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## Surgical management of abdominal disorders in pregnant cattle under dexmedetomidine premedication and isoflurane anaesthesia: A review of 10 cases

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### Abstract

Abdominal disorders requiring surgical interventions in pregnant cattle warrant safe, reliable and effective anaesthesia. Dexmedetomidine, a newer alpha 2 agonist with high affinity for alpha 2a receptors do not interfere with pregnancy compared to other conventional alpha 2 agonists. The study was designed to evolve pregnancy safe general anaesthetic protocol for cattle. Ten pregnant cattle presented to Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal requiring major abdominal surgical interventions were selected for the study. Detailed clinical examination incorporating ultrasonography and/or radiography was carried out in all the animals. Surgical interventions were planned based on the diagnosis which revealed intussusception in four cattle, caecal dilation in three animals, DH in two cattle and umbilical hernia in one animal. Preanaesthetic evaluation of all the animals was carried out and stabilization of the patient was done. Dexmedetomidine and butorphanol at the dose rate of 1 microgram per kg and 0.02 mg per kg body weight, respectively were administered intravenously as a premedicant. Induction of anaesthesia was achieved with “double drip” five minutes following premedication. Orotracheal intubation was carried out to have a secure leak-free airway and anaesthesia was maintained with isoflurane. Physiological, cardiopulmonary, anaesthetic and haematobiochemical parameters were studied at periodical interval to ensure safe anaesthesia. Saturation of peripheral oxygen, end tidal CO<sub>2</sub>, ECG, end tidal isoflurane, pulse rate, respiratory rate and tidal volume were monitored throughout the anaesthetic period. Surgical interventions selected were performed as per standard surgical technique. Dexmedetomidine and butorphanol premedication provided adequate sedation and facilitated smooth induction. Double drip administration did not cause significant cardiopulmonary depression and facilitated orotracheal intubation. The fresh gas flow rate and vapourizer setting during maintenance was found to be appropriate to maintain surgical plane of anaesthesia. The anaesthetic protocol employed did not produce significant life threatening depression on physiological and cardiopulmonary parameters. The anaesthetic recovery was found to be spontaneous, smooth and struggle-free. The haematobiochemical study did not show any adverse effect on hepatic and renal function. Based on the Fresh Gas Flow rate and vapourizer setting employed, the economics of the anaesthetic protocol was calculated and found affordable. Post anaesthetic follow-up revealed maintenance of pregnancy indicating that the protocol employed was safe in pregnant cattle.

**Keywords:** Abdominal disorders, surgical management, general anaesthesia, dexmedetomidine

### Introduction

Abdominal disorders requiring surgical interventions in pregnant cattle warrant safe, reliable and effective anaesthesia. Abdominal affections are more common during the pregnancy period (mostly last trimester) in cattle due to the compression by the foetus and sudden change in feed. Common observed abdominal affections in cattle were intussusception and intestinal obstruction. Dexmedetomidine, a newer alpha 2 agonist with high affinity for alpha 2a receptors do not interfere with pregnancy compared to other conventional alpha 2 agonists (Ramadhyan *et al.* 2010) [3]. Alpha 2 agonists ( $\alpha_2$ ) are also commonly used as an adjunct in general anaesthesia for pain management in cattle. The anaesthetic induction dose could be reduced by 30 to 80 per cent when  $\alpha_2$  agonists are included in the anaesthetic protocol (Thurmon, 1996) [4]. The study was designed to evolve pregnancy safe general anaesthetic protocol for cattle.

### Materials and Methods

The study was conducted in 10 clinical cases of pregnant cattle presented for abdominal surgical interventions under general anaesthesia. The age in years and bodyweight in kilograms were recorded.

