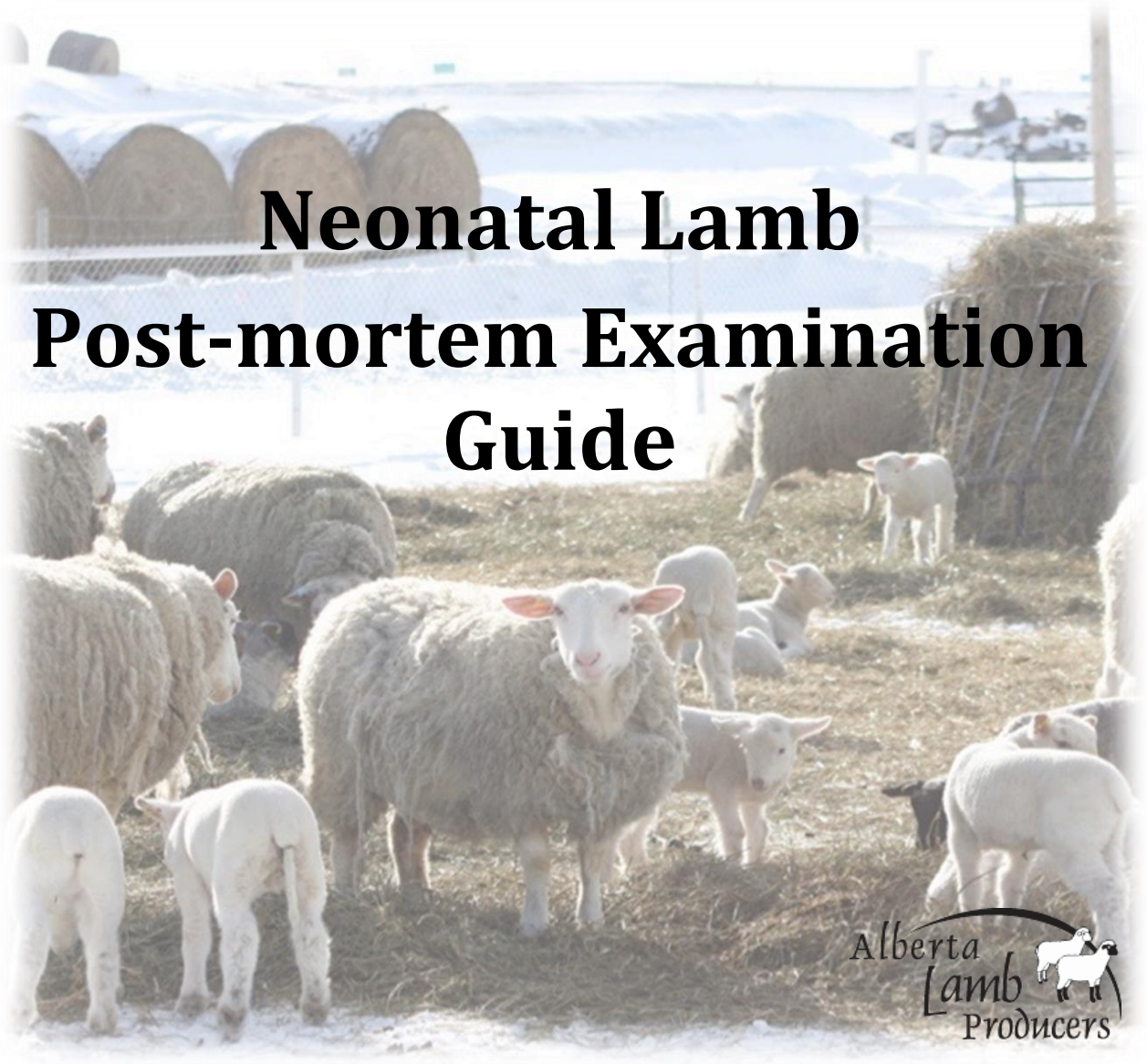
Neonatal Lamb Post-mortem Examination Guide



Introduction to Conducting Post-Mortem Examinations

Almost all pre-weaning deaths occur before seven days of age with most happening before lambs are three days old. These deaths are most often management related and preventable. Knowing exactly why a lamb died is a vital first step in correcting problems to prevent further losses. A professional post-mortem on every lamb that dies, however, is prohibitively expensive for most producers. Learning to conduct your own neonatal post-mortems is a cost-effective way to improve management and save lambs.

