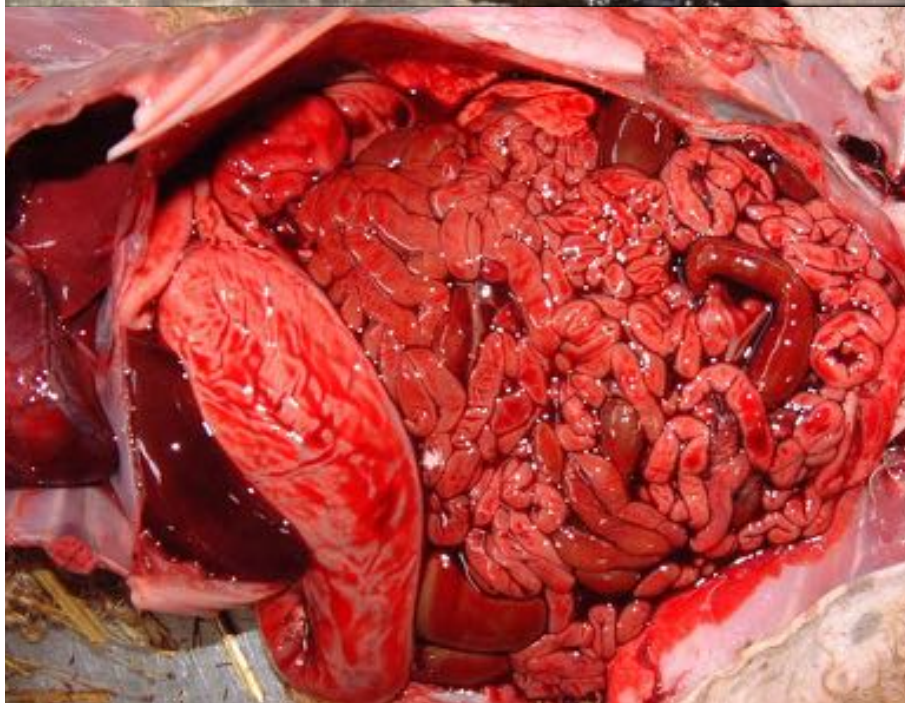
To ensure survival, lambs must be born mature, with adequate energy reserves, free from birth stress, and receive adequate post partum nutrition.

Pre-partum nutrition.

- Severe maternal undernutrition during mid pregnancy causes poor placental development.
  - poor oxygen, nutrient and electrolyte transfer
    - low lamb birth weights.
    - long term foetal hypoxaemia inhibits the new-born lamb's capacity for thermoregulation.
- Maternal under-nutrition during the final six weeks of pregnancy results in the birth of hypoglycaemic lambs and in poor udder development and colostrum production.
- Overfeeding of single-bearing ewes during late pregnancy can result in dystocia.
- Lambs born to 55 – 60 kg ewes with birthweights below 3 kg and greater than 5.5 kg suffer the highest rates of perinatal mortality.

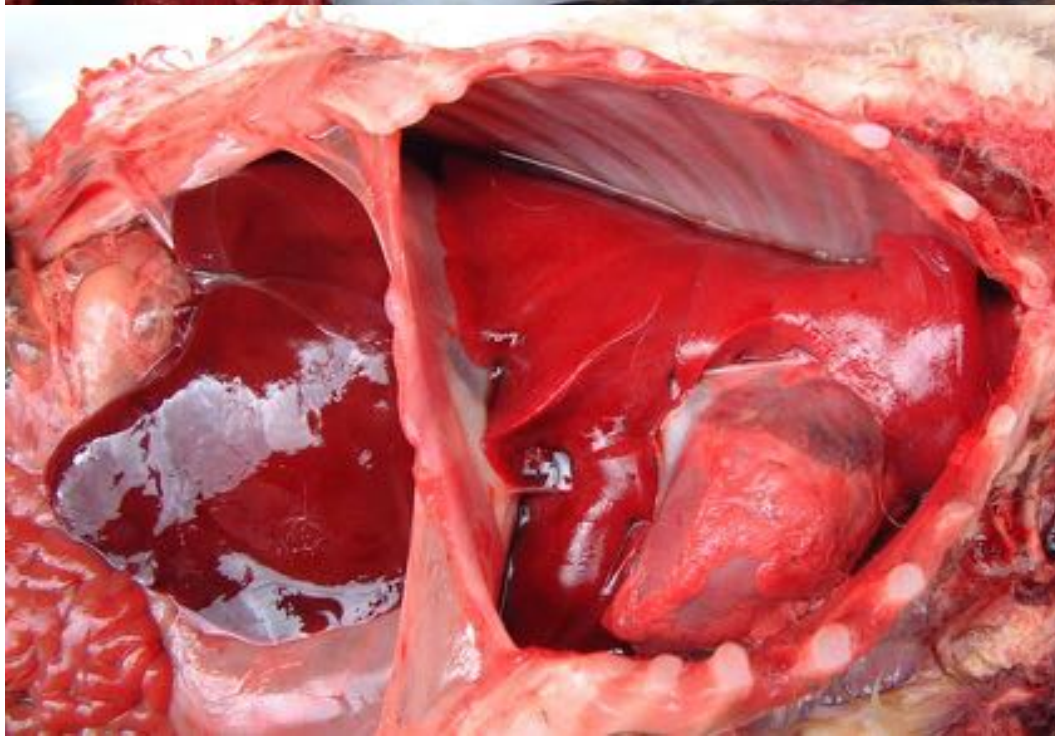
Birth stress (dystocia).

- Compression of the umbilical cord, protracted labour or trauma to the foetal central nervous system.
  - short term, usually reversible hypoxaemia.
  - parturient deaths result .
  - Inhibited thermoregulation, teat searching and suckling behaviour.
  - soft tissue trauma occurring during parturition and subsequent infection may compromise maternal behaviour.



Birth stress (dystocia).

- Poor maternal pelvic conformation.
- Foetal oversize.
- Malpresented lambs.
- Unskilled shepherding.
- Uterine inertia.
- Vaginal prolapse.
- Ringwomb.



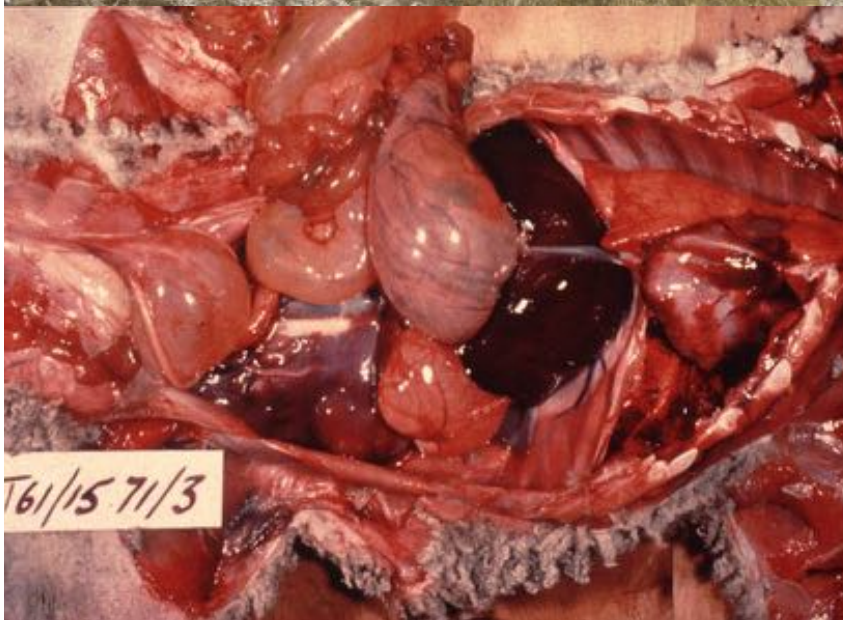
Post partum nutrition.

- Healthy lambs are born with limited energy reserves.
- In physiologically compromised lambs these reserves are depleted.
- Starved lambs rapidly become hypoglycaemic
  - weakness, lethargy and inability to maintain body temperature.

- An average 5 kg lamb requires about 1 litre of colostrum during its first 24 hours. Failure of the neonatal lamb to suckle, or failure of the newly-lambed ewe to provide adequate colostrum results in starvation and poor passive immunity to disease.

Maternal factors responsible for lamb starvation.

- Genotype - some individuals and certain ewe breeds demonstrate poor mothering behaviour .
- Inexperience - primiparous ewes refusing to allow their lambs to suckle.
- Undernutrition - resulting in poor colostrum accumulation.
- Dystocia.
- Concurrent diseases - such as metritis or maedi-visna.
- Mastitis.
- Multiple births.



Lamb factors responsible for lamb starvation.

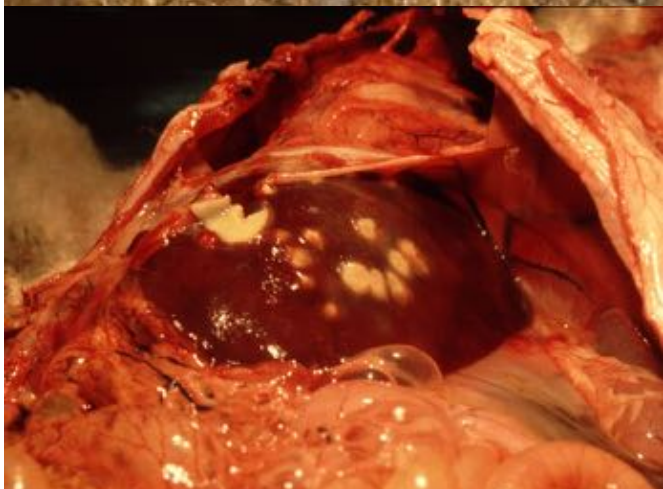
- Genotype - some terminal sire bred lambs are slower to suckle than pure hill breed lambs.
- Multiple litters - three lambs to share two teats.
- Birth stress.
- Prenatal malnutrition.
- Hypothermia - hypothermic lambs don't suckle.
- Infectious disease.

Extrinsic factors responsible for lamb starvation.

