**Drugs used for dehorning and disbudding**

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| Drug | Doses/Calculations | Class of drug | MOA | Effects | Contraindications | Withdrawal times |
| 2% Lidocaine | **Cornual  Br. Lacrimal nerve:**  ***Lethal Dose****:* 10mg/kg  For 130kg cow  ***Volume***= D x W / C             = 10 x 130 / 20             = 65 mL lidocaine  **½LD = 32.5mL**. It is safe to give up to this volume.  Therefore 10mL given on each side = **20mL given** | Class-1b antiarrhythmic drug | Lidocaine enters the nerve cells by diffusion through membranes. It works by stopping sodium (Na) ions from passing through the voltage-gated channels of pain receptors in the body, by binding to the Na channels. An amide on lidocaine allows it to act like an amino acid, and interact with the active sites in the Na channel domains, causing a conformational change. When the active site has something else interacting with it, then it cannot transfer the Na ions, and therefore cannot send signals of pain to the brain. | Lidocaine is a moderately long-acting local anaesthetic. It blocks initiation and transmission of nerve impulses at the site of application by stabilizing the neuronal membrane. | Lidocaine is contraindicated in animals with a known hypersensitivity to the drug. | **Epidural:**  Meat- 1 day  Milk- 24 hours  **Infiltration:**  Meat- 4 days  Milk- 72 hours |
| For 100kg cow  ***Volume:*** D x W / C  = 10 x 100/ 20  = 50 mL lidocaine  **½LD = 25 mL**. It is safe to give up to this volume.  Therefore 5mL given on each side = **10mL given** |
| 10% Ketamine | **IM Sedative:**  For 130kg cow  ***Dose***: 0.05 mg/Kg  ***Weight***: 130 Kg  ***Conc.***: 100mg/mL  ***Vol.*:** D x W / C          =(0.05mg/Kg x 130Kg)/ (100mg/mL)  = 0.065 mL  = 0.07 mL Ketamine | N-methyl-D-aspartate (NMDA) antagonist | Ketamine acts as an antagonist for NMDA receptors which are involved in processing CNS input, therefore blocking this input. It also acts on opioid receptors and voltage gated Ca channels which aid in its analgesic effect. The full mechanism of action is not completely understood. | Ketamine is a rapid-acting general anaesthetic. It produces anaesthesia characterised by profound analgesia with normal ocular, pharyngeal and laryngeal reflexes, normal or increased muscle tone, cardiovascular stimulation, a minimal respiratory depression (which can become severe in some cases of IV administration). There may also be hyper-salivation, increased CSF pressure and, during recovery animals may be hyper-responsive and ataxic, so exposure to handling or loud noises should be kept at a minimum during recovery. Co-administration with alpha-2-agonists (such as xylazine used in this lab) or benzodiazepines can control the increased muscle tone. | Contraindicated in hypertensive animals, those at risk of heart failure, those with hepatic or renal insufficiency, head trauma, pre-existing seizure disorders. | Meat: 3 days  Milk: 48 hours |
| For 100kg cow  ***Dose***: 0.05 mg/Kg  ***Weight***: 100 Kg  ***Conc.***: 100mg/mL  ***Vol.*:** D x W / C          =(0.05mg/Kg x 100Kg)/ (100mg/mL)  = 0.05 mL Ketamine |
| Xylazine | For 130kg cow  ***Dose***: 0.025 mg/kg  ***Weight***: 130kg  ***Conc.***: 0.2%  ***Volume:*** D x W/ C=(0.025\*130)/20  = 0.16 mls | Potent Alpha 2 adrenergic agonist | Xylazine has a highly lipophilic nature, it directly stimulates central α2 receptors as well as peripheral α-adrenoceptors in a variety of tissues.As an agonist, xylazine leads to a decrease in neurotransmission of norepinephrine and dopamine in the central nervous system. It does so by mimicking norepinephrine in binding to presynaptic surface receptors, which leads to feedback inhibition of norepinephrine.  Xylazine also serves as a transport inhibitor by suppressing norepinephrine transport function through competitive inhibition of substrate transport. | Causes sedation, anaethesia, muscle relaxation and analgesia in many animals. It is 10–20 times more potent in ruminants than other species and is therefore used as a very useful sedative and analgesic in cattle, goats, and sheep. | Induces uterine contractions and therefore should not be used in pregnant cows. Detomidine is regarded as a better alternative. If animal is very excited, anxious or unruly, xylazine may not produce reliable sedation.  Side effects in animals include transient hypertension, hypotension, gastrointestinal upset and respiratory depression. | Meat: 4 days  Milk: 24 hours |
