# 1

# General Lambing Management

It is should be emphasised that most sheep and goats give birth to their lambs and kids naturally and unassisted, as nature intended. When problems do arise, timely intervention is required to prevent losses. However, inappropriate intervention too soon can also cause harm to both ewe and lamb, can compromise animal welfare and may result in economic loss.

The normal hormonal processes involved in giving birth occur most effectively when the dam feels safe and is undisturbed. While good observation is essential, disturbance of the lambing ewes should be minimised and shepherds should move among the flock in a calm and quiet manner. The role of a good shepherd in the delivery of lambs at lambing time should be to provide the right amount of assistance at the right time, and no more. The keys to achieving this are good preparation and adequate supervision of lambing ewes to spot problems in a timely manner.

Most assisted deliveries can be undertaken satisfactorily, using a gentle hygienic technique to give a viable, humane and profitable outcome. The general principles and practice of delivering goat kids are the same as those for lambing ewes. In this chapter, specific reference to goats is only made where the important principles differ.



## Preparation for Lambing

Around the world, the economics of small ruminant farming have necessitated a shift of focus away from the care of individual animals and towards whole flock or herd approaches. Careful preparation for lambing or kidding is now, therefore, of paramount importance to protect of the welfare of pregnant and lambing ewes or does, and their newborn lambs or kids. Lambing should be seen as the critical time when the benefits of general preparation, nutrition and animal health management throughout the year are realised.

Careful shepherding and the design and selection of the lambing environment – be it in lambing paddocks, or lambing sheds – is required to minimise disturbance of lambing ewes, thus enabling the establishment of a good ewe-lamb bond and enhancing the survival of newborn lambs. Whenever possible, steep

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Neil Sargison, James Patrick Crilly and Andrew Hopker.

**Figure 1.1** Lambing fields should ideally be small and flat with easy access to food and water.

and exposed fields should be avoided. Lambing fields should not be too large and water sources not too far apart (Figure 1.1).

When potentially less suitable lambing paddocks must be used, they should, if possible, be reserved for single-bearing adult ewes. Buildings should be well ventilated and drained. Pens should be small enough to allow animals to be grouped according to their nutritional and animal health needs, and should be designed in a manner such that lambing and lambed ewes can be isolated and removed without undue disturbance of the whole group. Consideration should be given to the housed ewe space requirements of about 1.1 $m^2$ per ewe, the need for constant access to forage, and concentrate feed trough space requirements of about 0.5 m per ewe (Figure 1.2). These requirements vary with breed and litter size.

Sufficient individual pens should be available, based on a figure of about 10% for the flock. These should be large enough to allow the ewe and lamb to lie safely apart from each other, and need to be clean and well drained. All pens should be well lit and easily accessible. Food and water must be available at all times.

Despite long-term planning, the need for careful skilled assistance for some lambing ewes is inevitable. A clear plan is required to avoid suffering in ewes which cannot be lambed. This should include guidelines about when and how to seek assistance and provision for the immediate humane destruction of distressed animals. Lambing equipment should be prepared in advance (see Table 1.1). Provision should be made for the management of those diseases which occur annually in most flocks around lambing, and there should also be clear guidelines about when to seek assistance, and to ensure prompt and humane destruction to prevent further suffering when treatment is unsuccessful or uneconomical. Preparation for lambing must also be aimed at prevention and management of disease in newborn lambs. Despite careful preventive management, the occurrence of disease in newborn lambs is inevitable, so provision should be made for the treatment of the common problems and specific diseases that occur in the flock.

**Figure 1.2** Lambing sheds need to be carefully organised to ensure ease of observation, precision nutritional management and minimal disturbance of lambing ewes.

**Table 1.1** Equipment list for lambing sheep.

| |
|---|
| Suitable antiseptic solution |
| Obstetric lubricant |
| Arm length disposable gloves |
| Lambing ropes, snares or other aids |
| Clean needles and syringes |
| Antibiotics for treatment of mastitis or metritis |
| Injectable anti-inflammatory drugs |
| Plastic retainers or harnesses, local anaesthetic, clean obstetric tape and needles for the management of vaginal prolapse |
| Calcium borogluconate injection for the treatment of hypocalcaemia |
| Propylene glycol, or other concentrated energy supplements for the treatment of pregnancy toxaemia |
| Strong iodine tincture for navels and a dip cup or spray to apply |
| Stomach tubes, colostrum, a warming box, glucose injection, syringes and needles for the treatment of starvation and hypothermia |
| Kettle for hot water |
| Rehydration drench or formula for lambs |
| Clips or small syringes and needles for subconjunctival injections to correct entropion |
| Oral antibiotics for watery mouth prevention if needed |
| Injectable antibiotics for the treatment of neonatal bacteraemias if needed |
| Elastrator rubber rings for lambs if needed |
| Marker paint |
| Spare hurdles for making addition pens |
| Disinfectant for pens and floors |
| Sufficient clean buckets for food and water |

## Normal Lambing

The normal ewe gestation period is 143–147 days. Impending lambing (parturition) is signalled by udder development, accumulation of colostrum, slackening of the sacro-iliac ligaments between the tail head and the vulva and visible dropping of the abdominal contents, giving an appearance of hollowness of the sublumbar spaces on both sides of the ewe. The birth process is described as having three consecutive stages.

First stage labour is represented by cervical dilation, which takes 2–6 hours, being fastest in ewes bearing multiple lambs (multiparous ewes). Behavioural changes are often the first sign of impending lambing. The ewe will frequently separate herself from the flock or not come forward for feeding. If she does come to the trough, she may leave early. Sheep may paw at the ground and then sniff the area, while frequently lying down and then standing (Figure 1.3).

Ewes lambing outdoors often separate themselves from the flock at this stage, so it is important that corners, ditches, bushes and other such areas are checked regularly. Abdominal contractions (straining) will start, initially lasting 15–30 seconds and occurring at about 15 minute intervals. Straining becomes more frequent, until it is happening every two to three minutes, and a string of mucus may be seen at the vulva. The appearance of the water bag at the vulva indicates that the ewe is ready to give birth, although the bag may burst and go unnoticed. This process usually occurs faster in older animals which have previously given birth, and tends to be slower in ewe lambs and gimmers. Disturbance of the sheep during this process may also delay progress.

Second stage labour is represented by the passage of the lamb through the birth canal, and typically takes about one hour. The breaking of the water bag (rupture of allanto-chorion) is indicated by a rush of fluid, following which part of the

**Figure 1.3** Ewes in first stage labour initially separate themselves from the main group in a preferred lambing site before abdominal contractions begin.

**Figure 1.4** The appearance of the placenta and foetus in the birth canal indicates second stage labour.

**Figure 1.5** Normal unassisted delivery of a lamb in anterior presentation.

placenta (the amnion) and foetus are presented into the birth canal. Powerful reflex and voluntary contractions of abdominal muscles will occur every couple of minutes. Parts of the lamb may be seen protruding from the vulva (Figure 1.4).

Once the lamb has appeared at the vulva it is normally delivered soon afterwards (Figure 1.5). Again, disturbance of the ewe may delay this process.

Once the lamb is born, the ewe should immediately lick and clean the lamb. This process is important for stimulating the lamb and establishing the bond between mother and young, as well as drying the lamb. Ewes bearing multiple lambs may start to deliver the next within minutes, or a gap of an hour may occur. Delays greater than one hour should be considered abnormal, and the ewe should be examined.

**Figure 1.6** The placenta should be passed within about 3 hours of lambing.

Third stage labour is completed by expulsion of foetal membranes (placenta), which usually occurs within 2–3 hours of the end of second stage labour. The placenta may be passed at the time of lambing, or shortly afterwards (Figure 1.6). If the placenta has not been passed within three hours, the ewe should be investigated, as this could result in potentially serious infection.

The process of preparing to give birth, including dilation of the cervix and delivery of the lamb(s), takes longer in ewes lambing for the first time (primiparous), compared with animals which have given birth previously. These animals should be given sufficient undisturbed time in a quiet environment to allow the hormonal mechanisms of birth to take place. Careful, unobtrusive observation should be undertaken, to allow early detection of potential problems.

## When to Intervene

Every sheep and every delivery is different, so there are no hard and fast rules for when to intervene. Intervention with lambing should only be considered when failure to do so might compromise the health of the ewe or unborn lamb. Intuitive, common sense assessment of the ewe usually gives an indication of prolonged birth stress. If the ewe lies on her side (lateral recumbency), with frequent abdominal straining and vocalisation, it may indicate that the lamb is engaged in the birth canal. Tooth grinding and, heavy breathing, involving contraction of abdominal muscles and panting, may indicate more serious concerns. Table 1.2 gives some guidelines as to when intervention and assistance should be considered.