Why learn to conduct post-mortems?

- **Economical way to gather important information.** Although there are times when you need outside help, on-farm post-mortems are an economical way to check all lambs that die.
- **Find the true cause of death.** At times the cause of death might seem obvious (e.g. a pasture born lamb with signs of predation). However, an exam may reveal clues that counter the first assumption (e.g. the lamb had died before birth and scavenging was secondary).
- **Prevent further lamb losses.** Conducting exams of all lambs that die will help determine if a death is an isolated event or part of a larger problem (e.g. losing several lambs to dystocia could indicate ewes are not being checked often enough, multiple abortions may point to an infectious disease). If the problem does escalate, using post-mortem records (rather than relying on memory and guesswork) can decrease time and expense in preventing further losses.

Using this guide:

Almost all deaths of very young lambs are due to a few common causes. This guide includes a step-by-step post-mortem procedure* that can help pinpoint when and why a lamb has died. The steps are grouped to look for the most common causes of death. The first page of each group is an examination checklist including pictures, while the second page provides details about each step.

Post-mortem Guide Contents:

Steps	Why did it die? Determining common causes of death.	Pages
1-3	Record important information, perform an external examination and dissection	3-4
4-5	Was the lamb alive at birth (e.g. signs of true stillborn/late term abortion)?	5-6
6-8	Did the lamb die from dystocia (difficult birth)?	7-8
9-11	Did the lamb die from starvation/mismothering/exposure?	9-10
12-16	Did the lamb die from 'Other' causes (e.g. infection, trauma)?	11-12

In most of the exam steps, you are asked to check a 'Yes' or 'No' option. Some cases, however, may be more difficult than others to interpret. It is important to look at all information as a whole to come to the most logical conclusion about the cause of death (i.e. do all of the findings support the same conclusion?).

Accompanying this guide are two additional documents for recording exam results:

- Results can be recorded during the exam on the '*Neonatal Lamb Post-mortem Examination Checklist'*, a two-page checklist that follows the steps in the current guide. It is laminated and reusable.
- '*Neonatal Lamb Post-mortem Examination Record Sheets'* are available to keep a paper record of the results for individual lambs. These sheets can either be used directly during the exam or by transferring information from the laminated 'Checklist' sheet.

Post-mortem equipment:

- **Gloves** to protect from disease transmission. See the '***Caution***' sidebar.
- **Knife, scalpel or heavy scissors** to make incisions**.** Note: neonatal lamb tissues (even the rib cage) can be easily cut.
- **Small garbage bag** to minimize contamination of the area. See 'Step 3' (pages 3 & 4).
- **Small container** to test lung buoyancy. See 'Step 4' (pages 5 & 6).
- **Disinfectant** to clean post-mortem area and equipment.
- **Camera (optional)** to take pictures during the exam. Pictures are an easy and accurate way of recording the condition of the lamb as it was found and details of the internal exam. If needed, the pictures can later be shared with your veterinarian.

Caution: Some diseases are transmissible between sheep and humans, including abortion diseases. Take precautions when performing post-mortems, such as wearing gloves. Pregnant women and anyone with compromised immunity (e.g. small children, those with immune disorders) are advised to take extra precautions, including not handling dead lambs.

When to get help:

Learning how to do post-mortems is relatively easy, however, going through the procedure first with a veterinarian or an experienced sheep producer can be very helpful. Please note that not all deaths can be diagnosed with this system and there are times when professional help is definitely warranted (e.g. potential infectious abortion storm). **Contact your veterinarian any time you are concerned about lamb losses.**

Adapted from Dr. Lynn Tait's presentation '*Neonatal Management*' (recording available from www.ablamb.ca).

***'Lamb Post-Mortem Protocol for Use on Farm: To Diagnose Primary Cause of Lamb Death from Birth to 3 Days of Age', J.M. Everett-Hincks and S.J. Duncan. The Open Veterinary Science Journal, 2008, 2, 55-62. (Link available on ablamb.ca).**

Steps 1-3: Record Information, External Exam and Dissection

CAUTION: Take precautions, such as wearing gloves, when performing postmortems to avoid possible disease transmission. Pregnant women and others with compromised immunity are advised not to handle dead lambs.