| For 100kg cow  ***Dose***: 0.025 mg/kg  ***Weight***: 100kg  ***Conc.***: 0.2%  ***Volume:*** D x W/ C=(0.025\*100)/20  = 0.125 mLs |
| Tolazoline | For 130kg cow  ***Conc***: 10% = 100mg/mL  ***ED***: 4x xylazine dose  4 x .025 = .1mg/kg  ***Vol***: (130kg x .1mg/kg) / 100mg/mL  **= .13 mL of Tolazoline given IV** | Alpha 1 and 2 adrenergic competitive antagonist | Reverses the effects of Alpha 2 agonists ,eg. Xylazine, by competitively binding to Alpha 2 adrenergic receptors. | A direct peripheral vasodilator. It has direct actions on blood vessels; decreasing the pulmonary arterial pressure and peripheral resistance, and increasing venous capacity and cardiac output and can cause tachycardia, hypotension, and increased  GI motility | It should not be administered to animals  exhibiting signs of stress, debilitation, cardiac disease, sympathetic blockage,  hypovolemia, or shock | Meat: 8 days  Milk: 48 hours |
| For 100kg cow  ***Conc***: 10% = 100mg/mL  ***ED***: 4x xylazine dose  4 x .025 = .1mg/kg  ***Vol***: (100kg x .1mg/kg) / 100mg/mL  **= .1 mL of Tolazoline given IV** |
| Flunixin | For 130kg cow  ***Conc***.: 5% = 50mg/mL  ***Dose***: 1.1mg/kg  ***Vol***.: (130kg x 1.1mg/kg) / 50mg/mL  = 2.9 **= 3.0 mL given IV** | Nicotinic acid derivative non steroidal anti-inflammatory (NSAID) | Flunixin meglumine is a non selective COX inhibitor. | It has potent  anti-inflammatory and analgesic effects and is indicated for the treatment of acute and surgical pain. Flunixin is an exception among the NSAIDs as it relieves visceral pain and not only integument pain as most NSAIDs do. | Flunixin is not given rapidly via IV as some anaphylactic reactions have been observed. Treatment for longer than 3 days can result in hematochezia and hematuria. | Meat: 4 days  Milk: 72 hours |
| For 100kg cow  ***Conc***.: 5% = 50mg/mL  ***Dose***: 1.1mg/kg  ***Vol***.: (100kg x 1.1mg/kg) / 50mg/mL  = **2.2** **mL given IV** |
| Penicillin | For 130kg cow  ***Conc***.: 200,000 IU/mL  ***Dose***: 10,000 IU/kg  ***Vol***.: (130kg x 10,000 IU/kg) / 200,000 IU/mL = **6.5 mL**  For 100kg cow  No antibiotics were used for this procedure because there were no open wounds hence no bleeding | Penicillin G (benzylpenicillin) – Natural penicillin | The structure of penicillins includes a β-lactam ring and a thiazolidone ring. Cleavage of the β-lactam ring destroys antibiotic activity. Penicillins bind to and inhibit the transpeptidase involved in the cross-linking of the bacterial cell wall, the third and final step in cell-wall synthesis. The weakened cell wall ruptures, resulting in lysis and cell death. Penicillins also inhibit other peptidases (penicillin-binding proteins) involved in cell wall synthesis and block the inhibition of autolysins. Rapidly growing bacteria are most susceptible  to the bactericidal effect of penicillin. | Penicillin G is used in all species for the treatment of infections caused by Gram(+), nonpenicillinase producing pathogens. | Allergic reactions to penicillin may occur in animals, especially cattle | Meat: 10 days  Milk: 48 hours |
| Streptomycin |  | Aminoglycoside antibiotic | Streptomycin binds to the 30S ribosomal fragment and inhibits the rate of protein synthesis and the fidelity of mRNA translation which results in the synthesis of abnormal proteins. It is bactericidal against Gram(–) aerobes and is synergistic with β-lactams against many Gram(+) pathogens. | Streptomycin is used to treat and prevent Gram(-) infections. | The aminoglycosides are relatively more toxic than other classes of antimicrobials. Hence, dosage regimens must  be adjusted in animals with decreased renal function and they should not be used with other ototoxic or nephrotoxic drugs. | Meat: 2 days |