- High stocking density of lambing ewes - resulting in mis-mothering.
- Disturbance of lambing or newly-lambed ewes.
- Human interference.
- Absence of feed near to the lambing site.
- Exposure.

Other causes of perinatal lamb mortality.

- Primary hypothermia.
- Non specific bacteraemias.
- Specific infectious diseases.



Other causes of perinatal lamb mortality.

- Specific infectious diseases.
- Inherited abnormalities.
- Predation.

Other causes of perinatal lamb mortality.

- Congenital trace element deficiencies.

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The effects of iodine deficiency on ewe fertility and perinatal lamb mortality

N.D. Sargison , D.M. West & R.G. Clark

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Recent information on iodine deficiency in New Zealand sheep flocks

R.G. Clark , N.D. Sargison , D.M. West & R.P. Littlejohn

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To link to this article: https://doi.org/10.1080/00480169.1998.36092

Management practices to reduce perinatal lamb mortality.

- Any management practices which ensure correct nutrition of the pregnant ewe, avoidance of dystocia, and adequate early lamb nutrition, will enhance the survival of newborn lambs.
- The relative importance and practicality of such practices differ between flocks; hence general advice may be inappropriate.

- Need to first investigate the primary cause(s) of perinatal lamb mortality in individual flocks.
  - problem history.
  - monitoring of nutritional adequacy.
  - postmortem examinations.

Problem history.

- Ewe feeding throughout pregnancy.
- Ewe body condition scores at mating and lambing.
- Ram breed and selection.
- Ewe breed and parity.
- Lambing percentage.
- Weather conditions and the provision of shelter during lambing.
- The management of ewes at lambing .
- The size, shelter and topography of lambing paddocks.
- The provision of skilled labour at lambing.
- The stage and estimated numbers of lamb losses.
- Ultrasound scanning data ewe vaccination programmes
- History of trace element deficiencies and supplementation regimens.
- History of abortions.
- Preventive treatments for other known disease problems.

Systematic postmortem examination of lambs as part of the investigation of high perinatal lamb mortality rates.

- Information on the time of death.
- A pathological diagnosis
  - Dystocia.
  - starvation-mismothering-hypothermia.
  - stillbirth/abortion.
  - other specific problems.

- From a number of necropsies, a pattern emerges.
- Provides useful information when placed in context by the disease history and clinical observations.

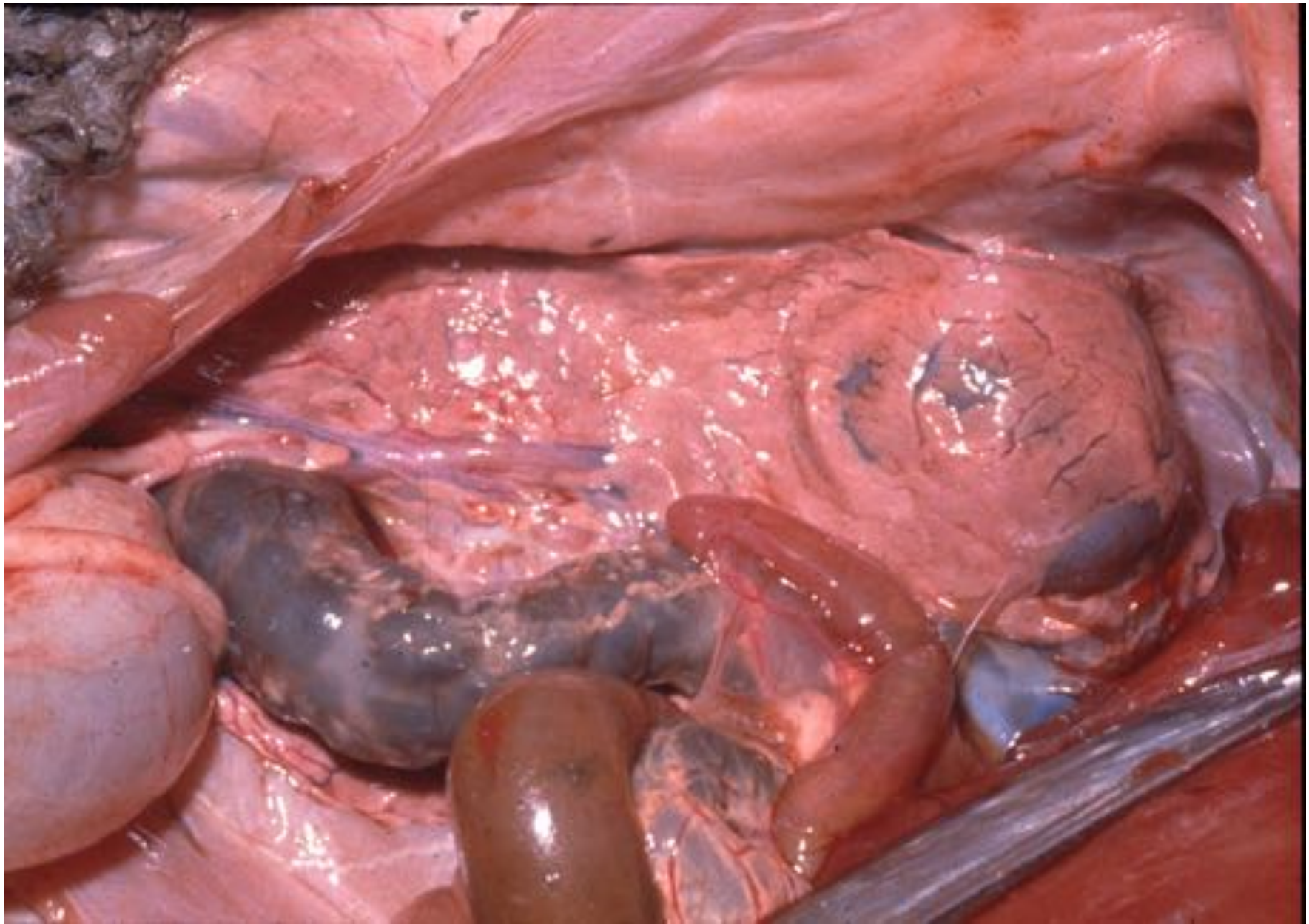
Postmortem examination of newborn lambs.

- Weigh lambs.
- Examine the feet to determine if the lamb has walked.
- Examine the umbilical cord for signs of blood clotting and desiccation.
- Check the carcase for signs of meconium staining, trauma, swellings and other physical abnormalities.
- Examine the brown fat around the kidneys and pericardium for signs of atrophy.
- Open the abomasum to determine the presence of clotted milk.
- Check for rupture of the liver capsule.
- Examine the lungs to determine if they are inflated.
- Check for subcutaneous oedema.
- Examine the thyroid glands for evidence of enlargement.
- Examine the carcase for other evidence of sepsis or inflammation.

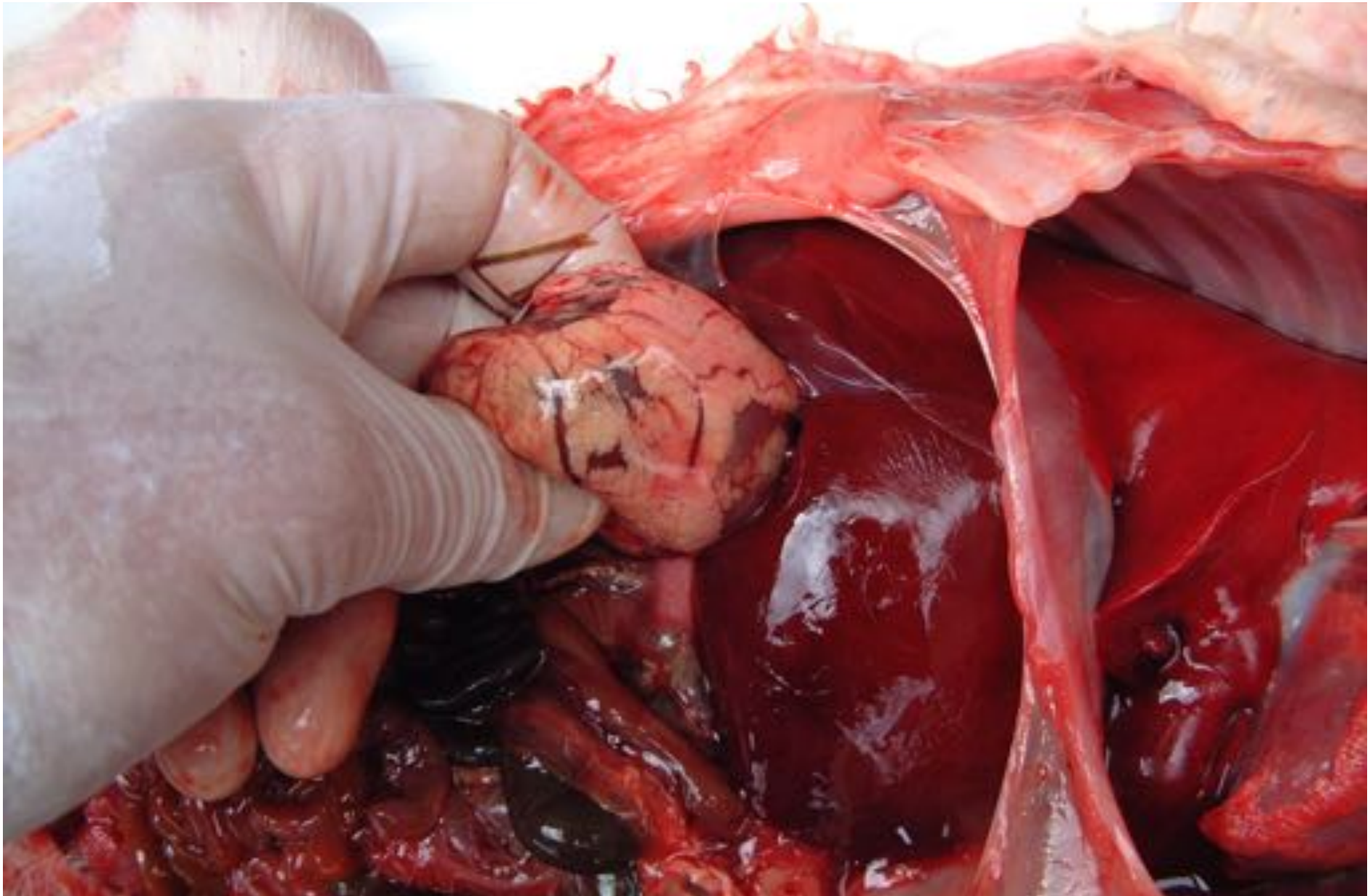
Not walked. Walked.

