

# Umbilical disinfection options in large animal neonates

A guide to umbilical disinfection options in large animal neonates by Dr Karen Dunne, PhD, MA, CertEM (StudMed), MVB, Dept. of Agriculture, Food and Animal Health, Dundalk Institute of Technology

Infection of the umbilical remnants ('navel ill') is a common and significant condition affecting large animal neonates. The umbilicus contains the umbilical vein, a pair of umbilical arteries and the urachus (Table 1). These structures may become infected alone or in combination (Table 2). The umbilical arteries and urachus were reported as the most commonly affected structures in the horse, versus the urachus and umbilical veins in cattle.

Table 1. Components of the umbilicus.

Structure	Origin	Function in utero	Outcome after birth
Umbilical arteries	Branches of the internal iliac arteries via the pudendal arteries	Transport foetal blood to the placenta for oxygenation	Atrophy to become the round ligaments of the bladder
Umbilical vein	Runs from the umbilicus cranially into the liver	Transports oxygenated blood from the placenta into the foetal circulation	Atrophies to become the round ligament of the liver
Urachus	Potential space around the vessels within the adventitial covering of the umbilical cord	Conducts urine from the foetal bladder to the allantoic cavity	Should involute and close when the umbilical cord ruptures after birth, urine is then diverted to the urethra

The umbilical cord is disrupted after birth, abruptly transitioning the blood flow via the umbilical vessels and the transport of urine to the newborn animal's cardiovascular and urinary systems. The cord should rupture cleanly one to two inches from the abdominal wall, at which point the vessels within it immediately constrict, occluding further flow. The umbilical arteries and veins can be examined via transabdominal ultrasonography after birth. This technique may be useful in the investigation of umbilical disorders and is readily performed in both foals and calves.

## UMBILICAL INFECTION

Infection is most commonly due to ascending bacterial invasion of the umbilical stump in the post-partum period, but haematogenous spread may also arise in septicaemic individuals. Beta-haemolytic *Streptococci*, *Actinobacillus* species and *Escherichia coli* are common isolates, but a wide range of microbial species have been implicated.

Term	Definition
Omphaloarteritis	Infection of the umbilical artery or arteries
Omphalophlebitis	Infection of the umbilical vein
Omphalitis	Infection of the umbilical arteries, vein and urachus
Persistent urachus	Urine leakage from the umbilicus due to failure of the urachus to close after birth
Patent urachus	The re-opening of a previously closed urachus, associated with abdominal straining and/or recumbency

Table 2. Terminology related to umbilical remnant disorders.

Clinical signs of umbilical infection typically appear in the first week of life. However, cases may present up to two months of age. Characteristic signs include heat, pain and swelling of the umbilicus. Erythema of the skin may also be present but is difficult to detect through the hair coat. Purulent discharge may be present on the umbilical stump or coat. Urine leakage may occur in cases of urachal patency. Palpation is typically resented and may reveal thickening of vessels within the stump – the umbilical vein courses cranially on the midline towards the liver, while the paired umbilical arteries run caudally along with the urachus towards the bladder. The patient may also be pyrexia, lethargic and reluctant to nurse. Cases are at risk of secondary complications such as septicaemia, liver abscessation, septic arthritis, septic pharyngitis, pneumonia and umbilical herniation.

Inadequate colostral antibody intake leading to failure of passive transfer (FPT), and poor hygiene practices around parturition and in the early post-partum period are recognised as further risk factors for the condition. Failure of the umbilical cord to rupture after birth, necessitating manual disruption or severance may contribute to an increased incidence of excessive haemorrhage, umbilical infection and patent urachus. Optimal hygiene and husbandry practices in the care of the large animal neonate may significantly reduce the morbidity and mortality caused by infection of the umbilical remnants and associated complications.

## CARE OF THE UMBILICUS

Large animal farmers and breeders are encouraged to routinely treat the umbilicus with antiseptic solutions after birth to reduce the risk of infection. A variety of preparations and approaches may be employed. It's an area of husbandry that should be reviewed with clients periodically, and in particular if more than occasional and seemingly sporadic cases of umbilical infection arise on a holding.