Difficult, painful and extended lambings have serious consequences for the health and welfare of both the ewe and her lambs. The consequences of the birth of weak lambs as a result of an obstructed labour (dystocia) include an increased mortality rate, a higher incidence of neonatal infections, slower weight gain,

**Table 1.2** Indications of the need to assist lambing.

| |
|---|
| The ewe has been trying to lamb for one hour without a lamb being delivered. |
| The interval between the water-bag breaking and expulsion of a foetus exceeds 30 minutes. |
| No further progress has been made 20 minutes after some of the lamb has been visible at the vulva. |
| Frequent powerful contractions have persisted, but no progress made in the delivery of a lamb. |
| The ewe appears to have started to lamb, then stopped. |
| The lamb's head is visible, but no forelimbs have been seen at the vulva. |
| Two forelimbs, but no head is seen visible at the vulva. |
| A foetal head and only one forelimb is seen at the vulva. |
| Only a tail is seen at the vulva. |
| A large and obviously stuck lamb is seen, sometimes with a swollen head or tongue. |
| Parts of two lambs are seen at the same time at the vulva. |
| Thirty minutes have elapsed after the birth of the first lamb, but twins or triplets are expected. |
| An unpleasant brown or smelly vulval discharge is noted, indicating the presence of decomposing foetuses. |
| Other problems, such as vaginal prolapse, have been identified. |

**Figure 1.7** Protracted lambing or unskilled intervention can seriously compromise the health, welfare and productivity of both the ewe and her lambs.

higher medication costs and greater time spent on their care. The consequences of trauma on the ewe include reduced colostrum and milk let-down or production, poor mothering behaviour, higher medication costs, time spent on care and potentially reduced future fertility (Figure 1.7).

Prompt assistance should be given for any cases of ewes suffering dystocia. Unskilled intervention often results in swelling (oedema) and bruising of vulva, with outward evidence of vaginal bleeding on the tail and skin around the rectum and vulva (perineum). Excessive or uncontrolled force must never be used, as this endangers both mother and offspring, nor should numerous individuals attempt to lamb the same sheep. A failure to observe these measures and strict hygienic precautions often leads to womb infection (metritis).

Veterinary assistance may be appropriate when serious problems arise. It is better to seek veterinary assistance early, and minimise interference with the ewe, than to delay before having to call the vet to remove non-viable lambs from a now-debilitated animal that may subsequently die.

Factors which make veterinary assistance essential include:

i) oversized or malpresented lambs that cannot be delivered without compromising the welfare or survival of the ewe or lamb;
ii) failure of dilation of the cervix that cannot be corrected by gentle manipulation;
iii) some congenital deformities in the lamb.

If it is considered to be genuinely uneconomical or impractical to seek veterinary assistance in circumstances such as these, there must be a contingency for the immediate euthanasia of the affected ewe, to prevent further intolerable suffering. However, in calculating the economics of veterinary involvement, the cost of losing a ewe and her lambs as a result of incorrectly managed dystocia must include the lost sale value of the lambs, the replacement cost of the ewe, carcase removal or disposal charges, the cost of medicines used and staff time caring for the ewe before death.

## Hygiene

To protect the ewe, the lamb and the shepherd, attention to hygiene is of paramount importance during the examination of lambing ewes and assisted lambings. Using dirty, ungloved hands to lamb a ewe can result in potentially fatal infection of the womb (metritis). Even less serious womb infections result in reduced milk production, with consequences of poor lamb growth, increased lamb losses and associated treatment costs.

Wherever possible, hands should be thoroughly washed with water and an antibacterial soap, or a dilute solution of a disinfectant. In circumstances where no anti-bacterial cleanser is available, a thorough wash with soap and hot water will often be adequate. Protective arm-length gloves must be worn whenever hand washing is impractical. It can also be helpful to wash the vulva of the ewe prior to starting the examination, to prevent surface bacteria from being carried inside. Shearing of wool from around the vulva (dagging) well before the start of lambing may be advantageous, as this reduces the risk of contamination from faecal bacteria harboured in the wool.

Clean, disposable arm-length gloves should be used to improve hygiene and to prevent the spread of disease between animals and humans (zoonotic spread). While some operators dislike the use of gloves, with practice, their use becomes quite normal. Gloves also have the advantages that they work well with lubricant and that, once soiled, they can be discarded, so the operator's hands and arms remain relatively clean and odour-free.

## Lubrication

Use of obstetrical lubricant is essential when performing an assisted lambing. It eases the act of lambing, making the ewe feel more comfortable, and reduces physical trauma to the ewe, with resultant better milk production and mothering behaviour in the post-lambing period. Obstetrical lubricant is usually water-based, and mixing water with lubricant may increase its effectiveness by making the area more slippery. In circumstances where no lubricant is available, a copious lather of mild soap and water is sometimes used. However, this is a poor second choice, as even mild soap may cause irritation to the vagina.

## Gentle Manipulation

All assisted deliveries should be performed gently. The lamb should be handled carefully to correct mal-presentations, guarding against tears to the uterus. Particular attention should be paid to protecting the uterine wall from tears caused by the points of the lamb's hooves when repositioning legs. Excessive traction should never be used, as this can seriously reduce lamb viability and cause maternal trauma (Figure 1.8). This is particularly true in cases where the head and legs of the foetus have not properly engaged into the ewe's pelvis.

Key points are summarised in Table 1.3.

**Figure 1.8** Assistance of lambing ewes requires good hygiene, lubrication and gentleness.

**Table 1.3** Rules for lambing ewes.

| | |
|---|---|
| Be vigilant | Observe ewes for signs of lambing and progress. |
| Be calm and quiet | Avoid disturbing ewes as much as possible. |
| Be prepared | Acquire all lambing supplies well before lambing, and store appropriately in an accessible box or crate. |
| Be clean | Wash hands, equipment and the ewe's vulva before examining or assisting with a lambing. Wear gloves. |
| Be gentle | Do not pull too hard. Protect the uterus from tears by fingers or the lamb's hoof. |
| Use plenty of lubrication | |
| Know your limits | Do not persevere trying to lamb a sheep beyond 5–10 minutes if you are making no progress. Know when to call for assistance. |

## Obstetrical Techniques

The normal position, known as the presentation, for a lamb to be born is with the nose placed upon the forelimbs with both elbows bent (Figure 1.9).

When presented with a lamb in this position, first check that there is enough space within the birth canal for the lamb to pass through. Assess the size of the lamb's hooves and head and, if necessary, place a clean, lubricated hand inside the ewe's vagina and run it around the lamb to check for any obstructions. Feel along one leg to the shoulder, across the neck and head, the other shoulder and down the other front leg, in order to ensure that all the presented parts belong to the same lamb (Figure 1.10).

Now, carefully grasping one foreleg just above the hoof, gently extend the leg to straighten the elbow. Repeat this for the other leg. Then grasp both forelimbs somewhere between the elbow and wrist (carpus), using the fingers of one hand. Run the other hand over the top of the lamb's head, so that the fingers find purchase on the bones of the skull at the back of the head. Pull the lamb backwards and downwards (away from the ewe's head and towards her back feet) in an arc of a quarter circle. The lamb should come smoothly. If the ewe is still contracting, then it is important to work with her contractions. Once delivered, clear the lamb's nose and mouth and place it so that the ewe can nurse it. Palpate the ewe's abdomen, to consider if there are other lambs still inside, and be prepared to assist these only if appropriate. Check the ewe's udder for colostrum.

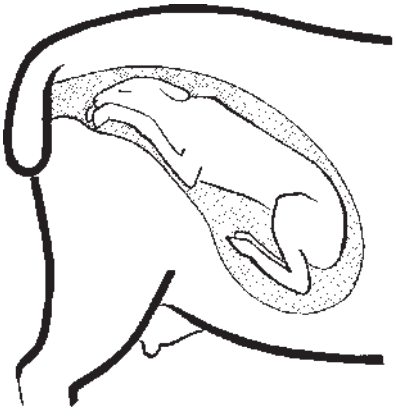

**Figure 1.9** Normal presentation of a lamb or kid.

### Leg Back Presentation (the nose and one leg in the birth canal)

Having determined the absence of a foreleg in the ewe's birth canal, it is next necessary to check with a clean, lubricated hand that the head and leg presented belong to the same lamb. With a small lamb, it may be possible to retrieve the missing leg by inserting a hand along the side of the lamb's head and down to the shoulder of the absent leg. Now work the fingers down to the elbow and then gently manipulate the leg up into position, being careful to shield the hoof, to prevent tearing of the uterus. Once both feet are present, the ewe can be lambed as normal.