Meconium staining - birth stress.

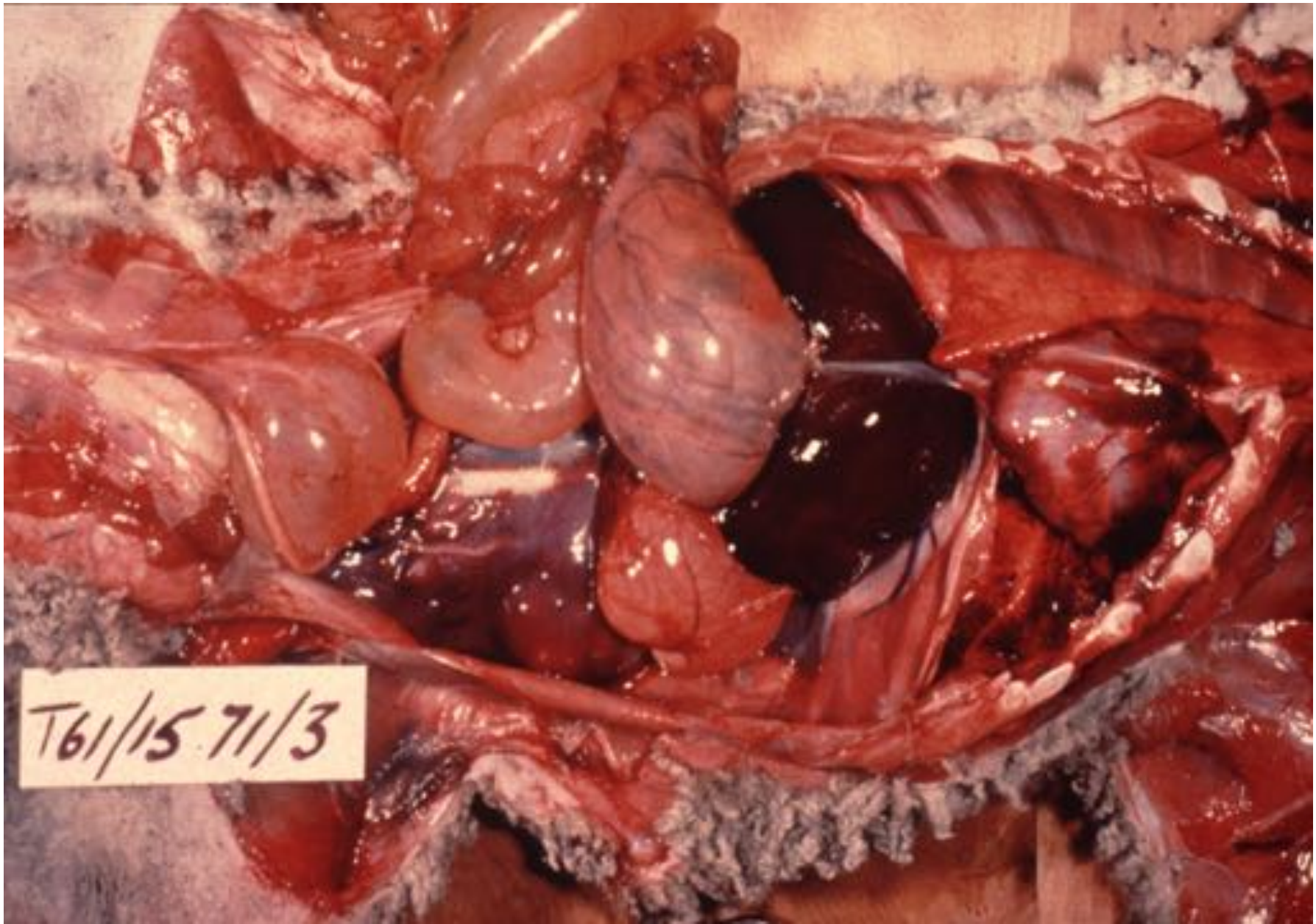
Good brown fat reserves – kidney.



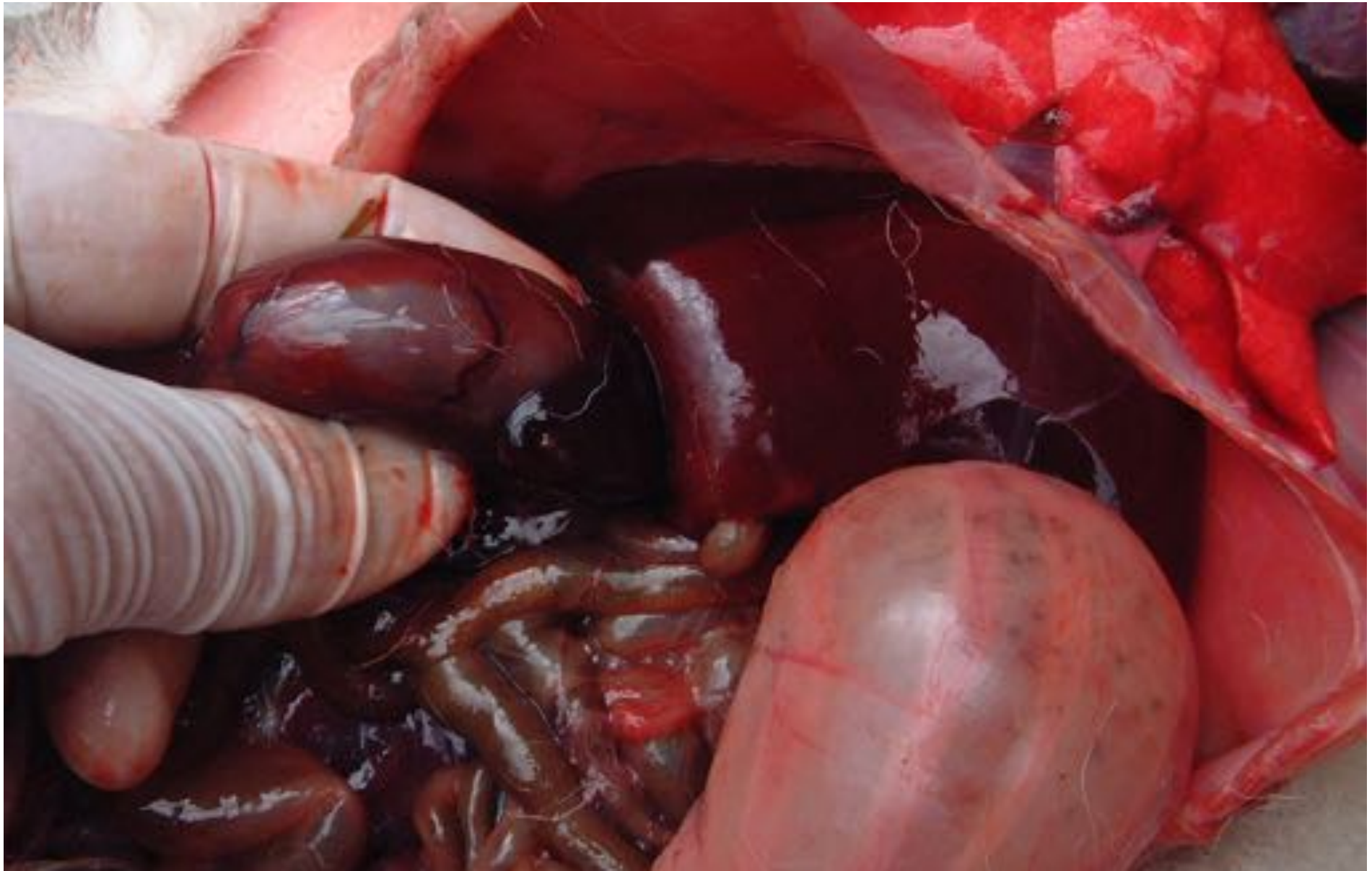
Good brown fat reserves – kidney.