Marginal auricular vein cannulation was performed using 18G intravenous cannula for administration of fluids and drugs. Withholding of feed and water was done for 24 and 12 h, respectively prior to induction of anaesthesia. Dexmedetomidine was administered at the dose rate of 1µg per kg body weight i.v. and butorphanol at the dose rate of 0.02 mg per kg body weight in all the animals. Induction of anaesthesia was achieved using double drip containing guaifenesin and ketamine at the dose rate of 50mg and 2mg per kg, respectively. Animals were positioned in left lateral recumbency and an inflated rubber tube beneath the dependent shoulder was placed to prevent injury to radial nerve. The upper forelimb was positioned in level to its shoulder to prevent hanging and injury during anaesthesia. Endotracheal intubation was performed after induction using Gunther's mouth gag by employing bare arm approach. Anaesthesia was maintained with isoflurane using large animal anaesthetic machine. Physiological, haematological and serum biochemical parameters were recorded during maintenance of anaesthesia and after recovery in all the animals. The abdominal surgeries like enterectomy and enteroanastomosis, transabdominal diaphragmatic herniorrhaphy, typhlotomy and umbilical herniorrhaphy were carried out as per standard surgical procedure. Based on the FGF rate and vapourizer setting employed, the economics of the anaesthetic protocol was calculated and found affordable. Post operatively the animals were maintained with fluids and antibiotic therapy. Post-operative complications were recorded if any.

### Results and Discussion

All the selected animals in the present study were between one to seven years of age with the mean body weight of  $288.16 \pm 26.30$  kilograms. All the animals showed good sedation after administration of dexmedetomidine at the dose rate of 1µg per kg body weight and butorphanol at the dose rate of 0.02 mg per kg body weight. The quality of sedation achieved with premedication was good in all the animals. Induction of anaesthesia with double drip containing ketamine at the dose rate of 2 mg per kg and guaifenesin 50 mg per kg body weight was found to be smooth in all the animals. The induction of anaesthesia was smooth in all the animals. The endotracheal intubation was easy in all the animals. The muscle relaxation was adequate and surgical plane of anaesthesia was found to be adequate in all the animals to carry out abdominal surgeries in cattle without any intra operative complications. The mean ( $\pm$ SE) rectal temperature ( $^{\circ}$ C) recorded before induction, after induction, 10<sup>th</sup>, 20<sup>th</sup> and 30<sup>th</sup> min of isoflurane anaesthesia and after recovery was  $38.70 \pm 0.13$ ,  $38.25 \pm 0.09$ ,  $37.56 \pm 0.17$ ,  $36.91 \pm 0.04$ ,  $37.41 \pm 0.07$  and  $38.38 \pm 0.05$ , respectively in all the animals. The reduction in temperature during maintenance phase of anaesthesia may be due to reduction in metabolic rate and reduced physiological activity (Tranquilli *et al.*, 2007) [5]. The mean ( $\pm$ SE) heart rate per min recorded before induction, after induction, 10<sup>th</sup>, 20<sup>th</sup> and 30<sup>th</sup> min of isoflurane anaesthesia and after recovery was  $87.42 \pm 0.82$ ,  $85.36 \pm 1.02$ ,  $84.11 \pm 0.43$ ,  $84.00 \pm 0.72$ ,  $83.11 \pm 1.21$  and  $85.54 \pm 1.05$ . The mean ( $\pm$ SE) respiratory rate per min recorded before induction, after induction, 10<sup>th</sup>, 20<sup>th</sup> and 30<sup>th</sup> min of isoflurane anaesthesia and after recovery was  $27.63 \pm 0.50$ ,  $24.33 \pm 0.89$ ,  $23.21 \pm 0.81$ ,  $21.60 \pm 0.32$ ,  $21.89 \pm 0.56$  and  $23.21 \pm 0.54$ . There was no significant reduction in heart rate and respiratory rate compared to the baseline values and maintained within the

physiological limits. The mean ( $\pm$ SE) P amplitude (mV), R amplitude (mV), S amplitude (mV), T amplitude (mV), P duration (sec), PR interval (sec) and QT interval (sec) during anaesthesia was  $0.13 \pm 0.04$ ,  $0.92 \pm 0.02$ ,  $0.08 \pm 0.05$ ,  $0.30 \pm 0.01$ ,  $0.07 \pm 0.03$ ,  $0.20 \pm 0.04$  and  $0.32 \pm 0.06$ , respectively. The mean ( $\pm$ SE) tidal volume during isoflurane anaesthesia was  $3.66 \pm 0.12$  mL per kg body weight and minute volume was  $73.86 \pm 0.14$  mL per kg body weight respectively. The mean ( $\pm$ SE) saturation of lingual arterial oxygen in percentage during isoflurane anaesthesia was  $97.89 \pm 0.54$  with mean arterial pressure in mm Hg was  $89.88 \pm 2.03$ . The mean ( $\pm$ SE) induction time in min was  $1.50 \pm 0.47$ , extubation time in min was  $12.73 \pm 0.95$ , time for sternal recumbency in min was  $16.12 \pm 1.05$  and time for unassisted standing in min was  $56.50 \pm 1.57$ .

