

General anaesthesia of indigenous pigs in Bangladesh

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Abstract

Anaesthetic trials were conducted with propofol (P), xylazine-propofol (XP), xylazine-ketamine (XK), xylazine-thiopentone (XT) in 16 healthy indigenous pigs. Respiration rate decreased significantly ($P < 0.01$) five minutes after induction, and during maximum depth of anaesthesia, and had not returned to control value after recovery from anaesthesia with all anaesthetic combinations. Heart rate with P increased significantly ($P < 0.01$) five minutes after induction, whereas it decreased significantly ($P < 0.01$) with XP, XK and XT during anaesthesia and remained below the normal range after recovery from anaesthesia except after XP. In all anaesthetic sessions, rectal temperature decreased significantly ($P < 0.01$) in all stages of anaesthesia: after recovery the rectal temperature almost returned to control value in P and XP. Slight to moderate salivation was observed in all pigs with P and XP. It is suggested that P and XP combination seems to be suitable for general anaesthesia in pigs, but XP is more suitable. (*Bangl. vet.* 2013. Vol. 30, No. 2, 46 - 53)

Introduction

Improper handling of pigs causes considerable stress (Hau and Van Hoosier, 2003; Madrigal *et al.*, 2006). Pigs are often given local or regional anaesthesia, sedation or general anaesthesia (Ko *et al.*, 1993). Anaesthesia is frequently required for therapeutic procedures and experimental models (Toyama *et al.*, 2004; Wessler *et al.*, 2011) and major operative procedures (Arras *et al.*, 2001; Caulkett, 2003). The responses to anaesthetic agents are highly variable (Sessler, 1994; Gross, 2009; Schifilliti, 2010). Xylazine, α -adrenergic agonist has been used routinely as a premedicant in pigs (Pypendop *et al.*, 1996; Lee *et al.*, 2010). Ketamine hydrochloride is frequently used for sedation, induction of anaesthesia and analgesia (Ajadi *et al.*, 2008). Xylazine hydrochloride has commonly been used with ketamine hydrochloride for surgical anaesthesia in pigs (Gaertner *et al.*, 2008).

Thiopentone sodium is an intravenous agent used for induction of anaesthesia prior to inhalation anaesthesia or as a sole agent for minor procedures in animals (Riebold *et al.*, 1995; Tacheci *et al.*, 2013). The combination of thiopentone sodium with xylazine hydrochloride causes a longer recovery time (Hall *et al.*, 2001; Kate and Polly, 2000). Propofol is an intravenous anaesthetic agent, used for anaesthetic induction and maintenance (Glen and Hunter, 1984; Watkins *et al.*, 1987) and measures to monitor

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the anaesthetic depth have been reported (Ribeiro *et al.*, 2009; Silva *et al.*, 2011). Combinations of xylazine hydrochloride and propofol have been used as safe anaesthetic for goats (Amarpal *et al.*, 2002), dogs (Cullen and Reynoldson, 1997; Kim and Jang, 1999), and horses (Mama *et al.*, 1998). However, there is no record of using propofol and its combination to anaesthetize indigenous pigs in Bangladesh. The present study was carried out to investigate the effects of propofol, and combinations of propofol, ketamine hydrochloride and thiopentone sodium with xylazine hydrochloride in pigs.

Materials and Methods

Experimental animals

Sixteen anaesthetic sessions were performed in 16 healthy indigenous pigs during January to May, 2013. Age of the pigs ranged from 12 - 16 months and body weight from 12 - 15 kg. The animals were selected randomly regardless of their sex for each anaesthetic session from a nomadic herd. They had access to pasture for 6 - 8 hours a day and had a free access to water. All animals were routinely examined before anaesthesia. The study was conducted at Upazila (sub-district) Veterinary Hospital, Taraganj, Rangpur.

Study design

The pigs were divided into four groups:

Group-P: This group was treated with propofol alone (Pofol[®], Popular Infusion Ltd, Bangladesh) 4 mg/kg body weight, intravenously.

Group-XP: Pigs were treated with xylazine hydrochloride (Xylaxin[®] Indian Immunologicals Ltd, India) 1.1 mg/kg body weight, intramuscularly. After five minutes propofol was administered 4 mg/kg body weight, intravenously.