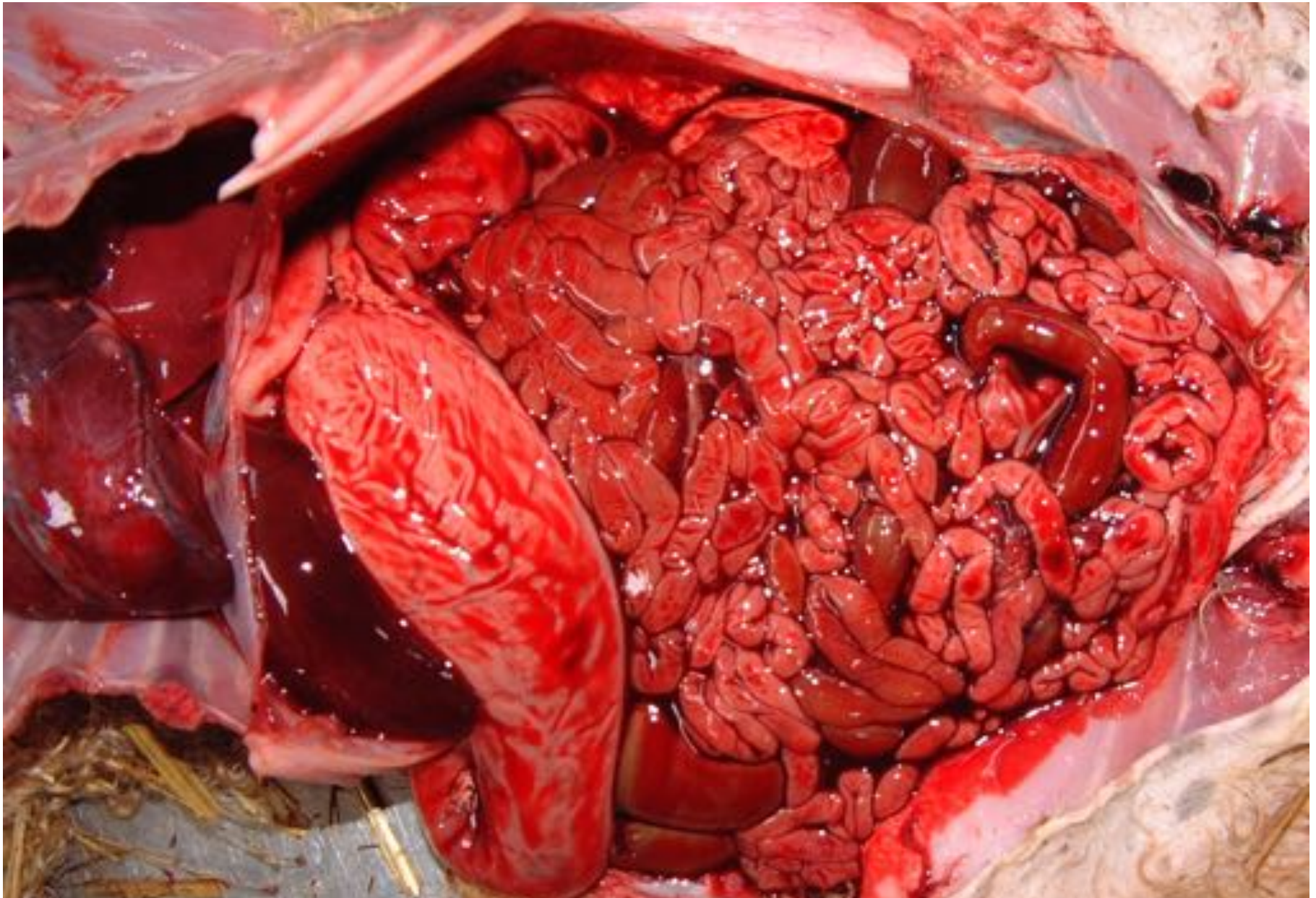
Atrophied brown fat.



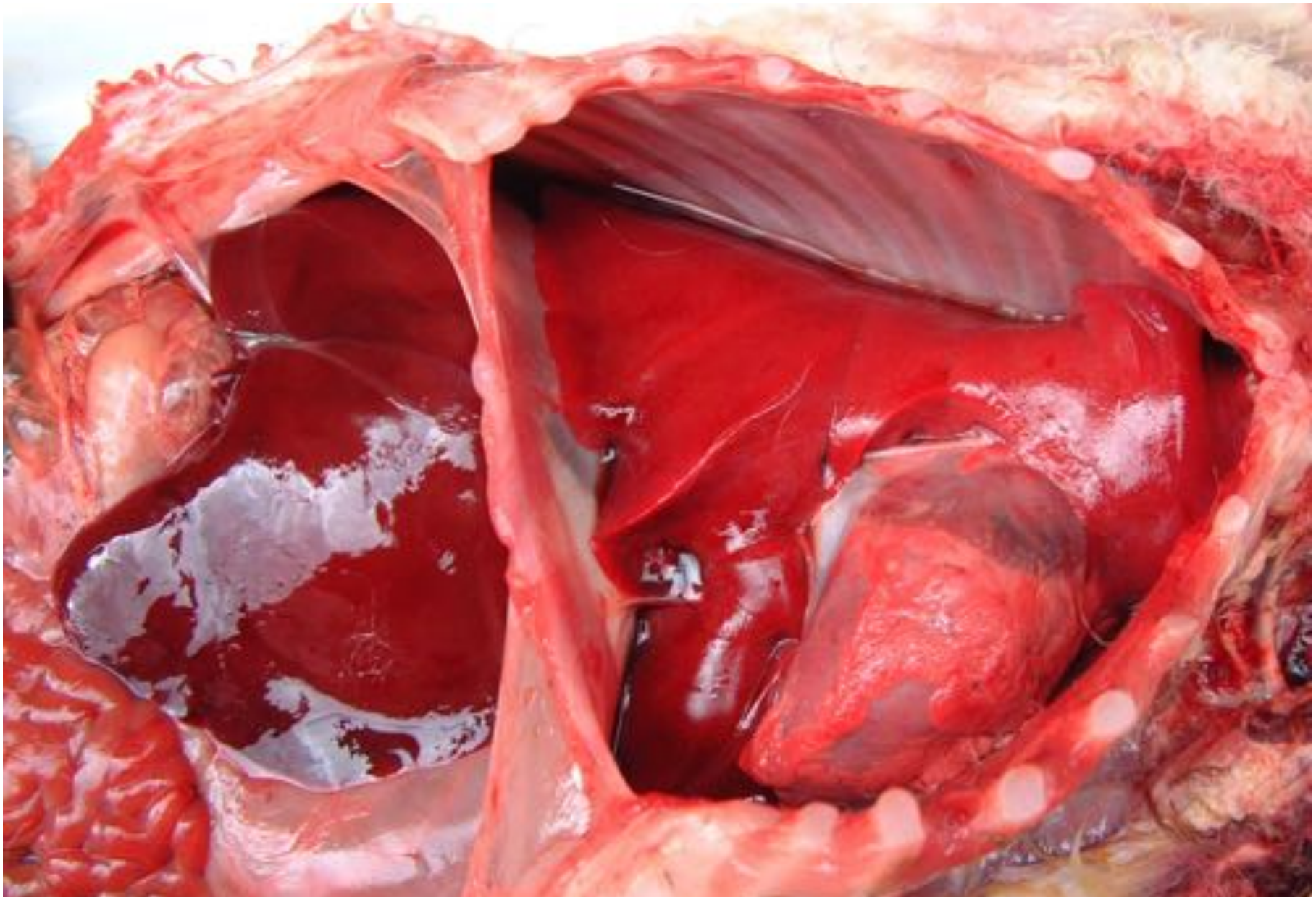
Atrophied brown fat.



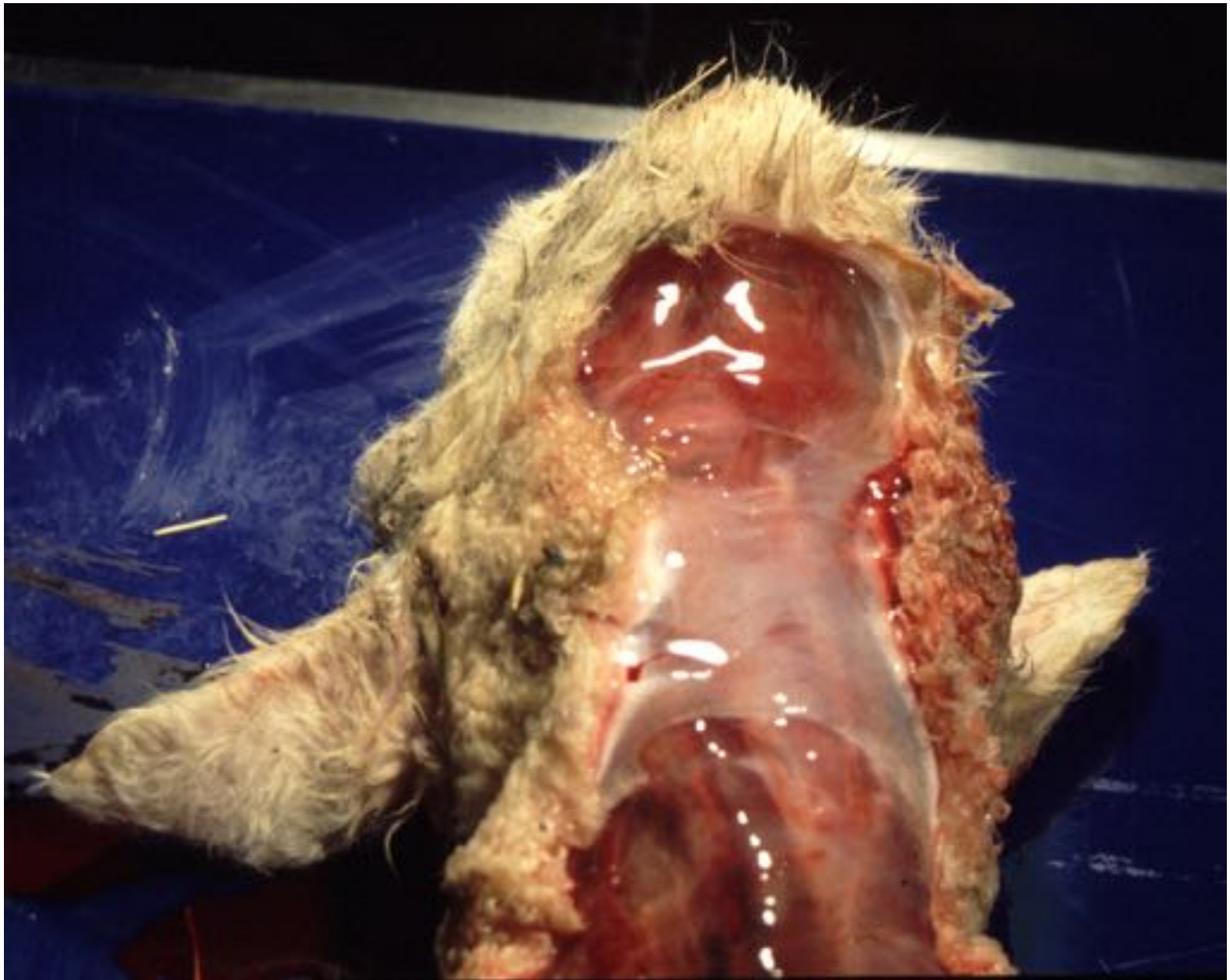
Ruptured liver capsule.



