Anaesthesia in Cattle (II) — Regional and Local Analgesia

R. S. Jones, *MVSc, DVM, DVA, MRCA, F.I. Biol, FRCVS*
Professor of Veterinary Anaesthesia
University Department of Anaesthesia RLUH
University of Liverpool
P.O. Box 147
Liverpool, L69 3BX England

Whilst a number of techniques of regional or local analgesia have been described in cattle many years ago, there are a number of others which have only been described recently or have been "rediscovered" and/or modified. The well tried techniques include cornual nerve block, paravertebral nerve block, epidural analgesia and the Raker technique for analgesia of the distal limbs.

It is considered essential to ensure that cattle are adequately sedated and restrained for the application of local analgesic techniques and for the period when surgery is being carried out. This is to prevent damage or injury to the surgeon, assistant and/or animal and to ensure that whilst perhaps not totally aseptic, the surgery is carried out in as clean a manner as possible. The actual techniques of sedation have been described in the earlier paper.

Local Analgesic Agents

A number of compounds have been used to produce local analgesia in domestic animals. The oldest one is of course, cocaine, but due to its toxicity and addictive properties it has, to all intents and purposes, fallen into disuse. It may, however, be used in some species for ophthalmic procedures. The first synthetic replacement for cocaine was procaine which again is used extremely infrequently. The most universally used compound in veterinary practice is lidocaine (lignocaine) hydrochloride. It is a more potent agent than procaine and has also a more rapid onset and duration of action. Lidocaine spreads through tissues relatively easily and will thus tend to penetrate nerve trunks more effectively. Hence it is rarely necessary to add hyaluronidase to lidocaine to increase the spread of the agent. Lidocaine is also effective when applied to mucous membranes. The agent is metabolized in the liver and it appears to have a duration of action of $1^1/_2$ - 2 hours. The duration of action of lidocaine can be increased by the addition of 1 in 50,000 to 1 in 500,000 of epinephrine, up to twice its normal length.

More recently bupivacaine ("Marcaine") has become available for use in veterinary practice. It has about four times the potency of lidocaine and has a duration of action of at least double that of lidocaine.

Proparacaine is a local analgesic solution which is recommended solely for ophthalmic use. It produces minimal damage to mucous membranes and hence little irritation in the eye. It does not produce papillary dilatation.

The toxicity of local analgesic solutions is something which tends to be disregarded in veterinary practice and in general it does not pose any problem in adults due to their relatively large weight. However, it can pose problems in calves on relatively rare occasions. Whilst accurate figures are not available for the toxic dose of lidocaine, in the state of current knowledge it would be unwise to exceed a dose of 5 mg/kg although doses of up to 10 mg/kg have been administered without any apparent signs of toxicity. The production of obvious clinical signs will relate to the rate of absorption which can vary with the site. **As a general guide not more than 25 ml of 1% lidocaine should be administered to a 50 kg calf.**

These local analgesic drugs have a complex effect on the central nervous system and they produce either depression in the form of sedation or excitation which is manifest as convulsions. Seizures should be treated by the administration of diazepam and/or thiopentone administered by the intravenous route. These drugs have a depressant action on the cardiovascular system and in sufficient dosage will produce cardiac arrest and this is treated by conventional methods of C.P.R. Respiratory depression may also be produced by local analgesic agents. Local toxic effects on muscle tissue may occasionally be observed particularly when large volumes of local analgesic agents together with a vasoconstrictor agent are administered.

In the application of any regional or local analgesic technique an adequate knowledge of the anatomy of the area under consideration is essential. Sharp and

This review of Anesthesia in Cattle was prepared at the invitation of the Editor. Professor Jones will provide references by request. Part 1 was published in the 1994 Bovine Practitioner.

sterile needles of suitable size are prime requirements as are sterile syringes and solutions. The site(s) of injection should be surgically prepared to minimize the possibility of infection.

Analgesia of the Head

Whilst analgesia of the horn is by far and away the most common local analgesic procedure carried out in cattle, the vast majority of veterinary surgeons are very familiar with the technique. Hence it would be invidious to give it detailed consideration in this paper. The cornual nerve is a branch of the ophthalmic division of the V^{th} (trigeminal) cranial nerve and is blocked in the temporal ridge of the frontal bone with 5 - 10 ml of lidocaine.