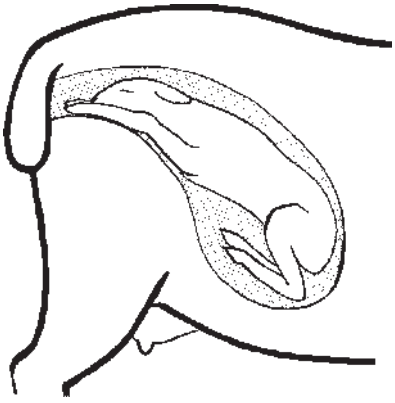

**Figure 1.10** The lamb's forelegs are extended in the correct position for assisted lambing.

More commonly, there is insufficient space within the birth canal to perform this procedure with the lamb in position. In this circumstance, it is necessary to push the lamb back gently into the uterus (retropulsion), in order to locate and tweak the missing leg into position. It is advisable to place lambing ropes, as described below, on the presented parts before pushing back inside, in order to aid later retrieval.

### Head Back Presentation (two legs and no head in the birth canal)

Having determined the presence of limbs, but the absence of a head in the ewe's birth canal, check that the limbs presented are both front legs by feeling the joints working up the leg, while envisaging the anatomy and nature of the joints of a lamb (Figure 1.11). To state the obvious, front legs have an elbow and hind legs a hock.

Now check that the two legs are attached to the same lamb. It can be helpful to place lambing ropes on both legs, as described below, in case the legs slip back inside.

Now run a hand over the lamb's shoulder blade, up onto its neck and along to the back of its head. Run the hand over the skull from the nearer to the further away ear, and then onto the further away side of the lamb's face. Use the fingers to bring the lamb's head round to the straight position, and then hook the fingers gently around the back of the lamb's skull and draw the head up to the pelvis.

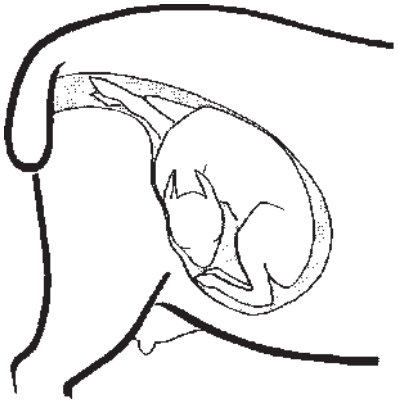

**Figure 1.11** Head back presentation of a lamb or kid.

If either leg has slipped back inside the ewe's uterus, retrieve it now, while keeping the head in the correct position.

If there is room within the pelvis to allow the lamb's head to pass with a hand around it, then deliver the lamb, otherwise apply a head rope or a lambing snare, as described below, to guide the head into the pelvis while applying gentle traction to the legs to deliver the lamb.

### Head Only Presentation

Having determined only the presence of a head, but no limbs, in the ewe's birth canal (Figure 1.12), it is first necessary to correctly place a head rope, as described below. Next, apply a generous amount of lubricant and with clean hands push the lamb's head back into the womb. Now retrieve the legs as described above and lamb the ewe. When the head only is presented through the birth canal, it rapidly begins to swell, making manipulation difficult and eventually causing the death of the lamb.

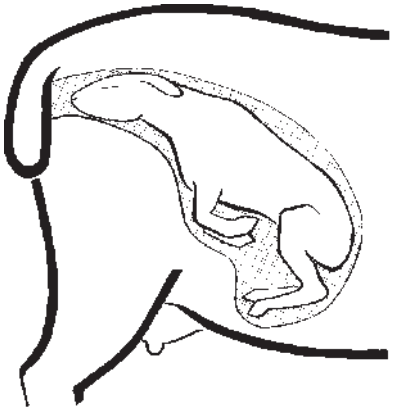

**Figure 1.12** Head only presentation with bilateral shoulder flexion of a lamb or kid.

### Backwards Presentation

Backwards presentation is identified by the presence of two back legs in the birth canal (Figure 1.13). These are confirmed as being back legs by the soles of the feet facing up towards the ewe's tail head, and the presence of the hock joints.

Feel along the inside of the legs and the tail, and identify the hindquarters in between the legs, confirming that the lamb is coming backwards, and that both legs are attached to the same lamb. Now bring the legs out to the level of the hocks, apply more lubrication and deliver the lamb, in one smooth, arc-like motion, arcing downwards (back and towards the ewe's back feet). Try not to stop during the delivery, as this can cause the lamb to inhale the birth fluids.

Beware of trying to deliver a large single lamb backwards, particularly in a terminal sire breed, as these may get stuck behind the rib cage, causing trauma or leading to inhalation of foetal fluids by the lamb.

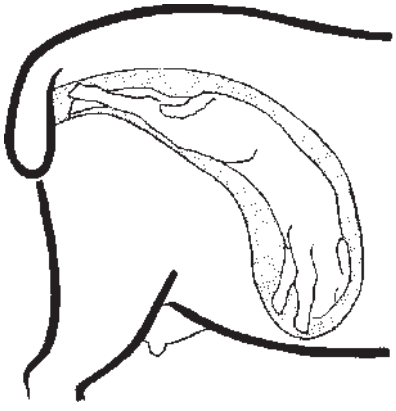

**Figure 1.13** Backwards (posterior) presentation of a lamb or kid.

### One Back Leg Presentation

Presentation of a single back leg in the ewe's birth canal is unusual. First check that the sole of the foot points up, the leg slopes up to the hock, and that the tail and hindquarters can be felt. Usually, it is necessary to push the lamb's hindquarters away slightly, in order to make some space. Feel down the hindquarters on the side of the missing leg, feeling down that side to find the hock. Now draw the hock back slightly to bring the leg backwards. Feel down the leg to the foot and cup the foot in the hand, bringing it upwards while pushing the hock away and down. The foot should now pop around to point backwards. It is very important to cup the foot within the hand, to protect the uterine wall from the hoof – otherwise, there is a significant risk of the hoof tearing the uterine wall. Once both legs point backwards, then the ewe can be lambed as described for a posterior presentation.

### Breech Presentation (tail only in the birth canal)

Breech presentation is identified by the presence of a lamb's tail, but no corresponding limbs in the birth canal (Figure 1.14). Using clean hands and generous lubrication, push the lamb's hindquarters back into the womb (retropulsion). Now retrieve both back legs, using the procedure described above, and being careful to avoid tearing. Now deliver the lamb.

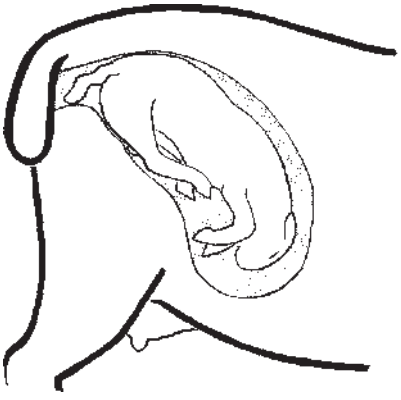

**Figure 1.14** Breech, or tail only presentation of a lamb or kid.

### Two Lambs Presented Together

A jumble of legs and heads in the birth canal can initially feel very confusing (Figure 1.15).

Solving the problem requires a careful and thoughtful approach. First use a clean lubricated hand to gently feel each leg, working out if it is a front or back leg, and what it is attached to. Try to visualise the problem. Having made a decision about which lamb is which, and which way round the lambs are laying, gently push one lamb back inside the womb. Now deliver the first lamb. Clear the lamb's nose and throat to stimulate it and give it to the dam. Now

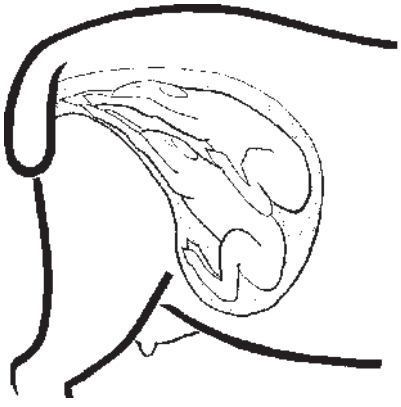

**Figure 1.15** Two lambs or kids normally presented together in the birth canal.

locate the second lamb, identify the legs and head, or both back legs, and deliver the second lamb.