Uninflated lungs.



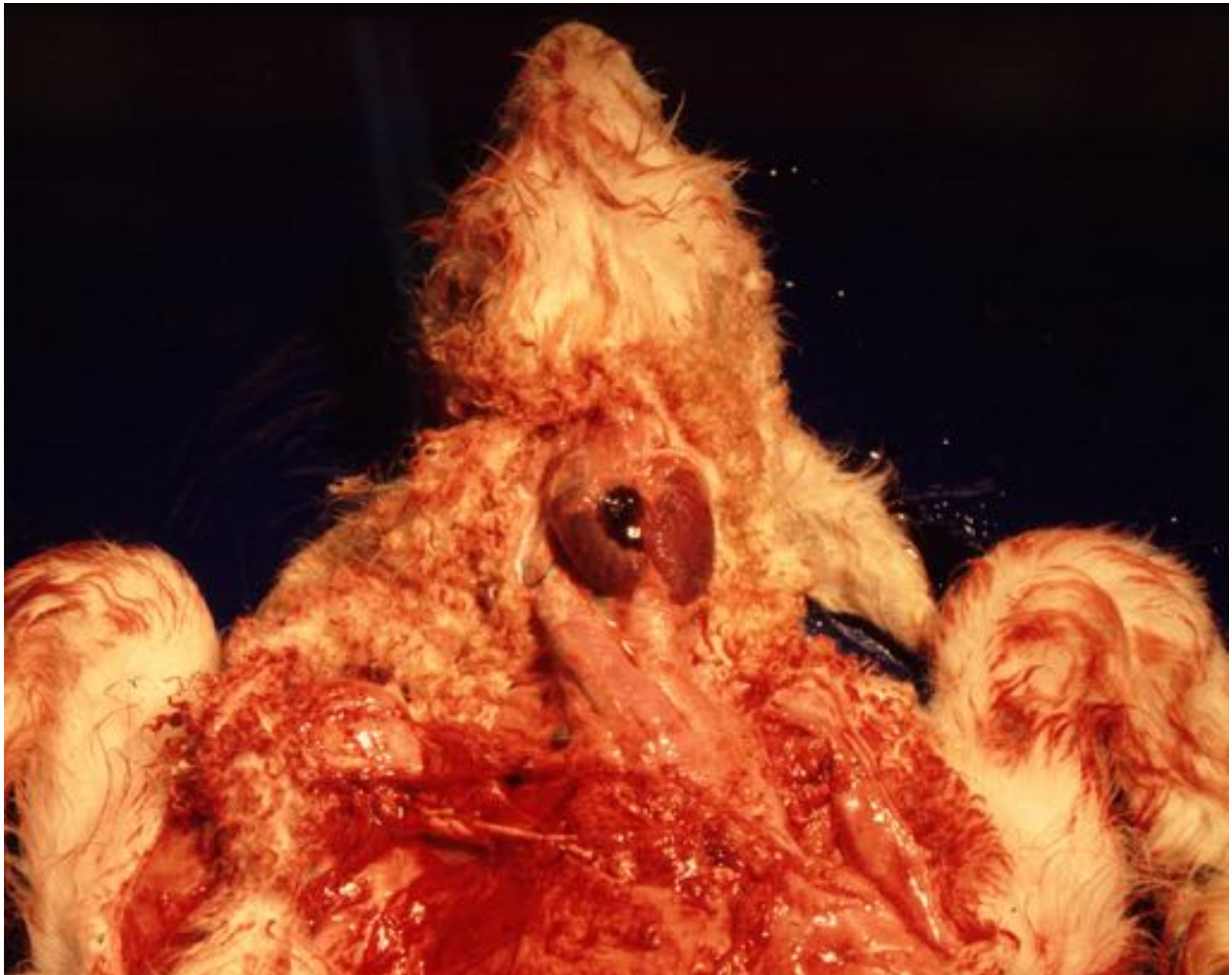
Oedema.



Oedema.

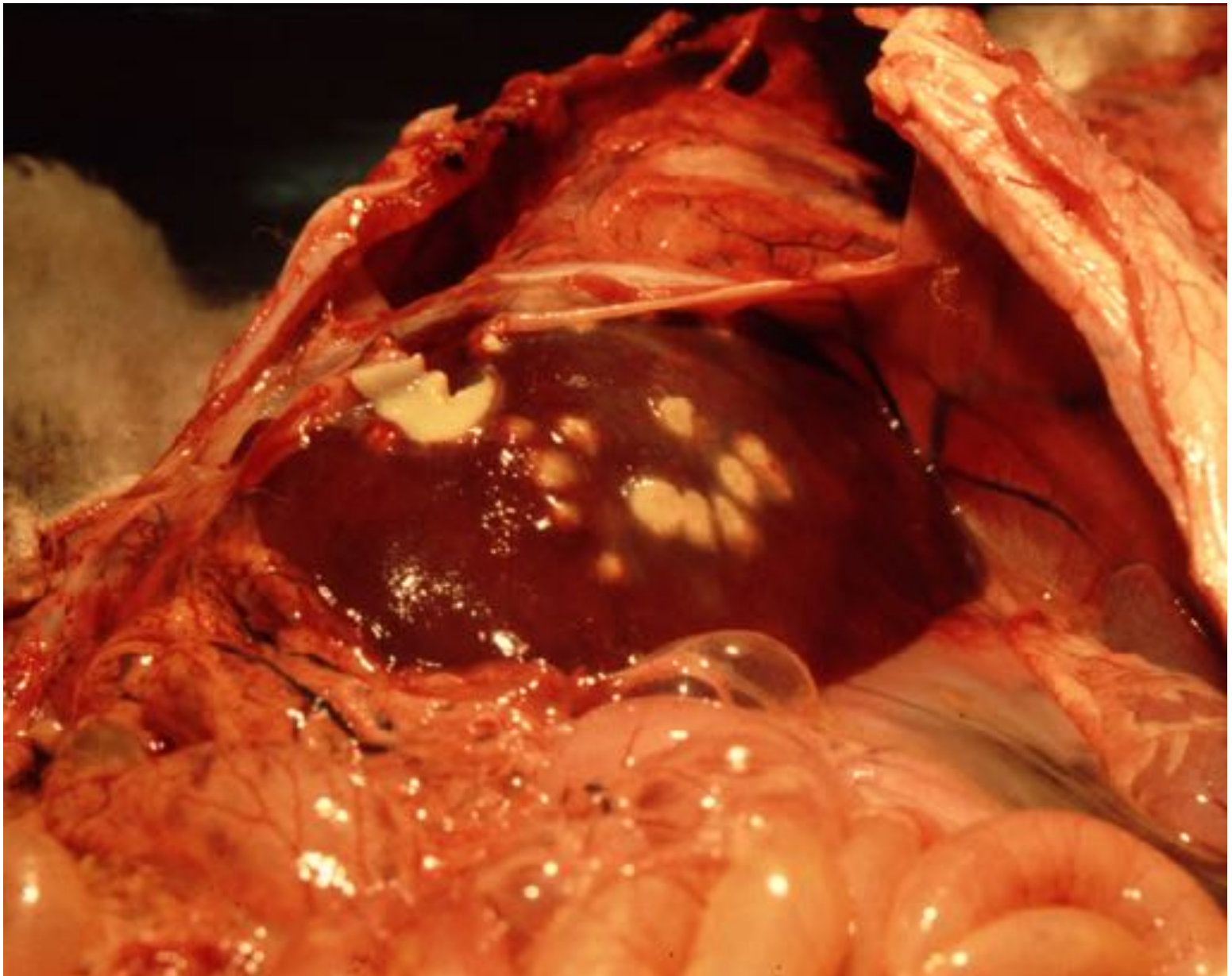
Oedema.

Check the thyroid glands.