The innervation of the bovine eye is relatively complex. The globe of the eye, the conjunctiva, membrane nictitans and most of the eyelids are supplied by the ophthalmic division of the trigeminal (V^{th} cranial) nerve. The extraocular muscles are supplied by the motor fibres of the trochlear nerve in the case of the superficial oblique muscles, the abducens nerve supplies the lateralis rectus and retractor oculi, muscles and the other muscles are supplied by the oculomotor nerve. The eyelids are supplied by the motor fibres of the auriculopalpebral nerve. A combination of topical and regional techniques are used for surgery on the eye and associated structures. To produce topical analgesia a few drops of proparacaine are instilled into the eye. It is likely to produce little or no epithelial reaction when compared with other commonly used agents. It has a relatively rapid onset of action of up to one minute and a duration of action of 10 - 15 minutes. It greatly facilitates examination of the eye and minor surgery particularly in the presence of blepharospasm due to superficial corneal irritation.

Local analgesia of the eyelids in cattle can be achieved by the subcutaneous injection of a 2 per cent solution of lidocaine along a line about 0.5 cm from the eyelid margins in adult cattle. Multiple injections are made at sites approximately 0.5 cm apart using a 2.5 cm 22 gauge needle.

Paralysis of the eyelids (akinesia) can be produced by blocking the auriculopalpebral nerve. It runs from the base of the ear along the facial crest, passes ventral to the eye, branching as it progresses. The nerve is blocked with 5 - 10 ml of 2 per cent lidocaine using an 18 gauge needle. The needle is inserted subcutaneously anterior to the base of the auricular muscles in front of the base of the ear. This is at the end of the zygomatic ridge and the nerve is often palpable in a notch on the ridge. The point of the needle is placed at the dorsal border of the ridge. This block will produce akinesia but no analgesia. It is, however, extremely useful in combination with topical analgesia for the removal of foreign bodies from the cornea and conjunctival sac and for the administration of subconjunctival injections.

Analgesia for enucleation of the eye has been produced by one of two methods. These are retrobulbar block or the method described by Peterson. Before embarking on either of these techniques it is essential to provide an adequate degree of sedation of the animal and to provide suitable restraint. One of the commonest uses of retrobulbar analgesia is to provide suitable conditions for enucleation or to facilitate surgery for the removal of corneal squamous cell carcinoma. To produce a retrobulbar block, a 10 cm 18 gauge needle is commonly used. A medial or lateral canthus approach may be used. The needle is placed either 2.5 cm away from the canthus or it is introduced in the fornix of the conjunctiva. In either case the needle is advanced along the floor of the orbit until the penetration of the tough periorbita is obvious.

Small increments of the local analgesic solution are injected as the needle is advanced. The majority of the solution is placed beneath the periorbita. A volume of up to 25 ml of 2 per cent lidocaine is used. The correct placement of the solution will produce corneal analgesia, mydriasis and proptosis of the eyeball. As the nerves to the ocular muscles are blocked, paralysis of the eye will also occur.

The technique described by Peterson requires more skill to perform but is probably safer than retrobulbar block. The notch formed by the supraorbital process cranially, the zygomatic arch ventrally and the coronoid process of the mandible caudally is located. Infiltration of the site with 5 ml of 2 per cent lidocaine is performed with a 2.5 cm 22 gauge needle. A 2.5 cm large bore needle (12 or 14 gauge) is inserted as far anterior and ventral as possible for use as a cannula for the passage of a 12 cm 18 gauge needle. The long needle is directed horizontally and slightly caudally until it is in contact with the coronoid process of the mandible. It is directed off the coronoid process and advanced to the pterygopalatine fossa rostral to the orbitorotundum foramen. It is at a depth of some 8 - 10 cm from the skin. A syringe is attached and aspirated to ensure that the ventral maxillary artery has not been entered. An injection of 10 - 15 ml of 2 percent of lidocaine is then made to block the nerves as they emerge from the orbitorotundum foramen.

The needle is then withdrawn until it is just subcutaneous and redirected caudally and laterally to block the auriculopalpebral nerve on the zygomatic ridge with a further volume of 5 - 16 ml of 2 per cent lidocaine. Adverse effects of both the retrobulbar and Peterson techniques include haemorrhage from blood vessel penetration, direct pressure on the eyeball, penetration of the globe and optic nerve damage. These are of little

consequence when enucleation is to be carried out but may be of considerable significance when other procedures are to be performed. **Both techniques will prevent blinking for several hours hence it will be essential to keep the cornea moist either by the use of sterile saline or lubricants. As an adjunct therapy the lids may be sutured together for a relatively short period of time.**

Whilst it is theoretically possible to block both the mandibular nerve and the maxillary nerve at a variety of sites on the head, for all practical purposes only two sites are used and that is one for the lower, the other for the upper jaw. To produce analgesia of the lower lip the mental nerve is blocked as it emerges from the mental foramen. To block the nerve supply to the nostrils, upper lips, gums and incisors the infraorbital nerve is blocked as it emerges from the infraorbital foramen. The foramen is not easy to palpate but can be located rostral to the facial tuberosity on a line extending from the nasomaxillary notch to the upper second molar tooth.