1 Record Information

Date of exam:_____ Lamb birth date:_____ Lamb age at death: _____

Ewe ID: _____ Number of lambs in litter alive:_____ Number dead:_____

Weather/ambient temperature: _____

Birth difficulties: Yes No Unknown

Ewe behavior towards lamb: Attentive Uninterested Aggressive

2 Examine the lamb externally for physical abnormalities

e.g. deformities, signs of trauma, decomposition, coat condition/colour, other signs. Consider taking pictures of the lamb as it was found and surrounding area.

Has the lamb walked?

Soft tissue is present on the bottom of the hooves if the lamb did not walk.

No

Yes

3 Dissect lamb & expose internal organs

Taking pictures during the exam can help accurately record findings and can be shared with your veterinarian, if needed.

Notes for Steps 1 – 3: Record Information, External Exam, and Dissection		
Step 2: External exam – What to note:		**Why is this important?**
General appearance	Head and limbs are normal size, weight & proportion for breed; skeletal or other deformities; position of placenta/afterbirth (e.g. over lamb's head/mouth)	Abnormal developmental/deformities indicate the lamb was not viable at birth. Multiple lambs with the same deformity could indicate a genetic issue (check breeding lines) or possible infectious causes. Nutrition during pregnancy affects lamb size/development. The lamb may have suffocated if the placenta was not cleared.
Decay	Foul odour; colour and condition of the lamb and placenta; dehydrated/ mummified carcass.	Healthy tissue is pink and elastic. The stage of decomposition indicates how long before birth the lamb died (mild signs to complete mummification). It is important to note the condition of the placenta as well as the lamb. A dark coloured, easily torn placenta indicates it was not sustaining the lamb before birth.
Trauma	Swelling; bruising; broken bones; signs of predation	Damage by ewe (stepping on or aggression) or by a predator. A difficult birth may cause external signs of trauma.
Fleece/Hair Coat	Groomed/cleaned by ewe; wet or dry; normal appearance for breed; colour	Grooming indicates ewe was interested in the lamb at birth. Coarse or unusual looking coat can be a disease sign. Difficult births can result in yellowish staining of the lamb's coat, due to meconium (fetal feces) release during birth.
Did the lamb walk?	Soft white or yellowish raised pads on bottoms of hooves	If pads are present, the lamb has not walked and death occurred before, during or shortly after birth

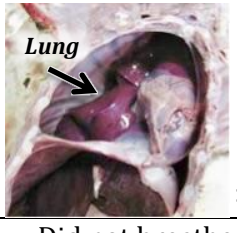
Step 3: Dissect lamb for internal exam

- Before beginning the dissection, you may wish to place the lamb inside a garbage bag with the edges of the bag rolled down. The bag can be pulled up with the lamb inside after the exam. This will help maintain biosecurity by containing material and fluid from the dissection. The carcass can then be disposed of or frozen, as needed.
- Place lamb on its back so you are looking at the abdomen. Spread legs out to stabilize the carcass.
- Starting just below the naval, hold a tent of skin up from the body. Make an incision through the skin and abdominal wall, and cut towards the tail/pelvis. Continue from the naval towards the head to under the chin.
- As you are cutting, hold the flap of skin up and away from the body to help prevent damage to internal organs.
- Cut through the rib cage along the edge of the sternum (breast bone) to expose heart and lungs.

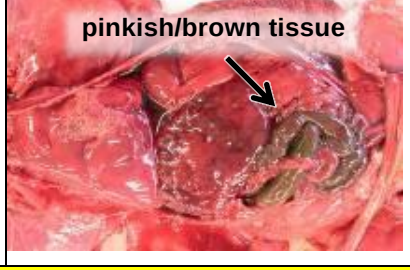
<table>
<tr><th colspan="3">Steps 4-5: Was the lamb alive at birth? See page 6 for details.
(Note: If lamb was observed alive after birth, go to Step 6).</th><th>NO</th><th>YES</th></tr>
<tr><td>4</td><td>Did the lamb breathe after birth?