## Correct Placement of Lambing Ropes or Snares

The traditional lambing rope is a short, soft braided rope, fitted with loops at each end. The loops are made into a noose and placed above the wrist (carpus) of the forelimbs (Figure 1.16) or ankle (tarsus) of the pelvic limbs (Figure 1.17). When used to secure the head, the noose of the rope should be placed in the lamb's mouth, then passed over the top of the skull and behind both ears (Figure 1.18).

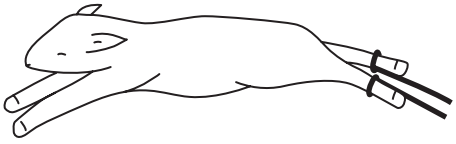

**Figure 1.16** Correct placement of a lambing rope above the carpus (wrist) of a lamb.

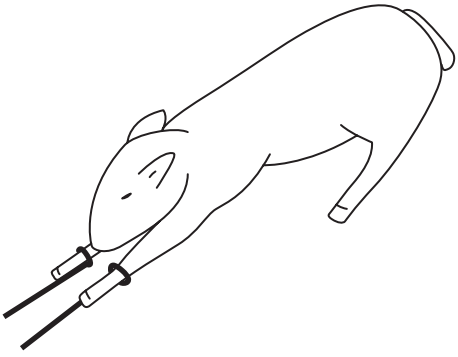

**Figure 1.17** Correct placement of a lambing rope above the tarsus (ankle) of a lamb.

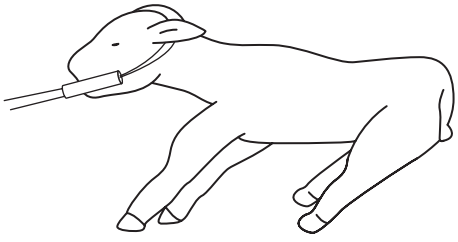

**Figure 1.18** Correct placement of a lambing snare on the head of a lamb.

The noose of the rope should never be placed around the lamb's neck or jaw. Ropes are best used to secure a leg or head that has to be moved to allow the lamb to be repositioned, and should never be used as a means of applying excessive traction. Plastic lambing snares can be used in a similar manner to head ropes.

## Ringwomb

Ringwomb is a general term used to indicate a failure of dilation of the cervix to allow the passage of the lambs into the vagina. Typically, when performing a vaginal examination of the affected sheep, the cervix is felt as a tight band constricting the birth canal, through which only 1–3 fingers can pass. The head or feet of a lamb can usually be felt beyond the cervix. Some suspected cases of ringwomb will actually be ewes in first stage labour which have been examined too early. This may particularly be the case when large groups of sheep are managed together indoors. Care should be taken to observe the sheep closely enough to avoid this situation.

Low maternal blood calcium has been implicated, but not proven, in

some cases of ringwomb. Calcium is required for muscle contraction so, in some cases, administration of injectable calcium borogluconate to the ewe may be helpful. The use of muscle relaxant drugs is rarely effective in cases of ringwomb. Gentle spreading of the cervix with the fingers is sometimes effective in dilating the cervix sufficiently to allow the delivery of the lambs, but this is impossible in ewes where the cervix will only admit a single finger. If gentle manual spreading has not dilated the cervix sufficiently to allow delivery of the lambs within 10–15 minutes, or is accompanied by bleeding, then it is unlikely that this will be effective, and veterinary attention should be sought.

## Uterine Torsion

Uterine torsion is an unusual condition, characterised by straining, but failure to identify a cervical opening or passage through the vagina into the uterus. Thin spiral folds are sometimes palpable in the vaginal wall. The incidence is highest in thin ewes carrying a large single foetus. Some cases can be corrected by casting the ewe and rolling her in the perceived direction of the torsion. However, most require veterinary assistance and delivery of the lamb by Caesarean section.

## Rupture of the Uterus

Excessive manual interference can cause rupture of the uterus, with subsequent shock, acute peritonitis and death of the ewe. Ewes are often anaemic and present with fast, shallow abdominal breathing, a rapid pulse and abdominal straining. Bright red arterial blood is often seen at the vulva and over the wool of the hindquarters.

## Dead Lambs

Assisted delivery of dead lambs can be problematic, because the birth canal is often dry and the ewe is often sick or exhausted. If the lambs have been dead for some time, their bodies may be swollen with gas or fluid. Ewes with dead lambs inside their wombs are at a very high risk of developing serious infections. When delivering dead lambs, special attention should be paid to hygiene and lubrication. Lubricant should be generously applied, both to hand and arms, and squirted into the birth canal. Manipulation of the foetus inside the ewe should be slow and gentle, as the uterus may be prone to tearing.

In some cases of head-only presentation of lambs, where the head has passed through the birth canal, the swelling may make it impossible to push (repel) the head back into the womb to create space to retrieve the legs. The lamb is often dead by this stage, in which case it is helpful to carefully remove the head using a sharp knife. This must be done skilfully to avoid the risk of accidental damage to

the ewe, and only when it is certain that the lamb is dead. The rest of the foetus can then usually be easily pushed back into the uterus, the front legs retrieved, and the ewe lambed as normal. Care should be taken to protect the birth canal from trauma caused by the stump of the severed neck.

Ewes should be treated with antibiotics for 3–5 days following the delivery of dead and decomposing lambs. An injection of non-steroidal anti-inflammatory drug (NSAID) should also be administered to the ewe. This may help to counter the action of some of the toxins she will have absorbed, and will speed her recovery by reducing pain and inflammation.

## Caesarean Section

Caesarean operations (C-section) can be carried out quickly and effectively on sheep, with little impact on mothering ability or future fertility. Caesarean section can only be undertaken by a veterinary surgeon. The vet will usually be able to deliver the lambs by this route in the same state that they were in when he or she started the operation. This means that one of the most important factors affecting lamb viability is making a decision to call for veterinary assistance early on, while the lambs are still strong and viable.

Having made the decision that a caesarean might be the most appropriate option, there are several things that can be done while waiting for the vet to arrive that will maximise the chances of a successful outcome. Move the ewe to a clean, well-lit and sheltered area. A clean area will reduce contamination of the surgical site, reducing the risk of post-operative infections. Good lighting will aid the vet in performing the surgery cleanly and efficiently. Strong draughts may result in contaminants blowing into the wound, or even result in some lighter items from the vet's surgical kit blowing away.

Some vets prefer to operate on a low table-like surface, such as may be quickly constructed from straw bales or pallets, while others will prefer to operate on the ground, in which case a comfortable bed of clean straw should be provided. Most vets will prefer also to have a small table for their instruments, such as a bale or an upturned box. This will help to prevent contamination or loss of surgical instruments.

The left flank of the sheep should be clipped from two inches in front of the last rib as far as the back leg, and from the pin bones down to the belly. Wool should never be plucked.

Two spotlessly clean buckets should be filled with clean, warm water just before the vet's arrival. It is also a good idea to wash your own hands well with soap and water, to reduce contamination. The vet will need at least one person to help them by holding the sheep. When the vet is ready, lay the ewe down on its right side (left side up) and hold it down, by applying gentle pressure to the shoulder. Make sure that you are relatively comfortable, and that one or both of your hands are free. The vet will give injections of antibiotic, anti-inflammatory drugs and inject local anaesthetic, and will then prepare him/herself and the surgical site, using water, antiseptic scrub and surgical spirit. The vet is now ready to operate.

**Figure 1.19** Delivery of a lamb by caesarean section. Thorough preparation and good aftercare of the ewe and lambs are critical to the success of the veterinary procedure.

The vet will cut through the skin and muscle layers and enter the abdomen, find the uterus (womb) and identify the correct site to cut. The vet will then cut into the uterus, reach inside and remove the lamb (Figure 1.19).

Frequently, the vet will pass this lamb to an assistant to revive. Once the lamb is breathing and rubbed dry, it is given to the ewe to lick, which is important to establish maternal bonding. The vet will then locate and remove any other lambs. Usually, all the lambs come out through the same incision in the uterus. Once all the lambs have been removed, the vet will suture the uterus closed, and then the body wall. Occasionally, you may be asked to assist the vet by holding things. In this case, push up your sleeves and wash your hands thoroughly. After this point, you should not touch anything at all unless specifically asked to do so.