## UMBILICAL ANTISEPTIC SOLUTIONS

A disinfectant refers to a chemical substance which can kill microbes (a biocide) while an antiseptic is a disinfectant which can be applied to living tissue to kill microbes. It has been considered important to chemically cauterise the tissues, but the umbilical vessels naturally lose their patency within 24 hours of birth and will shrivel, involute and dry within three to seven days in a healthy animal. Reduction of the microbial population on the umbilicus is therefore the primary goal of topical antiseptic application. Antiseptic 'scrub' solutions that also contain detergents or foaming agents should be avoided, as these are intended for intact skin only and may result in tissue irritation if applied to the umbilicus. Iodine-based antiseptics are the traditional choice for umbilical application but chlorhexidine solutions may also be utilised.

### Iodine solutions

Iodine is a chemical agent from the halogens group and has anti-microbial properties when applied topically. Povidone-iodine is a mixture of povidone, hydrogen iodine (an oxidised form of iodine) and free iodine. Approximately 10 per cent of the solution is available iodine. It is widely used as a skin antiseptic. Tincture of iodine is two to 10 per cent iodine mixed with water and ethanol. While solutions with iodine concentrations towards the higher end of this scale are often marketed commercially for umbilical treatment, a two per cent tincture is equally as efficacious as an antiseptic and carries a lower risk of tissue irritation. All iodine-based solutions are brown in colour and stain the skin and hair when applied, thereby helping the operator to distinguish treated from untreated animals. However, iodine-based antiseptics are not without their drawbacks; iodine has little residual action and it is deactivated by both organic matter and light exposure. Furthermore, solutions that contain ethanol sting when applied, have a shorter duration of action than povidone-iodine alone and may cause tissue irritation, especially at higher concentrations. One to three per cent povidone-iodine is recommended for umbilical treatment if an iodine-based solution is to be used.

### Chlorhexidine solutions

Chlorhexidine is an antiseptic with efficacy against Gram-positive and Gram-negative bacteria, anaerobes, yeasts and some viruses. It exhibits a residual antimicrobial effect when applied to tissues and is not deactivated by light or organic matter. Due to its wider and more persistent action than iodine, chlorhexidine has been recommended for use on premises with increasing or high rates of umbilical infections.

Chlorhexidine does not stain or sting when applied to the umbilicus but may be irritant if it contacts mucous membranes. A concentration of 0.5 per cent chlorhexidine has been recommended for umbilical application; 0.5 per cent chlorhexidine is commercially available as an umbilical antiseptic with the addition of a dye, which aids in the visual differentiation between treated and untreated

animals (Figure 1). An alternative is four to five per cent chlorhexidine solution diluted 1:2 or 1:4 with water. Chlorhexidine solutions will not result in obvious cauterisation and shrinkage of the umbilical stump, so this difference should be anticipated if making a switch from an iodine-based antiseptic.

The choice of antiseptic solution is ultimately a matter of personal preference and clinical experience. If the level of umbilical problems on a farm or premises is low then it is likely that the current husbandry practices are effective and there may be little inclination or desire to change. However, the choice, frequency and method of application of umbilical antiseptics should be reviewed in cases of both neonatal disease outbreaks and clinical audits of preventative healthcare practices.

### Storage of stock solutions

Once an antiseptic solution has been selected for use, it should be purchased or made up in advance of the expected onset of the breeding season or due date and placed in the birthing kit. Iodine-based solutions should always be stored in a brown or dark-walled container and kept in a dark place to retain their efficacy. Several clean and shallow screw cap jars or sterile containers should be available to allow a separate volume of umbilical antiseptic to be decanted and applied to each individual neonate (Figure 2).

### Application of umbilical antiseptics

Wash and dry hands and don disposable gloves to minimise the transfer of skin microflora to the umbilicus. Decant 25-50ml of the stock antiseptic solution into a container that has a neck wide enough to fit around the umbilical stump. Lambs and other small neonates may be suspended by the forelimbs while the umbilicus is treated. Calves and foals are best treated while standing and backed into a corner. Assistance may be required to restrain the neonate and care should be taken to ensure that personnel do not risk injury from an over-protective dam. Place the container over the umbilicus and press it firmly against the ventral abdominal wall. Hold it in place and gently swirl the contents for five to 10 seconds. This helps to ensure that the entire umbilicus is completely submerged. Avoid spray bottle applicators as areas of the umbilical tissues may be missed and the efficacy of the treatment reduced. Forceful application of the solution should also be avoided, as the urachus is short and the potential exists for chemical



**Figure 1.** An example of a 0.5 per cent chlorhexidine solution for umbilical treatment.



**Figure 2.** A 50ml screw-cap container may be used to store and apply antiseptic to individual large animal neonates.

cystitis to arise if the antiseptic were to enter the bladder. If the umbilicus must be treated on a recumbent animal extra care must be taken to avoid urachal irritation. Do not return the used antiseptic solution to the stock solution. It should either be discarded or recapped, labelled with the animal's identification and reapplied to that individual only.