Lung colour

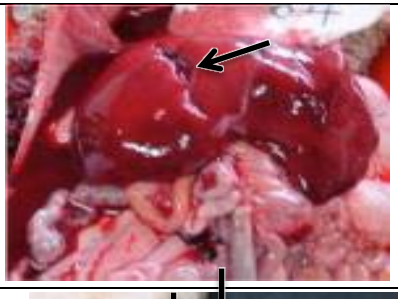
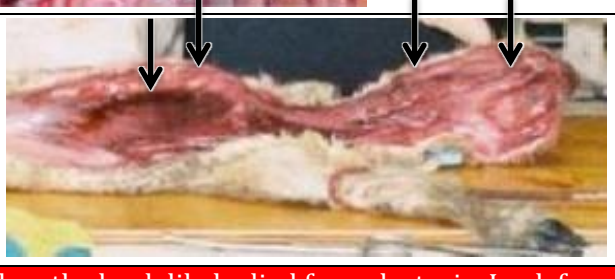
and/or

Lung buoyancy</td><td>
Check lung colour:
<table>
<tr><td>Light Pink = areated/inflated</td><td>Pink/red mix = partially aerated</td><td>Very dark red = not aerated/inflated</td></tr>
<tr><td>  </td><td>  </td><td>  ‡</td></tr>
<tr><td colspan="2">Lamb breathed</td><td>Did not breathe</td></tr>
<tr><td colspan="3">Check lung buoyancy:</td></tr>
<tr><td colspan="2">Lung floats (lamb breathed)</td><td>Lung does not float (did not breathe)</td></tr>
</table>
</td><td>☐

Go to Step 5</td><td>☐

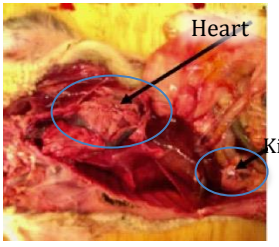
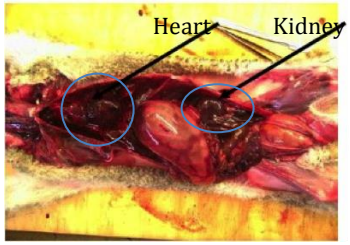
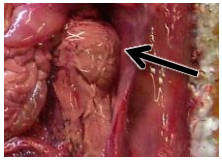
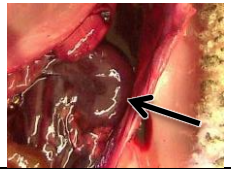
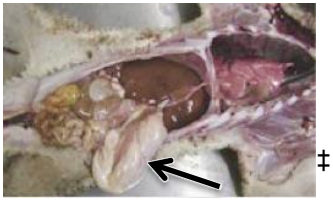
Go to Step 6</td></tr>
<tr><td>5</td><td>Is there evidence of tissue decay?</td><td> 
Tissue that is discoloured or has an abnormal texture indicates lamb was dead before birth</td><td>☐
Go to Step 6</td><td>☐
Go to Step 6</td></tr>
<tr><td colspan="5">If both answers are ‘White’ (and there was no delay in finding the carcass), the lamb died before birth. Treat as an infectious abortion. If Step 4 was ‘Yes’, lamb was alive at birth. If both answers are ‘No’, death occurred during or soon after birth, e.g. suffocation (afterbirth covering head), developmental abnormalities or dystocia (Step 6). If you are unsure whether the lamb was aborted, treat as infectious until known otherwise (see page 7 for details).</td></tr>
</table>