Following surgery, the lambs should be fed colostrum, either by stomach tube or by natural sucking. The ewe and lambs should be moved to a clean, well bedded individual pen initially, with food and water for the mother. Particular attention should be paid to monitoring the subsequent health of the ewe and lambs. The dam should be injected with antibiotics for three to five days following the operation. Sometimes, stitches will need to be removed after about ten days.

## Resuscitation of Newborn Lambs and Kids

Upon delivery, immediately clear any fluids from the nose, mouth and throat, using fingers, and then vigorously rub the chest using straw or a towel. If required, a piece of straw may be placed inside the nostril and wiggled to stimulate the lamb. The practice of swinging the lamb by its hind limbs underarm may be attempted, though its real effectiveness is dubious. This should be done gently

and only once or twice, looking around first to avoid striking the lamb's head against an obstacle. If it is suspected that the lamb may have inhaled some birth fluids, hold its back legs up in the air so that its head hangs straight down, and gently massage the chest to encourage drainage of fluid from the lungs (the benefits of this practice are also dubious, and fluid seen coming from the lamb's mouth and nose is usually amniotic fluid from its stomach).

If the lamb still is not breathing, it may be helpful to administer a respiratory stimulant, such as one drop of doxapram under the tongue, although the benefits of this are also questionable. Lambs which have suffered significant birth stress may benefit from the administration of a low dose of a NSAID, such as flunixin or meloxicam. NSAIDs should not be administered to young goat kids, as they can cause toxicity.

## Retained Placenta

Failure to pass the placenta is unusual in sheep and goats. In cases where the placenta has not been passed within 4–6 hours, antibiotic injection should be given and the lambs or kids encouraged to suck from the mother. Suckling causes the mother to produce the hormone oxytocin, which can aid the passage of the placenta.

## Care of the Dam After Assisted Lambing

Special care should be taken of dams and their offspring which have had an assisted delivery (Figure 1.20).

**Figure 1.20** Individual pens for ewes and their lambs following the need for assisted lambing must be clean, easily accessible, well lit to allow close monitoring, draught-free and large enough to ensure that the lambs can escape being laid upon.

**Figure 1.21** Lambing outdoors often provides a more hygienic environment than indoors. However, following assisted lambing, ewes and their lambs require shelter, easy access to food and water and routine health monitoring.

All sheep and goats that have had an assisted lambing or kidding are at increased risk of complications, and their young are more likely to suffer from starvation, hypothermia and infections. If lambing indoors, the mother and young should be moved to a clean, dry, well-bedded pen away from draughts. Water and good quality food should be freely available. Ewes and lambs should be checked frequently. If staying outside, there should be adequate shelter, water and supplementary feeding available (Figure 1.21). Outdoor ewes and lambs should be checked regularly and brought in to hospital pens if necessary.

The dam should be carefully observed for several days after an assisted lambing, for signs of a smelly discharge from the vulva, indicating metritis. Animals which have an infection, or are suffering from pain, may be less able to mother their offspring, so their lambs or kids should be carefully observed to check that they are suckling well. The dam should eat and drink, mother the lambs or kids, and should both stand and lie comfortably. Any animals where this is not the case should be examined to determine the cause of the problem, and appropriate nursing, treatment and supplementary feeding should be given.

Good nursing and regular supervision are the key to successful management of ewes and does. It is not necessary to give antibiotics to all sheep and goats which have had an assisted delivery; instead, they should be administered on a case-by-case basis, as required. Antibiotics of choice are penicillin-type drugs or oxytetracycline, and treatment should be for 3–5 days by daily injection. Care should be taken always to administer a sufficient dose of antibiotic, as under-dosing is both ineffective at treating infection and potentially causes bacteria to become resistant to the drug. Antibiotic drugs can only be prescribed by veterinary surgeons to animals under their care.

NSAIDS, such as flunixin or meloxicam, should be administered to reduce swelling in sheep and goats that have had a difficult or painful delivery, those where bruising has occurred, and those with an infection of the birth canal.

## Technique for Drug Injection of Ewes

Injecting animals is not difficult, but it should always be done carefully to prevent injury. A clean needle and syringe should be used, to avoid introducing dirt or bacteria which could lead to abscess formation.

The rump (gluteal) muscles are the largest muscle mass for injection. However, the neck muscle may be preferred in fattening lambs, to avoid damaging a valuable cut of meat. It is worth noting that the sciatic nerve runs from the pelvis, across the rump and down the back of the hindlimb. It must be avoided, as damaging this nerve will result in permanent lameness. Goats tend to be bony animals, so the site for intramuscular injection should be selected carefully.

Insert the needle smoothly, draw back a little on the plunger and check that no blood has entered the hub of the needle. If blood is present, suggesting that the point is placed in a blood vessel, then withdraw the needle and try again at a different site. Injecting some drugs (for example, penicillin) into a blood vessel can be fatal. When satisfied that no blood is present, inject smoothly, then withdraw the needle and rub the injection site to disperse the drug.

Any area of loose skin can be used for subcutaneous injection. Often, the loose skin over the ribs behind the shoulder blade is a good site. Pinch up the skin to make a tent, and then insert the needle into the tent. If the syringe draws air when the plunger is pulled back, then the needle has been pushed through the other side of the skin tent and should be repositioned.

It is important not to inject large volumes of fluid that might be irritant to a single site.

## Care and Management of Newborn Lambs

Lambs are most likely to survive and thrive if they are born mature, with adequate energy reserves and free from birth stress, and then receive adequate post-partum nutrition (Figure 1.22).

About 80–90% of all lamb losses are a consequence of events during the perinatal period, namely the period from birth to about one week old. Figures quoted for the incidence of perinatal lamb mortality in UK flocks range between 3–30%, although there is considerable variation within and between flocks, districts, seasons, sheep breeds, ewe age groups, farm management systems and record keeping. Perinatal lamb mortality represents a significant economic wastage, and provides an opportunity on many farms for management changes to improve the lambing percentage.

There have been several large-scale surveys of perinatal lamb mortality in a range of flock types and management systems, where dystocia linked to disproportionally high birth weights (Figure 1.23), and starvation-mismothering-exposure linked to disproportionally low birth weights (Figure 1.24) have been most often diagnosed. Dystocia may be a consequence of sire breed, the dam's pelvic conformation, maternal overfeeding, or prolonged first stage labour in multiple litters. Furthermore, dystocia injury alone may not result in lamb death, which may only occur when the lamb is subsequently subject to cold stress or

**Figure 1.22** Normal, healthy, brown fat reserves over the kidneys and heart of a lamb born to a well-fed ewe.

**Figure 1.23** Yellow staining of the coat of a newborn lamb indicates birth stress due to dystocia, causing the meconium to be passed into the amniotic sac during parturition.

undernutrition. Likewise, starvation-mismothering-hypothermia has several causes, including dystocia.

Most newborn lamb deaths are a consequence of different combination of events occurring pre-partum, during parturition and post-partum.

### Maternal Nutrition

Severe maternal under-nutrition during mid-pregnancy results in inhibited placental development, which causes poor oxygen, nutrient and electrolyte transfer to the growing foetus and, ultimately, results in poor lamb birth weights. Long

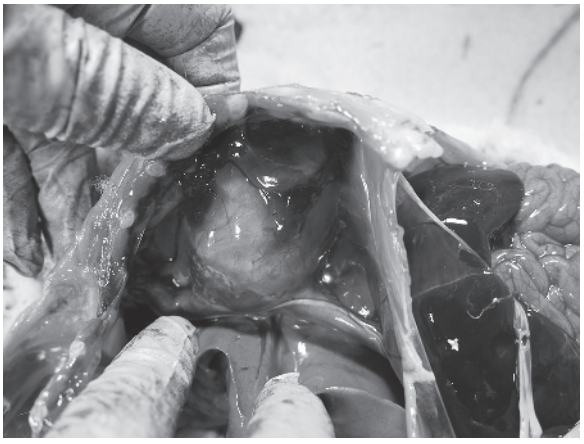

**Figure 1.24** Purple colour and almost transparent brown fat over the kidneys and heart of a newborn lamb, indicating depletion of brown fat reserves and death due to starvation-mismothering-exposure.

term under-nutrition of the pregnant ewe inhibits the newborn lamb's capacity for thermoregulation, thereby increasing its susceptibility to hypothermia. Severe under-nutrition during the final six weeks of pregnancy results in the birth of lambs with low liver glycogen and brown fat energy reserves, and also in poor udder development and colostrum production for the ewe.