Analgesia of the Limbs

The classical sites for nerve blocks of the limbs have been described by Raker and details of these blocks are available in all of the standard textbooks. The anatomy of the nerve supply to the digits of cattle is much more complex than in the horse. Hence regional analgesia of the area is much more difficult to produce. Ring block of the area in an attempt to block all of the nerves has been described but even this technique is not wholly satisfactory, particularly when the anatomy of the area is distorted by the inflammatory response.

However, the blocking of the individual nerves and the ring block of the area has been largely superseded by the technique of intravenous regional analgesia or I.V.R.A. It was described by Bier in the human subject in Germany at the turn of the century. The technique was "re-discovered" in the early sixties and was applied to cattle, pigs and sheep by a number of workers including the author and his colleagues. The actual mechanism of the production of analgesia is not known. However, the basis of the technique involves the placing of a tourniquet proximal to the lesion requiring attention and to a suitably accessible, large and superficial vein. The local analgesic solution is injected intravenously and the whole area of the limb distal to tourniquet is analgesic. It remains in that state until the tourniquet is removed with the important proviso that the tourniquet is placed correctly and is 100 per cent efficient.

Whilst the technique has been carried out on the standing animal, it is best performed on the recumbent one. The animal is sedated and if it does not become recumbent within a few minutes, it is cast and restrained with hobbles in lateral recumbency. The hair over the site of a suitable superficial vein is clipped and the skin washed and prepared. In the fore-limb a tourniquet is applied above the carpus and the radial vein is used. In the hind limb the tourniquet is placed above the hock. To improve the efficiency a roll of bandage is placed in the groove between the Achilles tendon and tibia and the lateral saphenous or the lateral plantar veins are used. A piece of stout rubber tubing or a blood-pressure sphygmomanometer cuff, inflated to a pressure in excess of 200 mm Hg., is used. Once the tourniquet is in place the site is again washed and prepared before the injection is made. A 2.5 - 3.5 cm, 19 or 20 gauge needle is inserted into the vein and 25 ml of 2 per cent plain lignocaine is injected in the average size cow. Digital pressure is applied to the site of injection to prevent haematoma formation on removal of the needle. Analgesia of the limb, distal to the tourniquet will develop within a 5 - 10 minute period. It will be effective until the tourniquet is removed. The presence of analgesia can be tested by a needle prick in the interdigital area.

The advantages of this technique are that it is less time consuming and requires only one injection when compared with other techniques. The presence of a tourniquet enables the surgery to be performed more efficiently due to the virtual absence of haemorrhage.

To produce analgesia of the fore-limb distal to the carpus, the musculocutaneous, ulnar and media nerves can be blocked. However, the details of these techniques are beyond the scope of this paper and can be found in the standard texts. Similarly the common peroneal and tibial nerves may be blocked in the hind-limbs.

Analgesia for Laparotomy

A number of techniques have been described for the production of analgesia of the abdominal wall. The majority of them are well known and fully described in the standard texts and hence do not warrant a full discussion here.

A line block or a simple infiltration technique is used to produce analgesia of the site of incision. After the first injection the subsequent injections are made into the edge of the desensitized area. Up to 100 ml of a 2 per cent lignocaine solution may be used. In adult cattle of around 500 kg body weight it is suggested that 125 ml of a 2 per cent solution of lidocaine is absolutely safe and produces no signs of toxicity. It is even suggested at double that volume it does not produce any obvious signs of toxicity.

An inverted L-block may also be used to provide analgesia for laparotomy. It involves the injection of the lidocaine solution away from the surgical site and minimizes any interference with the wound including healing.

The classical or proximal paravertebral technique of blocking the thirteenth thoracic (T_{13}) and first and the first (L_1) and second (L_2) lumbar nerves is a well described and tested one. For additional analgesia the third (L_3) and fourth (L_4) nerves may also be blocked. For this technique to be successful, adequate sedation/restraint of the animal is essential. In addition surgical cleanliness and an adequate knowledge of the anatomy of the area are required to prevent problems and ensure success.

A variation on the classical technique on a distal paravertebral method has been described. This involves blocking the dorsal and ventral rami of T_{13}, L_1 and L_2 nerves at the distal ends of L_1, L_2 and L_4 vertebrae. This technique is well described in textbooks and has its advocates.

Another technique which has been well documented but is rather less popular is that of segmental dorso-lumbar epidural analgesia. A local analgesic solution is injected into the epidural space either between L_1 and L_2 vertebrae or, less commonly, between T_{13} and L_1. This desensitizes the nerve roots as they emerge from the dura which covers the spinal cord. The technique requires considerable technical skill and whilst it only requires about 8 ml of 2 per cent lidocaine it is probably beyond the scope of the average veterinary surgeon.