Notes for Steps 4 -5: Was the lamb alive at birth?	
Step 4: Did the lamb breathe after birth?	**Why is this important?**
The colour of the lungs indicates if the lamb breathed after birth: light pink lungs are full of air (aerated) showing the lamb breathed. Very dark red (liver coloured), deflated looking lungs indicate the lamb did not breathe. If the colour is difficult to rate, test for buoyancy by removing part of the lung and placing it in a container of water. If the lamb had breathed the air in the lung will cause the lung to float.	Partial or full aeration of the lungs are signs the lamb was alive at birth. If a lamb did not breathe, it is important to try to establish if it was dead before the birth process began. For instance, a lamb that died before breathing, but shows little or no decomposition (Step 5) should be checked for signs of dystocia or suffocation by the placenta.
Step 5: Is there evidence of tissue decay?	**Why is this important?**
Note any signs of decomposition of lung tissue (pinkish/brown discolouration). The lungs in particular, will show signs of decomposition very soon after death**.** Depending on the stage, other signs could include: The entire body may appear swollen and/or fluid can be felt under skin (generalized edema). If the lamb was dead for a long period, absorption of fluids from all tissues and organs will result in dehydration, progressing to mummification of fetus. Tissues will be dark and non-elastic to the touch.	Unless there was a delay in finding the carcass, lambs with signs of tissue decomposition died before birth. Tissues begin breaking down soon after death. Visual signs of decay progress from generalized edema and mild tissue degradation in the early stages to complete decay or mummification of carcass. The stage of decomposition can help determine how long the lamb was dead before birth.
Note: Infectious abortion diseases are very serious and can decimate a lamb crop. Treat all abortions (i.e. lambs that died before birth) as infectious until the cause is known. Take precautions to avoid the spread of disease by isolating affected ewes, removing all afterbirth and disinfecting birth area, if possible. Although non-infectious abortions can occur, it is advisable to freeze the carcasses and afterbirth of all aborted fetuses (use a leak-proof bag and label with date and ewe ID). If the problem escalates, submitting all abortions for laboratory analysis will improve the chances of identifying the problem. **Contact your veterinarian if three or more abortions occur.**	

Steps 6 - 8: Did the lamb die from dystocia (difficult birth)? See page 8 for details			NO	YES
6	**Is there evidence of hemorrhage (bleeding)?**	*Presence of blood in abdominal cavity.* 	☐ **Go to Step 7**	☐ **Go to Step 7**
7	**Has the liver ruptured?**	 *Cut appearance on liver.*	☐ **Go to Step 8**	☐ **Go to Step 8**
8	**Do head, neck, sternum and/or ribcage show signs of trauma?**		☐ **Go to Step 9**	☐ **See note below.**

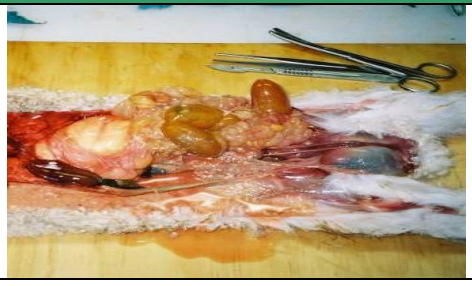
If one or more answers are '***Yes***' then the lamb likely died from dystocia. Look for other signs that can help confirm this diagnosis (e.g. yellow meconium staining on lamb's coat). **PLEASE NOTE** other sources of trauma may cause the signs listed above (e.g. predation or aggressive ewe). You may choose to end the exam if you are certain this was a difficult birth. If you are uncertain that the injuries were due to dystocia, continue exam and note trauma in Step 14.

Notes for Steps 6 - 8: Did the lamb die from dystocia (difficult birth)?	
These three signs can indicate that the birth process was difficult and/or prolonged. Even if lambs survive, the damage is often so great that they will not get up to nurse and suffer from starvation. However, the death would still be attributed to birth trauma. Some deaths may be inevitable (overly large lamb, malposition, etc.), but in many cases interventions can be successful, if problems are caught soon enough. Have a good supply of water-based lubricant on-hand during lambing season and use generously during an intervention. If multiple lambs die of dystocia, reassess if ewes are being checked often enough to catch problems. Consider genetics if there are many overly large lambs (e.g. traced to a particular ram). Ewe nutrition and body condition during pregnancy will also affect the likelihood of dystocia.	
Step 6: Evidence of internal bleeding	**Why is this important?**
Presence of fluid or clotted blood in the abdominal cavity, not originating from the umbilical veins.	It is not normal to see any amount of blood when you open the abdominal cavity. Internal bleeding indicates trauma from a difficult birth or other cause. The source of the bleeding is often from the liver.
Step 7: Liver rupture	**Why is this important?**
The liver is located in the upper part of the abdominal cavity and has a distinctive red-brown colour. A healthy liver will have a smooth appearance. To check for damage, examine all surfaces for jagged looking ruptures. Note that the underside of the liver has naturally occurring folds that are not due to damage.	The liver is susceptible to damage, and trauma will cause it to rupture and bleed.
Step 8: Signs of trauma	**Why is this important?**
Note the location and severity of any edema/fluid accumulation on the body. One of four severity grades can be assigned: no edema, minor edema (visible but not measurable), moderate edema (greater than 3mm and up to 1 cm in depth) and severe edema (greater than 1 cm depth). Other injuries that may result from a difficult birth (e.g. broken ribs, bruising under skin).	Edema and injuries can occur in different parts of the body and as the result of a variety of conditions. However, edema more than 3 mm thick in at least one area including the head, neck, chest and ribcage is a strong indication that the lamb was alive during the birth process, and that there was a difficult or prolonged birth.