The mean ( $\pm$ SE) fraction of inspired-isoflurane concentration in percentage was  $1.61 \pm 0.05$ . The mean ( $\pm$ SE) end-tidal isoflurane concentration in percentage was  $1.12 \pm 0.02$ . Sudden elevation in heart and respiratory rate was not encountered in the selected animals which show that the selected anaesthetic protocol had antinociceptive efficacy. The mean ( $\pm$ SE) haemoglobin in g per dL before premedication, during maintenance and after recovery were  $14.56 \pm 0.39$ ,  $12.32 \pm 0.53$  and  $12.97 \pm 0.21$ . The mean ( $\pm$ SE) packed cell volume in per cent, before premedication, during maintenance and after recovery were  $41.74 \pm 0.89$ ,  $39.11 \pm 0.52$  and  $39.89 \pm 0.38$ . The mean ( $\pm$ SE) total erythrocyte count in millions per microlitre before premedication, during maintenance and after recovery were  $7.14 \pm 1.01$ ,  $6.89 \pm 0.82$  and  $6.99 \pm 0.41$ . The mean ( $\pm$ SE) total leucocytes count in thousands per microlitre before premedication, during maintenance and after recovery were  $9.01 \pm 0.63$ ,  $8.81 \pm 0.54$  and  $8.99 \pm 0.82$ , respectively in all animals. The significant reduction in haemoglobin, packed cell volume and total erythrocyte count during anaesthesia and after recovery in all the animals could be attributed to the red blood cell sequestration to the spleen caused by isoflurane as reported by Bishop (2005) [1].

The mean ( $\pm$ SE) of serum urea nitrogen in mg per dL before premedication, during maintenance and after recovery were  $19.42 \pm 1.28$ ,  $17.31 \pm 2.01$  and  $17.71 \pm 1.74$ , serum creatinine in mg per dL before premedication, during maintenance and after recovery were  $1.82 \pm 0.31$ ,  $1.61 \pm 0.18$  and  $1.70 \pm 0.73$  and serum glucose in mg per dL before premedication, during maintenance and after recovery were  $65.72 \pm 1.21$ ,  $68.16 \pm 2.01$  and  $68.71 \pm 1.72$ . There was no significant changes in serum urea nitrogen, serum creatinine and total protein values except in Serum glucose observed during different stages of anaesthesia and the increased concentration of glucose during surgery may be due to  $\alpha$  adrenergic inhibition of insulin reduced the uptake of glucose (Kumar *et al.*, 2014) [2].

The anaesthetic recovery was smooth in all the animals with two animal showed signs of lameness due to prolonged recumbency. Adequate intravenous fluids, antibiotics and analgesics were given post operatively for 3-5 days. All Animal passed dung after surgery and rumen motility and rumination regained after three days. No signs of abortion were observed in the selected animals during the post anaesthetic follow-up. Regular wound dressing was done with 5% povidone-iodine and the sutures were removed on the 11th postoperative day and the animals were discharged.

### Summary and Conclusion

Dexmedetomidine was administered at the dose rate of 1µg per kg body weight i.v. and butorphanol at the dose rate of

0.02 mg per kg body weight in the anaesthetic protocol ensured good sedation, smooth induction, and good recovery for abdominal surgeries in cattle. It is concluded that use of dexmedetomidine and butorphanol found to be the suitable preanaesthetic in the anaesthetic protocol for general anaesthesia to carry out abdominal surgeries in cattle. Post anaesthetic follow-up revealed maintenance of pregnancy indicating that the protocol employed was safe in pregnant cattle.

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