Another technique which has been well documented but which requires considerable skill and anatomical knowledge together with special equipment and an absolutely sterile technique is that of thoracolumbar subarachnoid analgesia. It involves the insertion of a catheter through a Tuohy needle at the lumbo-sacral space.

Anterior and Caudal Epidural Analgesia

Caudal epidural analgesia is a well tried and classic technique in the bovine species. It involves the insertion of an 18 gauge needle of suitable length into either the sacro-coccygeal or first inter-coccygeal space. A dose of 1 ml of a 2 percent lidocaine per 100 kg body weight is usually adequate to produce analgesia for surgery of the tail and perineum and to prevent straining during obstetrical procedures.

A continuous caudal epidural technique has been used to prevent straining over a relatively long period. It involves the placement of a 16 or 17 gauge thin walled catheter into the epidural space. A dose of 5 ml of 2 per cent lidocaine is administered every 4 - 6 hours to prevent straining.

Sacral paravertebral analgesia can be used to prevent straining and the technique does not interfere with the function of the sciatic nerve. The spinal nerves S_3, S_4 and S_5 are blocked as they emerge from the spine on either side. A volume of 5 - 10 ml of 2 per cent lidocaine is used at each site. In view of the fact that S_3 supplies motor fibers to the retractor penis muscle in the bull, it should not be blocked.

Anterior epidural block involves interference with the motor function of the hind limbs. To produce this block in adult cattle, 100 to 150 ml of 2 per cent lidocaine is injected at the site of caudal epidural block and passes forward. Indications for this technique are relatively rare and include surgery on the hind limb and the udder.

Internal Pudendal Nerve Block

Nerve block of the internal pudendal or pudic nerve is a well tried technique and has been used mainly in the bull for operations on the penis. However, it can also be used for the prevention of straining due to uterine or vaginal prolapse in cows. It is a technique which again requires adequate restraint and sedation together with an accurate knowledge of the anatomy of the pelvic structures. The main advantage of this technique over the epidural one is that it does not induce a period of prolonged recumbency.

Analgesia for Castration of the Bull

Analgesia for castration of male cattle can be produced by infiltration of the skin incision site. This does not block nerve fibers in the spermatic cord. Hence, either a direct injection into each spermatic cord at the base of the scrotum or intratesticular injection may be used. The latter technique is the one which is most favored but care must be taken not to exceed a dose of 5 mg/kg of lidocaine as signs of toxicity may be observed. A dose of 10 ml of 2 per cent solution per side is adequate in a 200 kg animal. Hence this is well within the limits. The bulk of the drug is carried via the lymphatic system into the general circulation.

Analgesia of the Udder and Teats

The nerve supply to the udder is multiple and somewhat complex. It receives innervation from four of the lumbar nerves and from three of the sacral nerves. However, regional analgesia is rarely practiced for surgery for this region. The vast majority of surgical procedures on the teats are generally carried out under local analgesia with either adequate physical restraint and/or sedation. In practice the vast majority of these procedures will be performed in the standing animal. On the rare occasion that major surgery is required then either general analgesia or an anterior epidural technique is employed.

A number of techniques of local analgesia have been employed for a number of years and most readers will be familiar with these techniques.

One of the most simple and effective for most of the relatively simple procedures is the ring block technique which can be carried out in the standing cow. Care must be taken, however, to ensure that relatively large amounts of epinephrine are not included with the local analgesic solution as this may produce vasoconstriction with associated tissue damage and even necrosis of the teat.

An alternative to the ring block is an inverted V block. This again can be used in the standing animal for the majority of minor surgical procedures.

When dealing with lesions within the teat, the cistern is infused with local analgesic solution once all the milk has been withdrawn. A tourniquet is placed as high on the teat as possible to confine the local analgesic solution.

Perineal nerve block can be utilized to desensitize the caudal part of the udder for the removal of supernumerary teats and the repair of wounds. The great advantage of this technique is that it is a regional one and hence no analgesic solution is present at the surgical site and will not interfere with wound healing. The nerve is blocked with 5 ml of 2 per cent lidocaine injected into the subcutaneous and subfascial tissues at the ischial arch, about 2 cm lateral to the midline.

APPENDIX I

Pudendal Nerve Block in the Bull

In order to operate upon the penis and preputial membrane of the bull, it is necessary to have both analgesia of the integumentary surfaces and relaxation of the retractor penis muscle. Whilst both objectives may be achieved by general anaesthesia, this procedure carries with it a risk of complications, for example, regurgitation and inhalation of rumen contents. For most simple operations or for examination of the penis and adnexa this risk is high.

Anaesthesia can be produced by epidural block but in practice it is not always possible to achieve satisfactory anaesthesia and relaxation of the penis without also affecting the bull's ability to stand. As there are management problems in bulls with hind limb inco-ordination, the technique of epidural block for penile anaesthesia is also unacceptable.