Overfeeding of single-bearing ewes during late pregnancy can influence the perinatal lamb mortality rate through dystocia losses of oversized lambs. Regardless of other factors, terminal sire-cross lambs with birth weights below 3.5 kg or greater than 5.5 kg suffer the highest rates of perinatal mortality.

### Birth Stress

A lack of oxygen supply (anoxia) to vital centres of the central nervous system, or the compounding effect of oxygen deprivation at lambing (hypoxaemia) on pre-existing foetal low oxygen transfer (hypoxia) due to placental insufficiency, usually results in parturient foetal death. However, birth-stressed lambs do not always die during parturition. Protracted labour, compression of the umbilical cord, or mild trauma to the lamb's central nervous system during lambing can result in short-term, usually reversible, hypoxaemia of the lamb. Maintenance of body temperature, teat-searching and sucking behaviour are inhibited in surviving lambs. Furthermore, for the ewe, soft tissue trauma occurring during parturition and subsequent infection may compromise maternal behaviour, making her less likely to bond with and feed the lamb.

### Post-partum Nutrition

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

Healthy lambs are born with limited energy reserves of plasma glucose and fructose, liver glycogen and brown fat. In physiologically compromised lambs, these reserves are depleted or absent. Starved lambs rapidly become hypoglycaemic and are weak, lethargic and unable to maintain body temperature.

Maternal factors responsible for lamb starvation include:

i) genotype, meaning that some individuals and certain ewe breeds demonstrate poor mothering behaviour;
ii) inexperience, for example ewe lambs and gimmers refusing to suckle their lambs;
iii) undernutrition, resulting in poor colostrum accumulation;
iv) dystocia;
v) generalised infection;
vi) mastitis;
vii) multiple births.

Lamb factors leading to starvation include:

i) genotype; for example, some terminal sire bred lambs are slower to suck than pure hill breed lambs;
ii) multiple litters, for example three lambs sharing two teats;
iii) birth stress and/or prenatal malnutrition;
iv) hypothermia, as hypothermic lambs do not feed;
v) infectious disease.

External factors responsible for lamb starvation include:

i) high stocking density of lambing ewes, resulting in mis-mothering;
ii) disturbance of lambing or newly-lambed ewes;
iii) human interference;
iv) poor pasture availability near to the lambing site;
v) exposure.

### Other Causes of Perinatal Lamb Mortality

Occasionally, severe cold, wet and windy weather results in primary hypothermia, where the rate of heat loss in small lambs is so rapid that death intervenes before brown fat can be catabolised to generate heat.

Common diseases, such as non-specific bacterial septicaemias and the disease known as watery mouth, are a consequence of poor colostrum intake during the first few hours of life and poor hygiene of the lambing environment. In housed flocks, environmental contamination may become overwhelming, and infectious diseases – in particular, non-specific bacteraemias – can become important and result in significant deaths of lambs between 1–3 weeks old. In other individual flocks, navel infections, joint disease, lamb dysentery, septicaemias or diarrhoea caused by specific bacterial infections can become important, although there are usually other primary predisposing factors.

Inherited abnormalities have the potential to cause large losses, although most have been successfully controlled or eliminated in the national flock. Iodine

deficiency (goitre), copper deficiency (congenital swayback) and selenium deficiency (congenital white muscle disease) have been associated with high perinatal lamb mortality rates. On some UK farms, predation by foxes or eagles can be significant, although many of the casualties are probably already compromised. Dog worrying is an increasing problem.

## Management to Enhance Lamb Survival

Any management practices that ensure correct nutrition of the pregnant ewe, avoidance of dystocia, provision of energy and protective antibodies through colostrum and a strong maternal bond will enhance the perinatal lamb survival rate. However, the relative importance and practicality of such practices differ between farms.

### Preparation for Lambing

Lambing is the critical time when the benefits of preparation throughout the year are realised. Lamb survival can be enhanced by planned nutritional management of the pregnant ewe.

Ewes lambing in good body condition, and which have been well fed during the final six weeks of pregnancy, suffer the lowest rates of perinatal lamb mortality. Planning is essential to ensure that ewes are mated in good body condition and correctly fed throughout pregnancy.

The maximum period of foetal growth is during the final six weeks of gestation. Nutrition during this period has a large effect on lamb birth weights, subsequent lamb viability and lamb growth rates. The mean birth weights of lambs born to adequately nourished and severely undernourished ewes are significantly different. Higher lamb mortality rates are found in triplet and twin lambs born to underfed ewes.

The use of ram harnesses or raddle (Figure 1.25) during the mating period, weighing or body condition scoring during mid-pregnancy, and ultrasound scanning for single or multiple pregnancies (Figure 1.26) are valuable management tools which can ensure that early lambing, thin or multiple-bearing ewes receive the best nutrition available.

### Avoidance of Birth Stress

Lambing difficulties may arise due to presentational, positional and postural abnormalities of the foetus. Dystocia can also result from relative foetal oversize, where the foetal dimensions are normal but the ewe's pelvis is too small, and absolute foetal oversize, where the maternal pelvis is normal but the foetus is abnormally large.

Presentation and postural abnormalities are very common but are generally simple to correct, provided that they are identified early during second stage labour. When such abnormalities occur in a high proportion of the flock, a potentially excessive level of disturbance of ewes in first stage labour should be evaluated.

**Figure 1.25** Keel or raddle marks can be used to enable precise management of ewes during late pregnancy, depending on their expected lambing date.

**Figure 1.26** Information collected during ultrasound scanning for pregnancy can be used to enable precise management of ewes during late pregnancy, depending on foetal numbers, thereby reducing perinatal lamb mortality.

Relative foetal oversize is commonly seen in pregnant ewe lambs, because of their small pelvic diameter and relatively large foetal size. As a general rule, ewe lambs should not be mated unless they have reached about 70% of their mature adult weight, and careful consideration should be given to the choice of terminal sire. The incidence of relative foetal oversize is highest in breeds of ewe whose

**Figure 1.27** Both pelvic size and conformation (the angle at which the pelvis sits) are important with reference to dystocia.

pelvises tend to be angled forward at the base, reducing the effective area of the birth canal (Figure 1.27).

## Easy Care Lambing

Easy care systems were developed in New Zealand with the original aim of reducing lamb losses to dystocia. Ease of lambing had previously been correlated to the functional area of the pelvic canal, with incompatibility in size between the maternal pelvis and the lamb at birth identified as the main cause for repeated assistance at lambing. Considerable variation had been identified within the national Romney flock, suggesting that ease of lambing might be a heritable trait. Lamb birth weight, the size and shape of the lamb's head and shoulders and limb bone thickness had also been identified as important risk factors.

Selection for ease of lambing was highly successful. However, early observations showed a disproportionally high incidence of social stress and mismothering at high stocking densities. Ewes needed to be spread out about a month before lambing commenced, so that they had time to settle down and find the warm, sheltered and dry areas. There was a need for careful pasture management to ensure pasture availability for set stocking through to the end of lambing. So long as there was sufficient pasture, ewes tended to remain at the lambing site until the lambs were strong enough to move further afield but, if pasture availability was limited, ewes tended to abandon the lambing site to look for food elsewhere, resulting in lamb losses. Human intervention of any kind invariably resulted in ewes being displaced from their lambing site and subsequent lamb losses.

Easy care lambing has been an important innovation in New Zealand sheep farming, but would be inappropriate for systems involving crossbred sheep

where lambing ewes have to be disturbed to allow for supplementary feeding. Nevertheless, various measures can be taken to reduce levels of dystocia and interference with lambing ewes based on the principles of easy care lambing. Technologies such as the use of ultrasound scanning data, recording of raddle marks and blood sampling pregnant ewes to determine the adequacy of protein and energy nutrition can be used to enable more efficient pasture management at lambing and reduce the disturbance of lambing ewes.

Careful selection of lambing fields is important, and a high standard of flock health care is required to eliminate the need to disturb the whole lambing flock while treating individual sick or lame animals. Replacement ewes should be selected on the basis of external pelvic conformation, in preference to fashionable breed characteristics. Ewes which require assistance or show signs of poor mothering ability should be permanently marked and culled after weaning. Terminal sires should be selected for small heads, fine bones and narrow shoulders. Systems should be adapted to allow careful shepherding to minimise the disturbance of lambing ewes.