Steps 9 - 11: Did the lamb die from starvation/mismothering/exposure? See page 10 for details.				NO	YES
9	**Is all brown fat depleted from around heart and kidneys?**	 *Light brown fat around heart & kidney*	 *Fat depleted (heart & kidney dark red)*	☐ **Go to Step 10**	☐ **Go to Step 10**
		 *Kidney with fat cover*	 *Kidney: fat cover depleted*		
10	**Is there a milk clot in the stomach?**	 Milk in Stomach	 Stomach opened to show clot	☐ **Go to Step 11**	☐ **Go to Step 11**
11	**Is there evidence of milk absorption in the gastrointestinal tract?**	*White scattered substance in the supporting membrane of the intestines.*		☐ **Go to Step 12**	☐ **Go to Step 12**

If all answers are '***Blue***', starvation and/or exposure contributed to or caused the lamb's death. You may choose to end the exam or continue to Step 12. If all answers are '***White***' or all are '***No***', lamb likely did not die of this cause. If all are '***Yes***', lamb died of exposure but had nursed (mismothering was likely not a factor).

Notes for Steps 9 - 11: Did the lamb die from starvation/mismothering/exposure?	
Management can prevent many of these losses once the exact cause is found. Lambs dying from starvation/ exposure will show signs outlined in Steps 9-11. However, all three signs may not be seen in the same animal (e.g. lambs with no brown fat but with milk clots in their stomach have likely died from cold exposure and not starvation). Exposure deaths can occur even if temperatures are relatively warm when lambs are weak, wet or not cared for by the ewe. If the lamb is weak and/or you are uncertain if it nursed, intervention is necessary to save the lamb. Follow recommendations for treatment based on body temperature, age and behaviour of lamb (e.g. drying off, tube feeding colostrum, dextrose injection). Starvation is often a result of mismothering (e.g. ewe has enough milk, but is not caring for lamb). Consider management changes to improve ewe/lamb bonding (e.g. use claiming pens, keep pre- and post-lambing ewes separate). Ewes may not have enough milk for multiple lambs, and fostering/bottle-feeding is necessary. Keep records and consider culling problem ewes. Details of management tips are available at ablamb.ca.	
Step 9: Heart and kidneys for brown fat	**Why is this important?**
Examine the heart and kidneys for fat depletion. Fat metabolism (break down) progresses from a slight softening to complete absorption (i.e. fat tissue becomes a dark, red-brown colour, and has soft and gelatinous texture). Brown fat is depleted first from around the heart and then the kidney area. Kidneys are attached along the body wall at the back of the abdominal cavity (under intestines during post-mortem).	Lambs are born with reserves of brown fat (light tan in colour), which provides energy until their first meal. If a lamb does not nurse, the fat reserves will continue to break down until depleted. Even in warm temperatures, fat reserves will be depleted in a few hours. Cold temperatures increase the rate of depletion.
Step 10: Milk in stomach	**Why is this important?**
Open the stomach (abomasum) and examine for milk clots. Milk may not still be in the stomach, if it has passed to intestines (Step 11).	A milk clot in the stomach is a sign that the lamb has nursed.
Step 11: Milk in gastrointestinal tract	**Why is this important?**
Check for milk absorption. If milk had passed from the stomach there will be a white scattered substance in the supporting membrane of the intestines. Check that meconium (sticky, tar-like fetal feces) has been passed.	This indicates that the lamb has fed and digested milk, and that the digestive system was functioning. Passing of meconium indicates the digestive track was functioning normally.