Pudendal Nerve Block has few of the disadvantages outlined above. The bull may be kept standing, or he may be cast if that is considered desirable. Although a number of approaches have been described, the most satisfactory one is that through the ischio-rectal fossa as first described by Larsen (1953). The technique described hereafter has been in use at the Liverpool Veterinary School for many years.

Figures I.1 and I.2 should be studied independently with their relevant text. They may then be superimposed to study the relationship between them. The section on 'Clinical Palpable Structures' is best studied with a living bovine animal which may be palpated both externally and internally.

Pudendal Nerve Block in the bull sounds much more complicated to perform than it actually is. The sites for the block are readily palpated in the thin dairy bull, in which initial experience of the technique should be sought. There is difficulty in inserting a long needle towards points which cannot always be palpated and which have no externally palpable landmarks. This difficulty is compounded by a fear of penetrating the rectal wall. Once these initial doubts have been overcome the technique is quickly mastered and will be found to have a wide application.

A. ANATOMICAL CONSIDERATIONS

I. The Nerves of the Sacral Plexus (Figure I.1)

A. *Caudal Rectal Nerves*
Origin = S4 and S5, the latter being generally small.
Supply amongst other things, motor function to the proximal segment of the retractor penis muscle.
Blocked by local anaesthetic placed at B. Probably not necessary for penile relaxation.

B. *Pudendal Nerve*
Origin = S3 with contributions from S4 and (not shown) S2, and possibly also S1 and L6.
Branches
1. Proximal Cutaneous Nerve
2. Distal Cutaneous Nerve
3. Deep Perineal Nerve

(These branches are not significant in pudendal nerve block for penile relaxation and anaesthesia.)
The Pudendal Nerve Proper then splits into
(i) *Dorsal Nerve of Penis,* which supplies motor function to the distal segments of the retractor penis muscle, and sensation to the free end of the penis.
(ii) *Superficial Perineal Nerve* which in turn splits into
(a) Preputial branch which supplies sensation to the preputial membrane.
(b) Scrotal branch, which in part supplies cutaneous sensation to the scrotum.
The whole of the pudendal nerve is blocked by local anaesthetic placed at A.

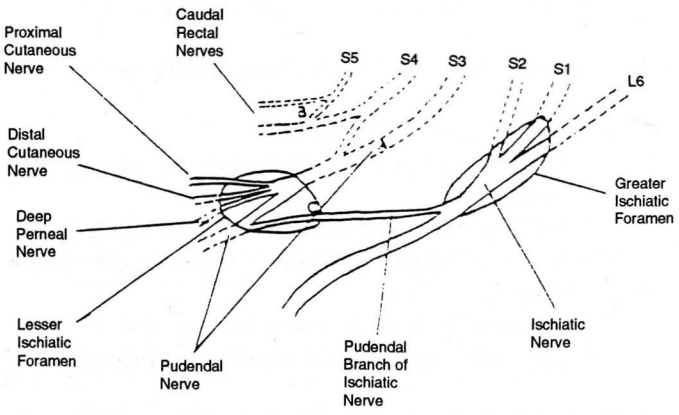
C. *Pudendal Branch of the Ischiatic Nerve*
(= Medial Branch of Caudal Cutaneous Femo-

ral Nerve)
The ischiatic nerve (origin S2, S1 and L6) leaves the pelvis through the greater ischiatic foramen, thus coming to lie lateral to the broad sacro-tuberous ligament. Soon afterward emerging from the foramen it gives off the caudal cutaneous femoral nerve which is directed caudally. This nerve has a medial branch which re-enters the pelvis through the lesser ischiatic foramen to join the pudendal nerve proper.

Blocked by local anaesthetic placed at C.

NOTE: There is marked individual variation in branching and anastomosis of these nerves.

Figure I.1 Nerves of the sacral plexus.



II. The Broad Sacro-tuberous Ligament and Related Structures (Figure I.2)

A. *The Broad Sacro-tuberous Ligament* is a massive sheet of connective tissue which forms the lateral wall of the pelvis. It runs from the sacrum and the shaft of the ilium to the ischiatic tuber and ischiatic spine. It has two foramina, one cranially (the greater ischiatic foramen) through which the ischiatic nerve passes and one caudally (the lesser ischiatic foramen).

B. *The Internal Pudendal Vessels,* which are branches of the internal iliac vessels, run on the lateral wall of the pelvis, medial to the broad sacro-tuberous ligament at about the level of the ischiatic spine. They cross the lesser ischiatic foramen to run close to the pudendal nerve at the caudal end of the foramen.