### Adequate Lamb Nutrition

Any management practice aimed at ensuring adequate nutrition of the pregnant ewe and the prevention of dystocia will also, in turn, be beneficial to early lamb nutrition and survival. Such practices will help to ensure the birth of vigorous lambs, adequate colostrum accumulation in the ewe, the prevention of pregnancy toxaemia and mastitis and non-disturbance of the newly-lambed ewe. Additional skilled labour employed for the supervision of lambing should also be available, to ensure that lambs are correctly mothered, to supplement the nutrition of small or weak lambs, and to treat hypothermic or diseased lambs.

When provided with adequate neonatal care, even lambs suffering from mild birth stress or pre-partum undernutrition can survive. The provision of adequate shelter in lambing paddocks is an essential component of such care on all farms. The positioning of supplementary wind breaks, such as straw bales or tin sheets, should be carefully planned around the ewes' preferred lambing sites. On extensively managed hill properties, provision of shelter is paramount, because it may be the only possible method of improving conditions (Figure 1.28).

## Lamb Fostering

Most ewes are unable economically to rear triplets, but most can support twins. The benefits of fostering lambs are, therefore, obvious. Several fostering methods have been described. Generally, the most successful method is to smear the orphan lamb with the foster ewe's lambing fluids immediately after the delivery of the foster ewe's lamb. It is important that the orphan lamb and the ewe's own lamb are well matched for size and that the orphan lamb is not too old. Use of ultrasound scanning results can facilitate immediate fostering of orphan lambs onto single-bearing ewes.

**Figure 1.28** Provision of shelter may be the most pragmatic means available to improve lamb survival in extensively managed production systems.

**Figure 1.29** Use of 'lamb adopter' crates requires an extremely skilful level of care, to ensure adequate welfare of the ewe and lambs. Close monitoring is required after the ewe has been released.

The use of lamb adopter crates, or confinement of the ewe and lamb in a pen with the ewe tied so that she cannot injure the lambs, require skilful management to protect the welfare of the ewe and lambs (Figure 1.29). Attaching the skin of the foster ewe's own dead lamb onto the orphan lamb is sometimes successful (Figure 1.30). Alternatively, stockingette tubing cut to fit around the ewe's own lamb for a few hours, to absorb its smell and then transfer it to the fostered lamb is sometimes successful.

**Figure 1.30** Fostering by skinning the dam's dead lamb and placing it over the surrogate lamb is not always successful. (The dead lamb is skinned by first incising the skin around each hock, and then making an incision extending from the inner aspect of one hock to that of the other. The skin is then forced away from the hindquarters, and is pulled forwards and inside-out over the body of the lamb. Incisions are then made around the elbows and neck, allowing the skin to be removed. The skin can then be turned the correct way round and fitted over the neck and forelimbs of the surrogate lamb, as shown.)

Careful monitoring is required after releasing the foster ewe and lambs. Orphan lambs often appear to follow the foster ewe at first, but are later found starving and hypothermic or dead.

### Artificial Rearing

In most flocks, there will be spare lambs that cannot be fostered, and these will need to be reared artificially. Artificial rearing can be successfully achieved if the lambs are correctly and hygienically fed and kept in an appropriately pre-planned warm, clean and dry environment.

The spare lamb should ideally be left with its mother for the first 24 hours of life, supplementing colostrum for the whole litter during this period. Newborn lambs should be fed 50 ml/kg of ewe colostrum or a colostrum substitute within the first four hours of life if the ewe is sick, has rejected the lamb, or has died. The lamb should then be transferred to a warm, dry and clean environment. About 50 ml/kg of milk replacer should be fed three or four times daily, using a bottle and an appropriate teat.

Whenever possible, it is desirable to feed lambs in a natural position, as close to that of nursing from their mother, rather than restraining the lamb in an unnatural position. When first training lambs to feed from a bottle, it is helpful to have something solid behind to prevent them from reversing, while restraining them with a hand placed under the chin. Fingers should never be placed inside the lamb's mouth (Figure 1.31).

**Figure 1.31** Training lambs to feed from a bottle is rewarding, but requires patience.

The lamb should be transferred to an artificial rearing pen at about three days old, provided that it is strong, sucking well and showing no signs of disease. Sick or weak lambs should never be introduced to the rearing pen. All lambs, irrespective of source or age, which are destined for artificial rearing should undergo a 48-hour quarantine period before being introduced to the communal artificial rearing pen. Lambs should be reared in small groups of up to about ten in clean, dry and draught-free pens, free from dangerous obstructions (Figure 1.32).

When using automatic milk feeders, it is sometimes necessary to increase the group size, but this increases the risk of disease spread and bullying. During the training period the rearing pen should be restricted in size but, once all the lambs are sucking well, they should be given as much space as possible, along with distractions such as footballs or straw bales to encourage playing behaviour (Figure 1.33).

If possible, feeding equipment should be cleaned daily, to prevent a build-up of faeces, urine and stale spilled milk in one area. If this is not possible, for example where static automatic feeders are used, the area around the feeder must be kept scrupulously clean and dry (Figure 1.34). In covered yards with open sides, provide straw bales arranged to form a cross, which can be used to provide shelter from draughts from all directions. These should be moved regularly to avoid build-up and concentration of pathogens. Infrared heat lamps should be avoided, because they encourage the lambs to huddle in one spot on badly soiled bedding.

Once in the rearing pens, lambs can be fed about 1–1.25 litres of replacer twice daily, although individual requirements vary greatly. Unless using automatic feeding machines that offer milk on demand, it is preferable to introduce lambs to cold milk replacer as soon as possible. Cold milk does not sour as quickly as warm milk, and lambs feed less greedily. Bottles, buckets, teats and valves should all be kept scrupulously clean and sterilised each day, using a suitable hypochlorite or detergent solution. It is important to use a good quality ewe milk replacer. These are

**Figure 1.32** A small group of young lambs being artificially reared using a bucket-and-teat setup.

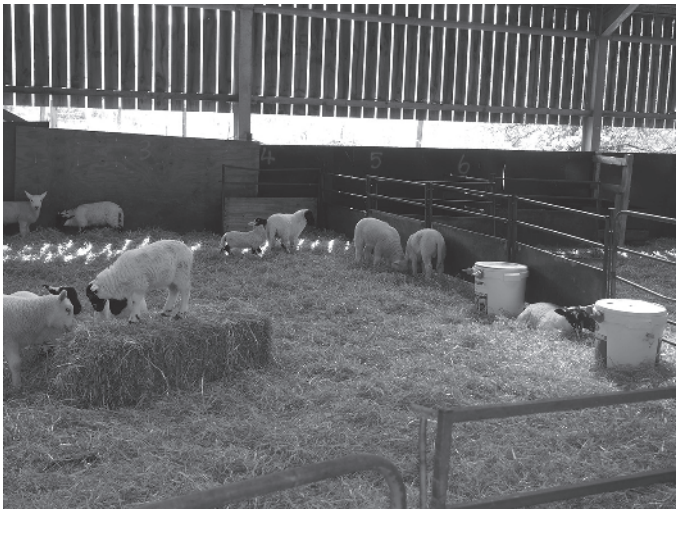

**Figure 1.33** A large group of older, artificially reared lambs, provided with sufficient space and distractions to allow individuals to display natural behaviour patterns.

**Figure 1.34** Maintaining strict hygienic conditions in the area around automatic milk replacer feeding machines is essential.

usually made up by mixing 200 g of milk powder with water to produce one litre of milk. The measure used to dispense the powder must be checked, to ensure that it gives the correct amount. If too little powder is used, the lambs may starve while, if too much is used, the lambs may scour and become dehydrated.

Lamb milk replacers have a higher fat content than calf milk replacers or cow's milk, which are generally unsuitable. Good quality hay and fresh creep feed should be made available from about one week old, to promote early rumen development. Clean, fresh water must always be available and presented in a manner such that the lambs can drink, but not drown.

If the cost of milk replacer were not a consideration, a recommendation could be made to wean all lambs from four weeks old once they reach 15 kg body-weight. However, many artificially reared lambs will not meet this target, so a balance must be struck between the cost of milk replacer and performance of the lamb, without compromising its health and welfare.

Care must be taken not to wean lambs too early, otherwise a serious check in growth and intestinal problems will result. Lambs should not be weaned before 30 days of age or at a body weight of less than 10 kg, although common sense and experience must be applied in the application of these guidelines. Lambs must be taking solid food before weaning. Weaning of artificially reared lambs should be undertaken abruptly, otherwise strong lambs that are ready for weaning will continue to get milk while weaker lambs will not.