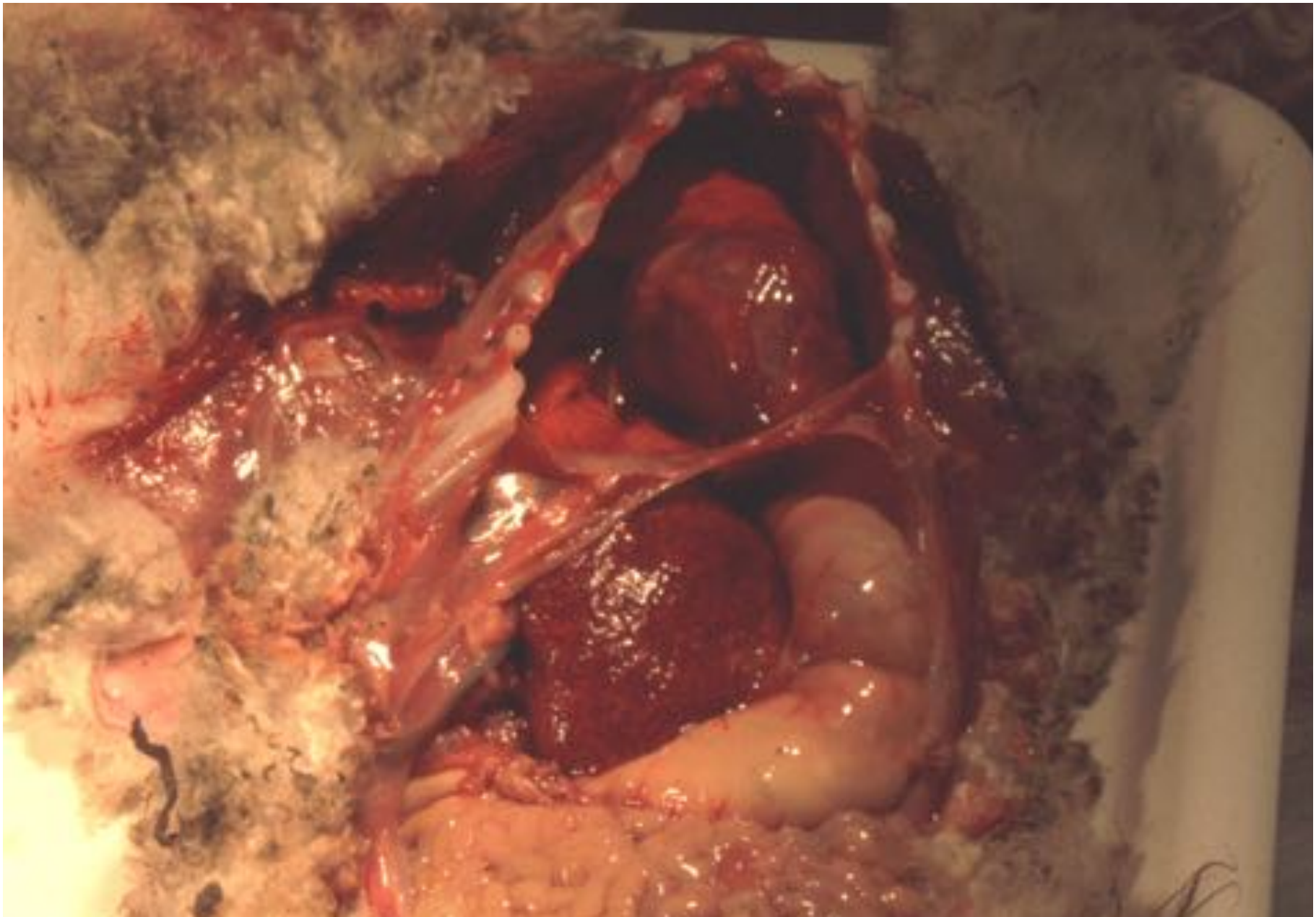


- Goitre.

Fusobacterium necrophorum.



Listeria monocytogones.



Lamb dysentery.

Predation.

Schistosoma reflexa.

Aprosopia.

Atresia ani.

Arthrogryposis.

Spina bifida.

Interpretation of the post mortem findings along with a detailed flock history and examination of ewes and surviving lambs usually provides an indication of the cause of the problem and the basis for constructive advice.

- Average bodyweights, atrophied brown fat and absence of clotted milk in the abomasum – hypothermia
  - on the basis of the disease history, this might be attributed to poor ewe nutrition, poor mothering ability, or disturbance of lambing ewes.
- Heavy bodyweights, submandibular oedema and/or rupture of the liver capsule – dystocia
  - on the basis of the disease history, this might be attributed to poor ewe pelvic conformation, poor sire conformation, or unskilled supervision of lambing ewes.


Management practices to minimise
perinatal lamb mortality

Management practices to minimise perinatal mortality.

1. Ensure adequate maternal nutrition
   - nutritional management.
   - disease prevention.
   - keel mark and ultrasound data.
   - metabolic profiles.
   - pre lambing shearing.

Example – monitoring of energy nutrition.

- Blood samples were collected on 10th March 2011 from twin and triplet bearing ewes in a flock of 300 Mule ewes due to start lambing on 1st April, to determine the adequacy of their nutrition.
- The ewes were scanned and keel marked, but only single bearing ewes were managed separately.



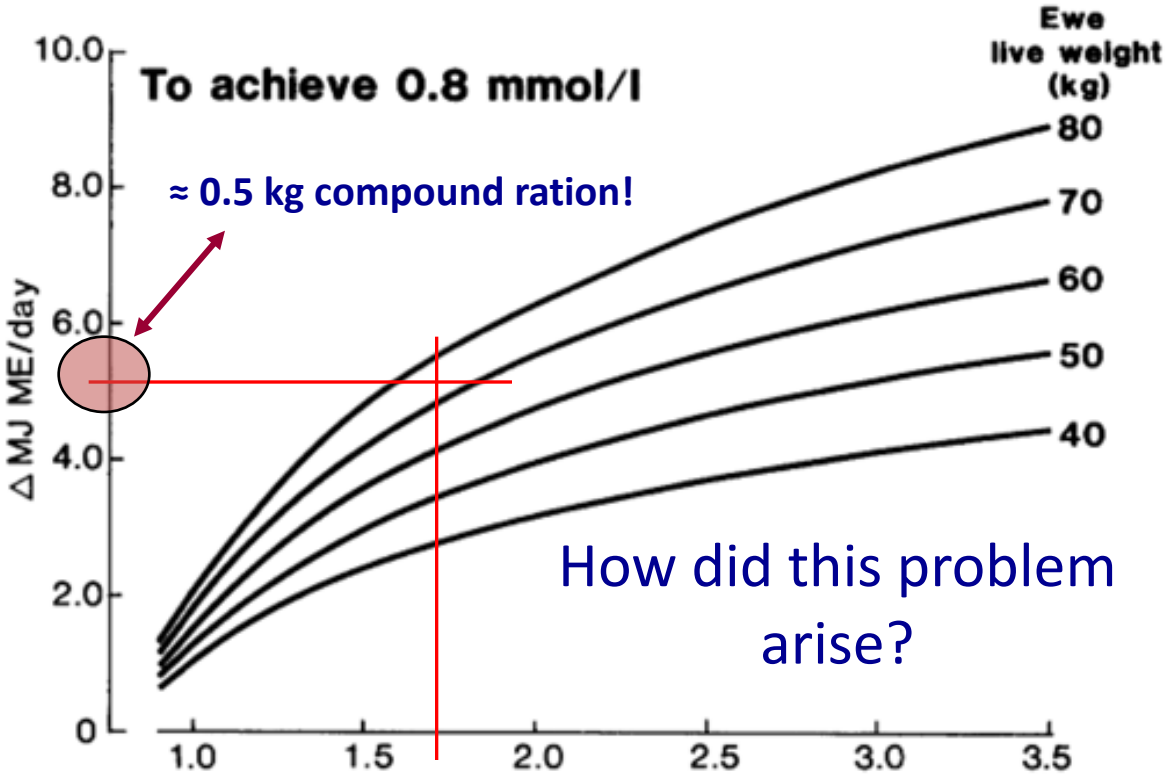
- The twin and triplet bearing ewes had been fed one loader bucket of clamp silage every second day, 0.6 kg /head/day of an 18% CP compound ration (in a single feed), and *ad-lib* high energy feed blocks.



Example –

Animal	BOHB (mmol/l)	UreaN (mmol/l)	Alb (g/l)
1Tr	0.80	2.10	27.00
2Tr	4.40	1.90	29.00
3Tr	1.50	2.10	31.00
4Tr	0.90	3.20	30.00
5Tr	0.90	1.80	28.00
Means	1.70	2.22	29.00

Animal	BOHB (mmol/l)	UreaN (mmol/l)	Alb (g/l)
1Tw	1.00	1.60	30.00
2Tw	2.10	1.80	32.00
3Tw	0.60	2.20	32.00
4Tw	1.70	1.90	27.00
5Tw	3.20	2.30	27.00
6Tw	1.60	2.60	34.00
7Tw	0.80	1.20	25.00
Means	1.57	1.94	29.57

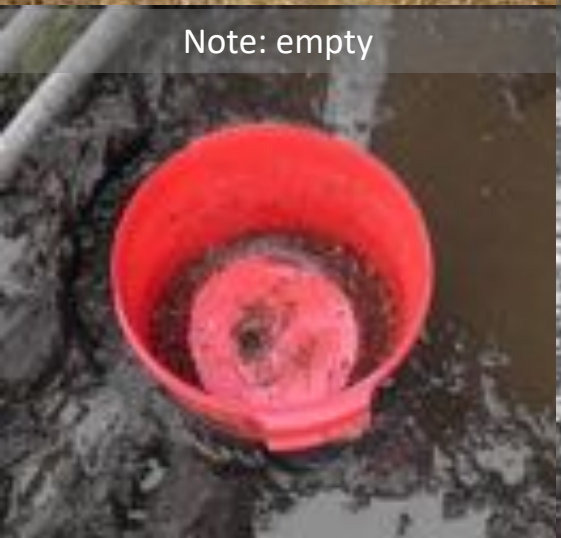


How did this problem arise?

Example –

How did this problem arise?

Note: selective feeding



Note: empty

Note: empty

16th March 2010 -- Compound feed gradually increased to 1.0 kg/head split into 2 feeds.

Animal	BOHB (mmol/l)	UreaN (mmol/l)	Alb (g/l)	Mag (mmol/l)	Cu (umol/l)
1 3	1.60	3.10	30.00	1.00	14.00
2 3	3.30	3.10	28.00	1.02	14.00
3 3	1.00	2.80	30.00	0.88	16.00
4 3	0.90	2.60	31.00	1.05	16.00
5 3	1.20	2.80	32.00	1.14	17.30
Means	1.60	2.88	30.20	1.02	15.46

Animal	BOHB (mmol/l)	UreaN (mmol/l)	Alb (g/l)	Mag (mmol/l)	Cu (umol/l)
1 F	0.20	3.10	31.00	1.02	14.20
2 F	0.50	3.20	29.00	1.00	9.80
3 F	0.60	2.70	30.00	1.05	13.40
4 F	0.90	2.70	28.00	1.01	13.30
5 F	0.20	2.60	32.00	1.06	12.70
Means	0.48	2.86	30.00	1.03	12.68

Fatter (BCS ~2.5) group of mostly singles.

Animal	BOHB (mmol/l)	UreaN (mmol/l)	Alb (g/l)	Mag (mmol/l)	Cu (umol/l)
1 2	0.40	2.20	29.00	1.10	12.80
2 2	0.20	3.80	26.00	0.94	14.30
3 2	1.10	2.20	30.00	1.09	14.00
4 2	3.30	2.40	28.00	1.05	14.50
5 2	0.60	2.50	35.00	1.11	
Means	1.12	2.62	29.60	1.06	13.90

Thinner group (BCS <2.0) of mostly twins and triplets.

Management practices to minimise perinatal mortality.

2. Avoid dystocia
   - ewe and ram selection.
   - use of keel marks and scanning data.
   - careful shepherding.
   - ewe feed management.

Selection for ease of lambing.

Selection for easy care lambing.

Continuing rise in lamb losses and ever *increasing* need for intensive shepherding.