C. *The Coccygeus Muscles* are sheet-like, originating from the medial side of the ischiatic spine and passing lateral to the rectum to insert onto the transverse processes of the first three coccygeal vertebrae. When palpating per rectum the muscle will be found to cover all but the most cranial portion of the lesser ischiatic foramen. Although the caudal rectal nerves pass medial to the muscle, the pudendal nerve and its branches pass lateral to it.

III. Clinically Palpable Structures

A. *The ischio-rectal fossa* is bounded ventro-laterally by the ischiatic tuber, cranially by the caudal edge of the broad sacro-tuberous ligament and medially by the tail and rectum. It is easily palpable in the thin dairy bull but may be difficult to define in fat beef bulls. A needle will be inserted through this area.

B. *The Cranial Portion of the Lesser Ischiatic Foramen* may be palpated per rectum with the hand inserted up to the wrist. It is a soft depression on the ventro-lateral wall of the pelvis and must not be confused with the obturator foramen which lies ventrally.

C. *The Pudendal Artery* is about the thickness of a pencil and can be palpated cranial to the lesser ischiatic foramen where it runs along the lateral wall of the pelvis. Pulsation of the artery renders its identification easy.

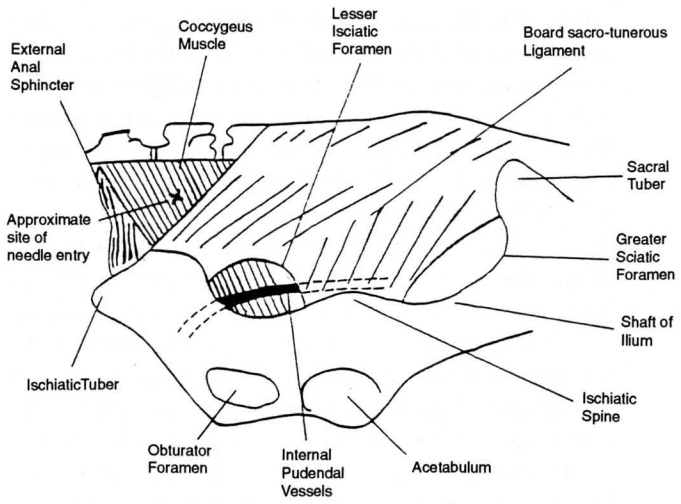
D. *The Pudendal Nerve* can be palpated in most subjects at about point A on Figure I.1 i.e. cranial and dorsal to the cranial end of the lesser ischiatic foramen and dorsal to the pudendal artery. It feels like a straw and can generally be rolled between the rectal wall and broad sacro-tuberous ligament. In fat subjects, however, the nerve may be difficult to palpate. Nevertheless, point A can always be defined by its relationship to the pudendal artery (which is palpable ventrally) and to the cranial portion of the lesser ischiatic foramen (which is palpable ventro-laterally).

NOTE: The caudal rectal nerves and the pudendal branch of the ischiatic nerve cannot be palpated.

B. TECHNIQUE

1. *Sedation and Restraint*
Chloral hydrate or xylazine at the appropriate dose rates for the breed, age and temperament of the bull are useful sedatives.
As always when dealing with bulls, the animal should be well under control and the head particularly well restrained.
It is an advantage to restrain the tail by tying it to one of the hind legs.

Figure I.2 Broad sacro-tuberous ligament and related structures: Lateral view with lateral muscles removed.



2. *Preparation*

The hair in the ischio-rectal fossae is close-clipped or, preferably shaved and the skin disinfected as for surgery. 2 ml of 2 or 3% lignocaine is injected subcutaneously in the deepest part of each fossa, i.e. about half-way between the ischiatic tuber and the spinous process of the first coccygeal vertebrae. Using a No. 11 scalpel blade a stab-incision is made through the skin in this area - this will facilitate insertion of the long needle.

Rigid surgical cleanliness throughout the procedure is essential as material is injected deep into the animal's body where abscessation or cellulitis would be serious. Therefore, the site of needle penetration must be thoroughly cleaned, the anaesthetist's hands should also be clean and the one which lies in the rectum must be gloved. The sterility of the blades, needles and anaesthetic solutions must be above question.

3. *Blocking the Right-hand Side*

The left hand is gloved and inserted into the rectum and point A located by palpation with the fingertips, as described in section A.III.

A 15 cm long 14 gauge needle is now inserted through the right hand stab-wound and advanced in a cranial and somewhat ventral direction towards point A. A thinner needle should *not* be used as it is difficult to palpate. Several problems attend this procedure:

(i) The direction of the needle cannot be easily altered once the needle has been inserted more than about 4-5 cm - it is, therefore, important that the initial direction should be correct.

(ii) In beef breeds fat in the ischio-rectal fossa sometimes makes it difficult to direct the needle truly cranially and medial to the broad sacro-tuberous ligament. In such animals it is necessary to insert the needle very close to the fat base of the tail.