Steps 12 -15: Did the lamb die from 'Other' causes? See page 12 for details.				NO	YES
12	**Is there infection around the navel?**	*Excessive yellowish fluid, swelling around navel area*		☐ **Go to Step 13**	☐ **Go to Step 14**
13	**Are there lesions on the liver?**	*Look for discoloured areas and/or abnormal texture.*		☐ **Go to Step 14**	☐ **Go to Step 14**
14	**Are there signs of trauma not due to dystocia?**	*Injuries anywhere on body (e.g. broken bones, bruising, edema, cuts, bite marks, signs listed in Steps 6-8). Note any other evidence (e.g. aggressive ewe, predation).*		☐ **Go to Step 15**	☐ **Go to Step 15**
15	**Is there an abnormality?**	*Examples: enlarged liver, enlarged kidneys, enlarged heart, brittle/weak ribs, incomplete digestive system, digestive system blockage, other*.		☐ **Go to Step 16**	☐ **Go to Step 16**
16	**Is the cause of death is unknown?**	*Keep a record of all relevant information and contact your veterinarian for more extensive testing, if you are concerned.*			

Notes for Steps 12 - 15: Did lamb die from 'Other' causes?	
The majority of lamb deaths that occur in the first 3 days are due to dystocia and starvation/exposure. However, other causes of death do occur, including the following:	
Step 12: Infection around navel	**Why is this important?**
Check the navel area, umbilical arteries and membranes for the presence of infection, including the following: swelling, black and/or blue tissue discolouration and yellowish fluid.	Navel infections may be severe enough to cause death, but more often lead to 'joint ill' (swollen joints) in lambs over a week of age. If navel infections are found, check cleanliness of lambing area and navel disinfecting practices at birth.
Step 13: Liver damage	**Why is this important?**
A healthy liver has a consistent colour (red-brown) and texture throughout the organ. The presence of lesions, abnormal colour or soft texture is evidence of infection.	Infections can cause liver damage. Major infections are not generally seen in neonatal lambs, as bacteria require time to multiply to the point where severe illness or death occurs. If a newborn lamb has signs of infection, it is more likely an abortion case (infection occurred before lamb was born).
Step 14: Trauma not due to dystocia	**Why is this important?**
Look for injuries anywhere on the body (e.g. broken bones, bruising, edema, signs listed in Steps 6-8), and for evidence that trauma was not related to dystocia (e.g. aggressive ewe or other adult sheep, predation).	Knowing the source of the injuries is vital to being able to make the correct management changes that will prevent further deaths.
Step 15: Abnormality	**Why is this important?**
Note any abnormalities, such as: enlarged organs (e.g. liver, kidneys, heart); brittle/weak ribs; severe bloating due to incomplete digestive system or blockage of digestive system; other.	Signs of congenital disorders or diseases indicate that the lamb was not viable. Severe bloating is a sign the lamb was born with an incomplete digestive system (missing anus or part of the colon) or that there is a blockage (e.g. dried meconium).
Step 16: Unknown Cause	**Why is this important?**
This exam looks for the most common causes of death. At times you may go through the exam and not find conclusive results. Record all relevant information and contact your veterinarian for more extensive testing, if you are concerned. Pictures taken during the exam can be shared with the veterinarian to help with the diagnosis.	

Where to find more information:

This booklet is intended as a quick guide to diagnosing common causes of neonatal lamb deaths. More detailed information, particularly for correcting management problems, is available at www.ablamb.ca, including the following:

- A full recording of Dr. Lynn Tait's presentation '*Neonatal Management: Why is my lamb dead and how could I have prevented this*'.
- Links to the full versions of the documents listed below and other management resources:
    - '*Lamb Post-Mortem Protocol for Use on Farm: To Diagnose Primary Cause of Lamb Death from Birth to 3 Days of Age*', J.M. Everett-Hincks and S.J. Duncan. The Open Veterinary Science Journal, 2008, 2, 55-62.
    - '*Lamb Autopsy. Notes on a procedure for determining cause of death*'. Peter J. Holst. State of New South Wales NSW Agriculture (2004).

Photo credits:

- Cover photo: Tracy Hagedorn
- Unless otherwise noted, autopsy photos are from Everett-Hincks and Duncan (reference above).
- Photos marked with '‡' were taken from Holst (reference above)

Disclaimer:

Growing Forward 2
A federal-provincial-territorial initiative
Alberta Lamb Producers
Alberta Government
Canada