While many healthy neonates will only receive a single application of umbilical antiseptic after birth some authors recommend twice or three times daily application for the first two to seven days of life. This is unlikely to be practical in every case, but should be considered for weak or sick individuals, hospitalised neonates, cases of FPT or on farms with a high incidence of umbilical infections. Animals that spend prolonged periods of time in recumbency due to illness or injury are at higher risk of umbilical complications, so particular attention should be paid to umbilical treatment and environmental hygiene in these high-risk individuals.

### Environmental considerations

The cleaner the animal's environment, the lower the microbial population on the umbilicus is likely to be. Healthy large animal neonates should be turned out as much as possible, as the risk of microbial accumulation over a breeding season is greatly decreased outdoors. Pens and stables should be completely mucked out and swept clean before being washed, disinfected and left to dry between occupants. A deep bed of clean, dry straw will reduce umbilical contamination when the animal lies down, as well as providing a warm, dry and comfortable environment.

Repeated cleaning and disinfection of stables and pens may be difficult to maintain on farm throughout the breeding season, due to time and labour constraints. Microbial populations will invariably increase in wet and dirty bedding, regardless of how much dry straw or lime may be applied over it. The hygiene and

disinfection procedures should be reviewed on premises that are experiencing a high or increasing incidence of umbilical infections. Antimicrobial culture and sensitivity testing is indicated to identify the organism(s) involved and guide optimal antimicrobial selection and therapy. Plasma immunoglobulin levels should be evaluated to check if FPT is a contributing factor.

### Colostrum management

Failure to ingest and absorb sufficient quantities of colostrum antibodies in the first six to 12 hours of life is a significant risk factor for umbilical infection. A review of the evaluation and effective management of colostrum is beyond the scope of this article.

### CONCLUSION

Chlorhexidine may be a more effective umbilical antiseptic than iodine-based solutions, especially in high-risk or compromised neonates, or on premises with a high incidence of umbilical infections. Consideration should also be given to how and how often the antiseptic solution is applied for optimal efficacy and to avoid complications such as a patent urachus or tissue irritation. Umbilical hygiene measures should be reviewed in conjunction with other husbandry practices, such as cleaning and disinfection protocols and colostrum management. Optimal umbilical care can help to reduce the incidence of septicaemia, synovial and physeal infections, and other significant conditions in large animal neonates. It is an important aspect of patient care that may contribute to a reduction in neonatal morbidity and mortality, which is beneficial to both human and animal wellbeing.

*References available on request.*

## READER QUESTIONS AND ANSWERS

### 1. WHAT DOES THE TERM OMPHALITIS REFER TO?

- A. Infection of the umbilical arteries and vein
- B. Urine leakage from the umbilicus
- C. Infection of the urachus
- D. Infection of the umbilical arteries, vein and urachus

### 2. THE UMBILICAL VEIN:

- A. Runs cranially, towards the liver
- B. Runs caudally, towards the bladder
- C. Branches in two as it enters the abdomen
- D. Atrophies to become the round ligament of the bladder

### 3. THE OPTIMAL IODINE-BASED UMBILICAL ANTISEPTIC IS:

- A. 10% tincture of iodine
- B. 2% tincture of iodine
- C. 2% povidone-iodine solution
- D. 0.75% povidone-iodine surgical scrub

### 4. WHICH OF THE FOLLOWING IS NOT A FEATURE OF CHLORHEXIDINE SOLUTIONS?

- A. Residual antimicrobial effect when applied to tissue
- B. Cauterisation and shrinkage of the umbilical stump
- C. Efficacy against Gram-positive, Gram-negative and anaerobic bacteria
- D. Stability in the presence of light and organic matter

### 5. THE OPTIMAL WAY TO APPLY AN ANTISEPTIC SOLUTION TO THE UMBILICUS IS VIA:

- A. Dampened cotton wool
- B. An individual screw-capped container
- C. A pump-action spray bottle
- D. A 20ml Luer-tipped syringe

ANSWERS: 1D; 2A; 3C; 4B; 5B.