(iii) The needle cannot be palpated for the first 6-7 cm because the coccygeus muscle lies between it and the rectal wall.

(iv) There is, therefore, a fear of penetrating the rectal wall. This difficulty is best overcome by deflecting the rectum to the left side until the needle is judged to be in correct position and then confirming this by palpation.

Whilst the anaesthetist holds the needle firmly in place, an assistant injects 8-10 ml of anaesthetic solution (2 or 3% lignocaine hydrochloride) to block the pudendal nerve at A.

The needle must now be almost completely withdrawn and redirected somewhat dorsally towards point B. Palpation will again confirm that it is in the correct position. 5 ml of anaesthetic solution are injected by an assistant to block the caudal rectal nerves.

Once again the needle is almost withdrawn and then redirected more ventrally to point C at the cranial part of the lesser ischiatic foramen. After palpation has confirmed that the needle is correctly placed a further 5 ml of anaesthetic solution are injected to block the pudendal branch of the ischiatic nerve. As there is some risk of accidental injection of the pudendal vessels it is a wise precaution to have the assistant draw back on the syringe before injection. Whilst it is possible that local anaesthetic injected at C will block the pudendal nerve itself, it is not wise to inject large volumes in this region because of the proximity of the blood vessels.

The needle is now completely withdrawn and the area around points A, B and C gently massaged to disperse the anaesthetic solution and thus render slight inaccuracies in anaesthetic placement insignificant. Care, however, should be taken not to direct the anaesthetic too far cranial to position A, or blockage of part of the ischiatic nerve may occur.

4. *Blocking the Left-hand Side*

The procedure described above is now repeated for the left-hand side. The author finds it easier to strip off the left glove, to glove the right hand and place it in the rectum, and to insert the needle with the left hand through the left hand stab-wound. It is preferable to use a new sterile needle for the second side.

5. *Effects of the Block*
In the normal animal, prolapse of the penis may be evident immediately after anaesthetic placement or massage, but it is not usually delayed by more than ten minutes. The use of lignocaine is preferable to procaine, and with massage of the area both appear to spread the onset of the block. Anaesthesia and exteriorization of the penis are adequate for detailed examination of the penis and preputial lining and for surgical or other treatment of these structures to be carried out.
It is a rule of pudendal nerve block that if the free end of the penis is desensitized, then motor paralysis of the retractor penis muscle is present. (Some believe this is because retractor muscle tone depends on afferent impulses from the penis and prepuce.) This rule has a useful diagnostic application. Failure to exteriorize the penis in the presence of analgesia of the free end cannot be due to continued normal tone in the retractor penis but must be due to some other physical impediment such as retractor muscle myopathy, preputial or peripenile adhesions or a congenitally short penis.

6. *Post-anaesthetic Care*
Once investigation or treatment has been completed, the penis should be lubricated with an antiseptic cream and replaced in the sheath. Application of a bandage round the sheath for about four hours retains the penis in position until the block wears off, so preventing both drying from exposure and trauma by the patient.

References

Larsen, L.L. (1953) The internal pudendal (pudic) nerveblock for anaesthesia of the penis and relaxation of the retractor penis muscle. *Journal of the American Veterinary Medical Association* 123: 18-27.

APPENDIX II

Paravertebral Anaesthesia in Cattle

For Caesarean operation, the 13th thoracic and 1st, 2nd and 3rd lumbar nerves are anaesthetized.

The technique for locating the nerves which is given below is that used for many years at the Liverpool Veterinary School and gives good results even in the hands of the inexperienced.

1. *The 2nd lumbar nerve*
The 6th lumbar transverse process is medial to the external angle of the ilium, so the first palpable transverse process in front of the tuber coxae is the 5th (Fig. II.1). The lateral extremity of the 2nd transverse process is located by counting forward from the 5th. The curvature of this transverse process is outwards and **forwards** so that the caudal edge is slightly behind the lateral extremity.
A small volume of 2% lignocaine without adrenaline is placed under the skin over the mid-point of the second transverse process. A 4" 16 gauge needle is introduced until it strikes the transverse process, withdrawn slightly and then redirected off the caudal edge until it penetrates the inter-transverse ligament (Fig. II.2). Failure to penetrate the ligament will result in no anaesthesia of the ventral branches and these are the more important. It is very helpful to strike the bone with the needle as one then knows just how deep the transverse process is and, therefore, how deep the inter-transverse process ligament lies. 12-14 ml of 3% lignocaine are therefore, injected below the ligament in order to block the ventral branch. The remaining 6 ccs are injected as the needle is withdrawn thus blocking the dorsal branch of the nerve.