The relatively close confinement of lambs in an artificial rearing system inevitably increases the risk of infectious diseases. The incidence of these problems can be reduced by following the practices outlined above. Milk replacer-fed lambs are sometimes found dead, with grossly distended abdomens, about one hour after feeding. The problem is associated with overfilling of the abomasum and rapid proliferation of gas-producing organisms. The incidence of abomasal

bloat is highest when lambs are fed infrequently, using warm milk replacer, encouraging greedy feeding behaviour. The problem is prevented by feeding lambs regularly with measured amounts of cold milk-replacer.

### Risk of Zoonotic Diseases

Feeding pet lambs raises challenges concerning the zoonotic transmission of pathogens, such as Gram-negative toxin-producing bacteria, coccidian parasites and viruses (Figure 1.35). Distressing high-profile reports of diseases in children due to verotoxigenic *Escherichia coli*, cryptosporidiosis and orf heighten awareness of the need for basic hygienic measures, such as hand washing and avoidance of oral contact with contaminated objects, as well as the importance of controlling zoonotic diseases in general.

### Alternatives to Fresh Colostrum

1) Ewes frequently have more colostrum than is immediately required by their own lambs. Excess colostrum can be milked, batched and stored or frozen in suitable small quantities. Care is needed not to overheat frozen colostrum during the thawing process.
2) Cow colostrum, procured in advance of the lambing season and frozen in small containers, is a useful alternative to ewe colostrum. Cow colostrum contains approximately 20% less energy per ml than ewes' colostrum, so correspondingly larger volumes are required. It contains some useful antibodies, but may not protect against specific pathogens found in individual flocks. Clostridial antigens can be boosted by prior immunisation of the cow with an ovine clostridial

**Figure 1.35** There is a strong and important bond between young children and pet or orphan lambs. However, strict hygienic precautions such as hand washing must be taken, regardless of the hygienic conditions on the farm.

vaccine. Rarely, cow colostrum contains antibodies against antigens on the lamb's red blood cells, causing severe and usually fatal anaemia when the lamb is between 10–20 days old. Pooling of colostrum from several cows will dilute the effect of any anti-sheep red blood cell antibodies present.

3) Most proprietary powdered colostrum substitutes for lambs are derived from cow colostrum, tested for anaemia-producing antibodies. Some are derived from ewe colostrum and are, therefore, superior. Powdered colostrum is convenient, although cost precludes its widespread use.

## Lamb Castration

Castration is a mutilation, and should only be performed when it is necessary to do so – for example, to avoid unwanted pregnancies or to avoid the development of male secondary characteristics in lambs or kids that may be kept for longer than about six months, when they might become sexually mature.

Rubber rings are a simple and effective means of castration. Good application technique is important to prevent unnecessary injury to the lamb and potentially costly castration failures (Figure 1.36). If rubber rings are used, they must, by law, be applied within the first week of life. Most shepherds apply rings between 24 and 72 hours after birth. Application of rubber rings before 24 hours is not recommended, as this may interfere with the ingestion of colostrum and the formation of the maternal bond.

It is first necessary to check that both testicles have descended into the scrotum, and that the lamb does not have a hernia. A hernia can be felt as a soft mass of intestines within the scrotum. The procedure may be easily carried out in a seated position. The rubber ring is placed on the prongs of the applicator prior to starting. The lamb is restrained between the knees with its head up and the body extended and relaxed. The scrotum should not be touched, as this will cause the lamb to retract his testicles. Using the applicator so that the prongs point towards the lamb's body, the ring is passed over the scrotum and both testicles. The prongs are pushed slightly into the abdomen and the ring is closed (Figure 1.37). The applicator should not be withdrawn at this stage.

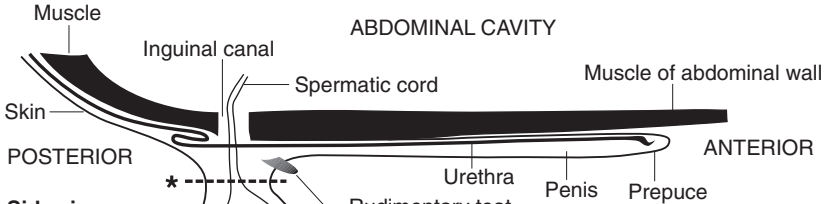


**Figure 1.36** Diagram showing the male lamb scrotal anatomy, along with the correct position for placing a rubber ring.

Next, a check should be made to ensure that both testicles are trapped within the scrotum beyond the ring and that both nipples are still above the ring on the lamb's belly and have not been drawn into the ring. Should there be any problem, it is much more easily dealt with now than after the removal of the applicator. When happy that the ring is correctly located, it can be rolled off the applicator.

It is normal for lambs to show signs of pain, including lying and kicking, for a few hours after application of rubber rings. They should be checked regularly to ensure that the signs of discomfort subside, and that they are correctly mothered up. Inclusion of excessive belly skin within the ring can result in significant wounds around the area. Should these be present, they should be cleaned with water and mild disinfectant or salty water and the lamb should be given antibiotic treatment.

**Figure 1.37** Lamb castration by correct placement of a rubber ring.

Bloodless castration is sometimes performed using precisely engineered surgical instruments, such as the Burdizzo emasculator or Ritchey Nipper. These instruments must be well maintained and handled with care to avid misalignment of the jaws, which can, in turn, result in castration failure and/or unnecessary pain or injury. These methods work on the principle that when the jaws are closed over the neck of the scrotum, the blood vessels in the spermatic cord are crushed and the scrotal contents deprived of their blood supply. The scrotum and its contents eventually shrivel and die. The scrotal skin remains intact, preventing the entry of infection.

With the lamb securely restrained, the device must be applied at two points approximately 1 cm apart, one on each side of the neck of the scrotum, along the spermatic cord (Figure 1.38). To avoid damaging the penis or urethra, the jaws must be applied well below the body wall and well above the testes. The jaws must never be placed across the whole width of the scrotal neck in a single crush. Doing this blocks the blood supply to the entire scrotum and causes pain.

As with rubber ring castration, bloodless castration requires a high level of skill and care to avoid causing unnecessary suffering. Lambs should be checked afterwards for mismothering and signs of excessive pain or swelling of the scrotal tissue. Poor technique may also lead to lambs not being properly castrated, and they should be checked again after several weeks to make sure that the procedure has been effective. Bloodless castrators must never be used for any other purpose, such as tail docking.

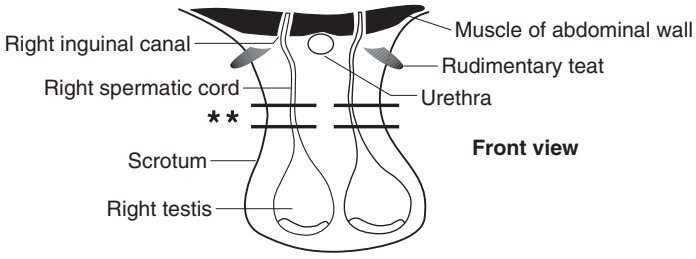


**Figure 1.38** Diagram showing the male lamb scrotal anatomy, along with the correct positions for bloodless castration. Bloodless castration equipment should never be placed across the entire width of the scrotal neck.

While not mandatory in young lambs, veterinary advice should be sought concerning the use of local anaesthesia and/or appropriate techniques.

## Application of Rubber Rings for Tail Docking

Tail docking may reduce soiling of the fleece, which may reduce incidences of flystrike. However, the procedure is a mutilation, and the benefits are contentious. Tail docking should only be undertaken where it can be justified as being beneficial to animal health and welfare.

**Figure 1.39** Use of a rubber ring for tail docking, showing the correct use of the applicator and placement of the ring.

Rubber rings may be used in a similar manner for tail docking of lambs, usually at the same time. Rings must be applied before seven days of age, but application before 24 hours old is not recommended.

The tail of a male fattening lamb should be long enough to cover the anus plus 2.5 cm. For a female lamb, the tail should be longer, such that it covers the vulva plus 4–6 cm. Sheep with excessively short tails may be at increased risk of flystrike and rectal prolapse.

The lamb is held in a similar manner to tail docking. The lamb's body is extended, and one leg is drawn up towards the abdomen to allow easier access to the tail. The ring is placed and its position checked before the applicator is removed (Figure 1.39). Tails have tendency to finish up shorter than expected so, if in any doubt, allow more tail at this stage.