Sires selected from within the un-shepherded flock.

first four years	*next four years*
100% docked	118% docked
15.4% wet-dry	10.2% wet dry
4% dead/missing	2.8% dead/missing

Refer to the list of selected papers on the topic of New Zealand easy care lambing management.

Easy care - avoid disturbance of lambing ewes.

Easy care - pasture management.

Summary of selection for easy care lambing.

- Up to 20% improvement in lamb survival.
- Selection for ease of lambing and maternal ability.
- Non-disturbance of lambing ewes.
- Very high level of management –
  - pasture management.
  - ultrasound scanning/ram harnesses.
  - general health care.
  - selection of lambing paddocks.
  - stocking rates.

Selection for ‘easy care’ in flocks that are not pastorally managed?

- Potential for 20% improvement in lambing percentage?
- Reduction in labour costs?
- Non disturbance of lambing ewes?
- Selection of both ewes and rams?

Sweden

- New Zealand
  - grass growth all year round.

- Scotland
  - need to feed sheep.
  - cannot avoid disturbance.

New Zealand.

Scotland.

Select ewes on the basis of pelvic conformation rather than pre-sale presentation.

Mark and cull ewes which require assistance as a result of poor pelvic conformation.

New Zealand Suffolk rams

New Zealand ‘do-for’ rams

Select terminal sires
for ease of lambing.

New Zealand Suffolk rams

UK Suffolk rams

Select terminal sires
for ease of lambing.

Careful shepherding to minimise premature disturbance.

Use keel mark and scanning data.

Management practices to minimise perinatal mortality

3. Ensure adequate early lamb nutrition
   - ewe nutrition.
   - avoid dystocia.
   - selection for mothering ability.
   - skilled supervision.
   - preparation of lambing kit.
   - selection of lambing paddocks.
   - provision of shelter.

New Zealand shelter.

‘Other’ causes of perinatal lamb mortality can be important in individual flocks.

- Primary hypothermia losses following extreme cold, wet and windy weather.
- Inherited abnormalities.
- Iodine deficiency (goitre).
- Selenium deficiency (white muscle disease and role in goitre).
- Predation (foxes? badgers? sea eagles? in the UK)
- Watery mouth.
- Non-specific bacteraemias (navel ill, joint ill and meningitis).
- Specific infectious diseases (such as *Fusobacterium necrophorum* navel infections, *Streptococcus dysgalactiae or Erysipelas rhusiopathiae* joint ill, lamb dysentery, *Pasteurella haemolytica* septicaemias or enterotoxigenic *E. coli* diarrhoea).

Common diseases such as navel ill, joint ill and watery mouth are a consequence of poor colostrum intake during the first few hours of life and poor hygiene of the lambing environment.

Hypothermia

Rectal temperature 39 - 40 °C

- healthy lamb exhibiting normal suckling behaviour.

Rectal temperature 37 - 39 °C

- moderately hypothermic lamb, weak.
- still capable of following the dam and suckling.

Rectal temperature < 37 °C

- severely hypothermic lamb.
- initially ambulatory, weak and depressed.
- may stand with an arched back, hollow flanks and lowered head, sometimes sheltering close to the ewe's udder, but is unable to suckle.
- clinical signs rapidly progress to recumbency, coma and death.

Treatment of hypothermic lambs.

Moderate hypothermia (37°C - 39°C)

- dry thoroughly.
- ensure a colostrum or milk feed.
- return to ewe.
- supervise closely.
- lambing buildings should be draught-free and all-round shelter should always be available in outdoor lambing fields.

Severely hypothermia (<37oC): under 5 hours-old

- dry thoroughly.
- warm to > 37 °C.
- give a colostrum feed at a rate of 50 ml/kg.
- warm to 39 °C.
- return to the ewe.
- monitor closely and check dam for milk supply, disease or poor maternal behaviour.

Moredun lamb warmer box.

Treatment of hypothermic lambs.

Severely hypothermia (<37oC): over 5 hours-old

- inject intraperitoneal 20% glucose at a rate of 10 ml/kg.
- dry thoroughly.
- warm to > 37 °C.
- give a colostrum feed at a rate of 50 ml/kg.
- warm to 39 °C.
- return to the ewe.
- monitor closely check dam for milk supply, disease or poor maternal behaviour.

Intraperitoneal glucose injection.

Watery mouth.

- 1-3 day-old lambs.
- Lethargy, profuse salivation
  and abdominal distension.
- Morbidity rates up to 24%.
- Poor treatment response.
- Intensive indoor lambing
  flocks of prolific ewes.
- Second and subsequent weeks of lambing.
- Triplets are three times more likely to be affected than singles and twins.

Pathogenesis of watery mouth.

- The abomasal pH of newborn lambs is neutral.
- Rapid multiplication of *Escherichia coli* acquired soon after birth during teat searching.
- Endotoxin release from the cell walls of lysed Gram-negative bacteria.
- Early colostrum intake prevents watery mouth.
- Secondary bacteraemia occurs in many cases.

The diagnosis of watery mouth is based on the clinical signs -

- Depression, anorexia and hypothermia, rapidly progressing to recumbency and collapse.
- The mouth is cold and the angles of the lips and lower jaw wet due to drooling of saliva.
- Lambs are frequently dehydrated, with abdominal distension.
- Rectal temperature may be normal, but the extremities are often cold.
- The ocular mucous membranes are congested and scleral blood vessels dilated.
- Abdominal palpation is resented and there are usually insufficient faeces to stain a rectal thermometer.

The diagnosis is supported by non-specific post-mortem findings.

- Abomasal distension with clear and mucoid fluid contents.
- Gas-filled small intestines.
- Congestion of various viscera.
- Multifocal fibrinous hepatitis, focal suppurative pneumonia and diffuse meningoencephalitis are present in some cases.

Treatment of watery mouth.

- Intravenous flunixin meglumine.
- Oral dextrose-electrolyte solutions.
- Intravenous or intraosseous fluids?
- Enemas?
- Systemic antibiotics?

Prevention of watery mouth.

- Good nutrition of the pregnant ewe.
- Management of abortion and dystocia.
- Adequate supervision to ensure all lambs suckle or receive 50 ml/kg of colostrum or colostrum Substitutes by stomach tube within their first hour.
- Maintenance of a clean lambing environment.
- Prophylactic use of oral aminoglycoside antibiotics (apramycin, neomycin and spectinomycin) or amoxycillin within 15 minutes of birth?

Responsible use of antimicrobial drugs?

Neonatal enteritis.

- Rotavirus.
- Coronavirus.
- Enterotoxigenic *E. coli.*
- Salmonellosis.
- Lamb dysentery.
- *Cryptosporidium parvum.*

Enterotoxigenic *E. coli.*

- K99 adherence pili enable attachment to the intestinal mucosa.
- A stable toxin is produced which causes severe watery, brown-coloured diarrhoea.
- Disease is uncommon and only affects lambs less than 48 hours-old.
- Most lambs die unless prompt fluid therapy is administered.

Enterotoxigenic *E. coli* - control and prevention.

- Strict hygiene.
- Ensure adequate colostrum status.
- Immediate isolation of sick lambs.
- (Vaccine containing killed K99 *E. coli*, administered at the same time as clostridial vaccination).

Non-specific bacteraemias.

- Polyarthritis (joint ill).
- Omphalophlebitis (navel ill).
- Endocarditis .
- Meningitis.

Result from tonsilar or enteroinvasion in colostrum-deprived lambs by *E. coli*, *M. haemolytica, P. multocida*, *A. pyogenes*, staphylococci and streptococci from a contaminated environment, followed by multiplication in other organ systems.

Joint ill.

- Polyarthritis may occur in lambs as young as 5 days old and is characterised by -
  - sudden onset lameness.
  - pain, heat and fluctuating swelling of several limb joints.
  - poor suckling behaviour and ill-thrift.

Joint ill.

- Clinical signs.
- Postmortem examination
  - joints contain pus.
  - thickened and congested synovial membranes.
  - erosion of articular surfaces.

Treatment of advanced cases is seldom successful and euthanasia is frequently indicated. Emphasis must be placed on control and prevention of further cases.

Tick pyaemia.

- Intradermal innoculation of staphylococcal bacteria by feeding ticks either derived from the skin surface or from the tick mouthparts and saliva
  - bacteraemia and joint ill.
  - posterior paresis due to spinal abscesses.
  - abscesses in other internal organs.
- Potentiated by immunosuppressive effects of tick borne fever.

Navel ill.

- Results from bacteraemia or infection of the umbilical vessels and urachus from a contaminated environment.
- Clinical signs -
  - a hunched-back stance, poor body condition and hollow flanks.
  - a moist, swollen and painful navel, which sometimes exudes purulent material.
  - swelling may continue internally to the bladder or liver, detected by pain on palpation.
  - concurrent systemic infection may also be noted.

The antibiotic and anti-inflammatory treatment response is dependent on the extent and duration of infection and colostral antibody status.

Bacterial meningitis.

- Usually affects 2 - 4 weeks old lambs.
- Clinical signs -
  - isolation from the dam and failure to suckle.
  - episcleral congestion.
  - lack of a suck reflex.
  - weakness, altered gait and depression leading to stupor.
  - hyperaesthesia to auditory and tactile stimuli.
  - opistotonus during the agonal stages.