2. *The 1st lumbar and 13th thoracic nerves*
The lateral extremity of the 1st lumbar transverse process may not be palpable but its position can be calculated as it is as far in front of the second as the third is behind.
A small volume of 2% lignocaine without adrenaline is placed under the skin over the mid-point of the transverse process approximately 2" from the mid-line.
The 4" needle is then introduced until it strikes the process, withdrawn slightly and then redirected first off the caudal edge to block the 1st lumbar nerve and then the cranial edge to block the 13th thoracic nerve.
In each case 12-14 ml of 3% lignocaine are injected in order to block the ventral branch. The remaining 6-8 ml are injected as the needle is withdrawn.

3. *The 3rd lumbar nerve*
This is anaesthetized in a similar fashion to the second.

Cornual Nerve Block in the Goat

This is very much different in the goat from that in cattle. You **must** be aware of this.

Please see the standard texts for a diagram of the nerve supply.

The nerve supply arises from the lacrimal and infratrochlear nerves which have cornual branches. The cornual branch of the lacrimal nerve emerges from theorbit behind the root of the supraorbital process. The

Figure II.1 Showing the ventral branches of the 13th thoracic and the lumbar nerves and their relationship to the transverse processes.

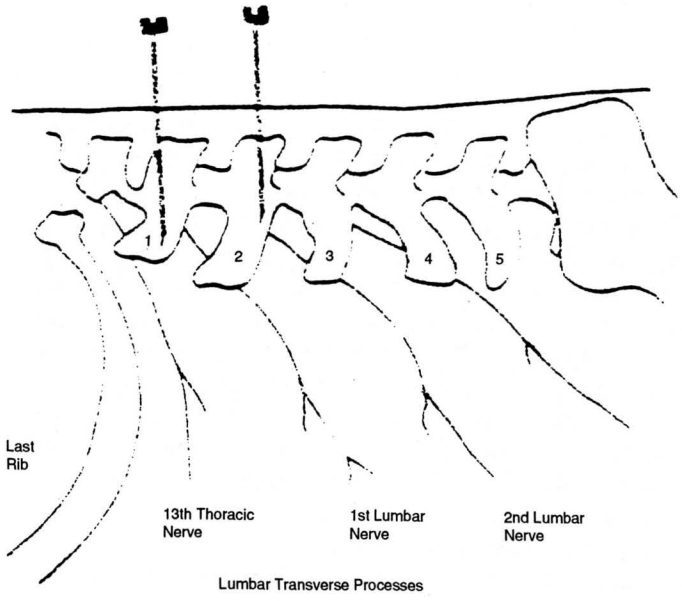
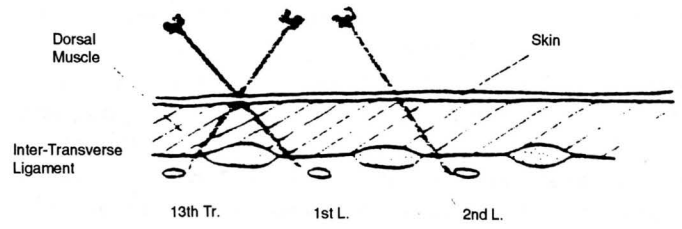


Figure II.2 Showing the relationship between the ventral branches of the spinal nerves and the inter-transverse ligament.



nerve, covered by a thin frontalis muscle, divides into several branches, two of which course towards the caudolateral aspect of the base of the horn and supply mainly the lateral and caudal parts of it. The main trunk of the infratrochlear nerve emerges from the orbit dorsomedially and divides into two branches, the dorsal or cornual branch, and the medial or frontal branch. The cornual branch soon divides, one division running towards the dorsal aspect of the base of the horn and ramifying in its dorsal and dorsomedial parts. The other division courses towards the medial aspect of the base of the horn and gives off branches to the medial and caudomedial parts of it. Both divisions are covered in part by the orbicularis and in part by the frontalis muscles.

Technique

The site for producing block of the cornual branch of the lacrimal nerve is caudal to the root of the supraorbital process. The needle should be inserted as close as possible to the caudal ridge of the root of the supraorbital process to a depth of 1.0 - 1.5 cm.

The site for blocking the cornual branch of the infratrochlear nerve is at the dorsomedial margin of the orbit. In some animals the nerve is palpable by applying slight pressure and moving the skin over this area. The needle should be inserted as close as possible to the margin of the orbit to a depth of about 0.5 cm. In adult animals, about 2-3 ml of local analgesic solution should be injected at each site.

These nerves may be blocked for the disbudding of kids, but kids are very small animals and it is easy to administer a toxic dose of local analgesic. General anaesthesia with halothane/oxygen is much safer for disbudding of these very young animals provided the oxygen mixture is switched off before any cautery is used. "Staffan" or propofol may also be used.