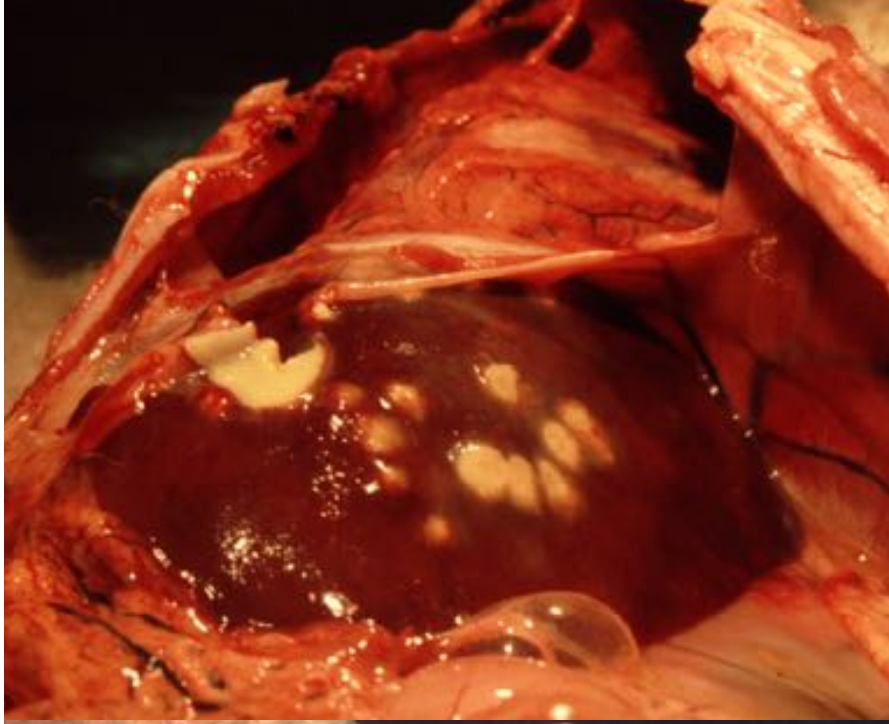
Bacterial meningitis - diagnosis and treatment.

- Clinical signs.
- Lumbo-sacral cerebro-spinal fluid (CSF)-
  - increase in protein concentration (0.5 - 8.0 g/l).
  - neutrophillic pleocytosis.

The treatment response to corticosteroids and antibiotics is poor.

Necrobacillosis.

- Navel infection with *Fusobacterium necrophorum.*
- Characteristic “white spot” abscesses in the liver.
- Secondary spread to joints and lungs.
- Poor environmental hygiene and poor passive immunity.



Entropion.




Prevention of non-specific bacteraemias.

- Ensure good maternal nutrition, control of abortion and prevention of dystocia.
- Employ sufficient skilled assistants at lambing.
- Provide good access to lambing pens and good lighting.
- Aim for a compact lambing period .
- Maintain strict hygiene of lambing accommodation.
- Aim for optimum stocking rates and pen size of housed lambing accommodation.
- Dip all lambs' navels in strong iodine solution at birth.
- Ensure that all lambs receive adequate colostrum within the first 4 hours of life.
- Hot water and a full clean lambing kit should be easily available.
- Check all penned lambs regularly.

Alternatives to fresh colostrum.

- Excess colostrum from other ewes.
- Cow colostrum
  - 20% less energy.
  - may not protect against some sheep diseases.
  - cow colostrum anaemia.
- Powdered colostrum substitutes
  - convenient.
  - expensive.

Iodine deficiency.

- Congenital goitre.
- Pot bellied lambs with scant wool usually die soon after birth.
- Less severely affected lambs die from starvation/hypothermia.
- Effect on ewe reproductive performance.

Overseas, the prevalence of severe iodine deficiency, where the thyroid glands of newborn lambs are obviously goitrous, is especially high in Merino flocks and frequently associated with the feeding of *Brassica* crops during late pregnancy.

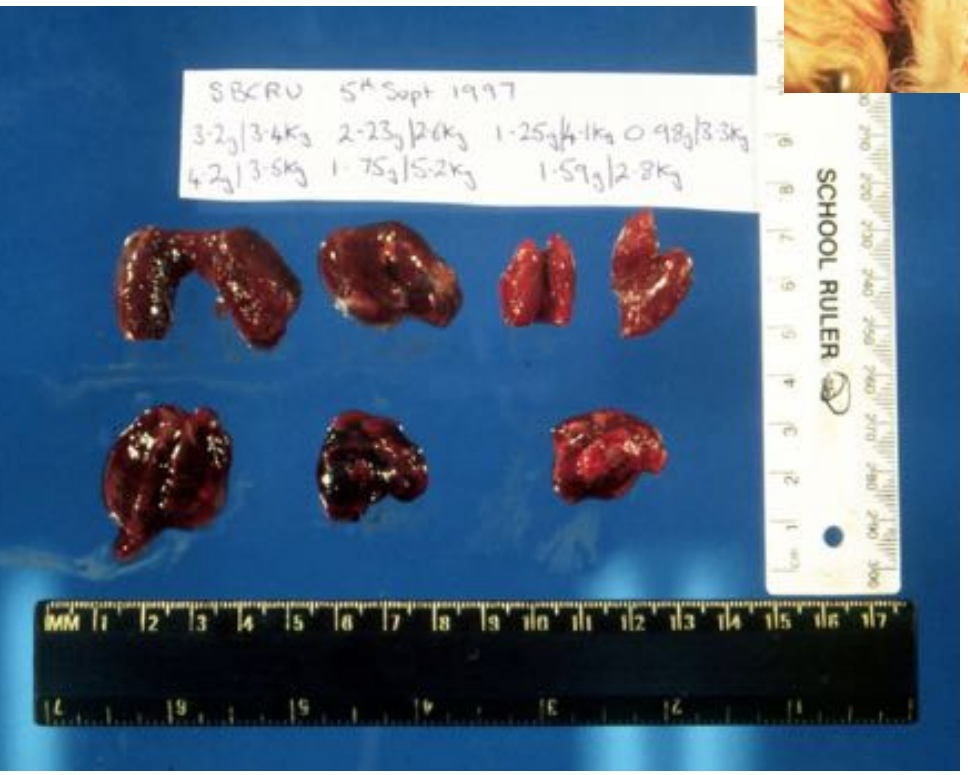
Brassica crops contain high concentrations of thiocyanate goitrogen precursors.

Iodine deficiency – diagnosis.

- Palpation of the thyroid gland of newborn lambs.
- Histological examination of the thyroid gland.
- Thyroid:body weight ratio of newborn lambs > 0.4 g/kg.
- Thyroid hormone concentrations.
- Pasture iodine concentrations.
- Controlled supplementation trials.

Large-scale supplementation trials are arguably the best method for the determination of iodine deficiency, but require careful planning and accurate records, and are time consuming and expensive in terms of the labour required.

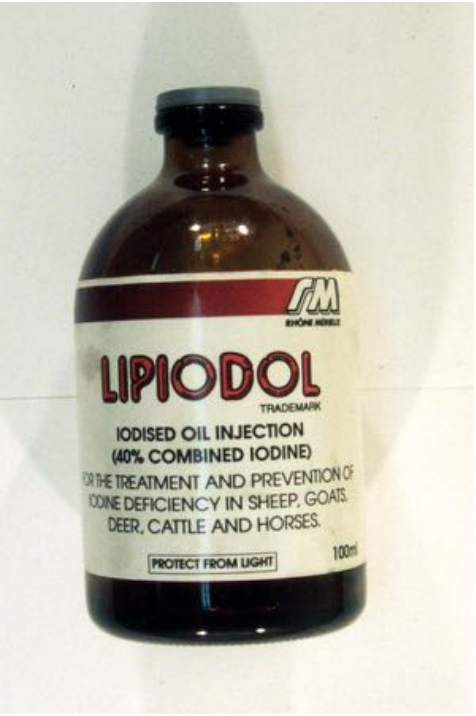
Iodine deficiency can be diagnosed by the post mortem examination of about 15 dead neonatal lambs, and calculation of their thyroid:bodyweight ratio.



The thyroid:bodyweight ratio of this lamb was 0.7 g/kg, indicative of iodine deficiency.

Careful dissection and weighing is required to determine accurately the thyroid:bodyweight ratio.

Iodine supplementation.



- Oral administration of 280 mg potassium iodide
  - pre-tupping.
  - during mid-pregnancy.
  - 4 weeks before lambing.
- Cutaneous application of iodine based preparations
- Injections of iodised oil
  - ewes - every 2 years.
- Sustained release ruminal boluses
  - provide effective iodine supplementation.
  - supplementation with other elements may be wasteful.

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Recent information on iodine deficiency in New Zealand sheep flocks

R.G. Clark , N.D. Sargison , D.M. West & R.P. Littlejohn

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Congenital swayback.

- Severe copper deficiency of mid to late pregnant ewes
  - stillbirths.
  - small and weak lambs with fine head tremours.
  - incoordinated, fine boned and dull coated lambs with pelvic limb weakness.
  - clinical signs induced by handling.
  - susceptibility to neonatal infections.
  - other signs of copper deficiency in the flock.

Clinical signs of copper deficiency in sheep.

- Swayback.
- Osteoporosis and bone fractures.
- Steely wool.
- Wool discolouration.
- Increased disease susceptibility?
- Ill thrift?

Congenital white muscle disease.

- Stillbirths.
- Weak lambs which fail to feed.
- Sometimes delayed in onset
  - gathering.
  - docking.
  - transport.
- Difficulty sucking.
- Sudden onset semi-paralysis.
- Death from respiratory failure or starvation.
- Ill thrifty survivors.
- Prevented by selenium supplementation of dams before lambing.
- Complementary role of vit E.

Vitamin E deficiency.

- Vitamin E has a complementary role to selenium as an antioxidant.
- Adequate amounts of both vitamin E and selenium are required to prevent white muscle disease.
- Fresh pasture and cereals contain substantial amounts of vitamin E.
- Root crops are poor sources of vitamin E.
- The vitamin E content of feed is influenced by the way in which it is stored.
- The effect of dietary insufficiency of vitamin E may be compounded when components of diets present a high oxidative stress.

Diagnosis of white muscle disease.

- Clinical signs
  - differential diagnoses:
    - joint ill.
    - pneumonia.
    - spinal abscessaton.
- Postmortem findings
  - necrotic lesions in the myocardium.
  - symmetrical myonecrosis of the hindlimbs
    - difficult to interpret.
- Histopathology
- Creatinine kinase concentrations
  - > 500 IU/ml
    - difficulty differentiating from exertion due to catching

Differential diagnosis:
S. dysgalatiae arthritis

White muscle disease – treatment.

- Subcutaneous injections of selenium and vitamin E
  - treatment may need to be repeated at weekly intervals.
  - risk of selenium toxicity.