Group-XK: Xylazine hydrochloride of 1.1 mg/kg body weight was given intramuscularly and ketamine hydrochloride (G-Ketamine[®], Gonoshasthaya Pharmaceuticals Ltd., Bangladesh) administered 11 mg/kg body weight, intramuscularly after five minutes of premedication.

Group-XT: Freshly prepared 5% thiopentone sodium (G-Thiopental[®], Gonoshasthaya Pharmaceuticals Ltd, Bangladesh) 8 mg/kg body weight was given intravenously five minutes after xylazine hydrochloride injection.

Preparation and anaesthesia of animals

The animals were closely monitored from 72 hours prior to anaesthesia. Thorough clinical examinations were performed. The animals to be anaesthetized were isolated from others and starved for 12 hours. Anaesthesia was performed in the morning when temperature and humidity were lower.

Monitoring of clinical parameters

Respiratory and heart rates and rectal temperature were monitored five minutes prior to premedication, five minutes after induction of anaesthesia, during maximum depth of anaesthesia and after complete recovery.

Observation of physiological responses

Salivation, lacrimation, urination, defecation, protrusion of tongue and shivering were observed in all pigs during the period of anaesthesia.

Statistical analysis

Student's paired *t*-test for correlated data was used to analyse clinical parameters to determine whether the changes observed in the test levels significantly differ from control values. Analysis of Variance (ANOVA) in completely randomized design (CRD) was applied to analyse data regarding the parameters. Results were assessed by the Least Significant Difference (LSD) test in "MSTAT" computer program.

Results and Discussion

The respiration rate decreased significantly ($P < 0.01$) five minutes after induction, and during maximum depth of anaesthesia, and had not returned to control value even after recovery in groups XP, XK and XT. These results correspond with previous studies where respiratory depression was observed with a decrease in tidal volume and respiratory rate (Lumb and Jones, 1996; Murrell, 2007; Thurmon and Smith, 2007; Lee *et al.*, 2010). Ketamine is a potent respiratory depressant (Ramakrishna *et al.*, 1981; Schifilliti, 2010). Xylazine-ketamine anaesthesia decreased respiration rate (More *et al.*, 1993). However, decreased respiration rate might be due to depression of respiratory centres either by xylazine alone or by both xylazine and ketamine. Similarly, thiopentone decreased respiratory rate in sheep (Huang *et al.*, 1997). Moreover, thiopentone decreased respiration rate as a result of depression of central nervous system and reduction of the sensitivity of the respiratory centre to carbon dioxide (Hall *et al.*, 2001). In group P, a significant ($P < 0.01$) decrease in respiration rate was observed during maximum depth of anaesthesia. This result is similar to Carroll *et al.* (1998) who reported depression of respiration rate in animals when anaesthetized with propofol.

Table 1. Effects of different anaesthetic agents on respiratory rate in pigs

| Groups | Respiratory rate/minute | | | After recovery from anaesthesia |
|--------|------------------------------|--------------------------------------|-------------------------------------|---------------------------------|
| | 5 min prior to premedication | 5 min after induction of anaesthesia | During maximum depth of anaesthesia | |
| P | 28.5 ± 0.8 | 24.0 ± 0.7* | 21.0 ± 0.4** | 26.3 ± 0.9** |
| XP | 29.5 ± 1.3 | 20.5 ± 1.2** | 16.5 ± 1.0** | 20.5 ± 1.3** |
| XK | 29.3 ± 1.9 | 24.0 ± 1.8** | 20.5 ± 1.3** | 25.3 ± 2.0** |
| XT | 29.0 ± 2.0 | 19.3 ± 0.9** | 16.9 ± 0.8** | 22.0 ± 0.7** |

Values are presented as mean ± SEM, * Significant ($P < 0.05$) ** Highly Significant ($P < 0.01$)

P - Propofol; XP - Xylazine-Propofol; XK - Xylazine-Ketamine; XT- Xylazine-Thiopentone

During anaesthesia with P the heart rate increased significantly ($P < 0.01$) five minutes after induction but insignificantly decreased at different stages. Previous studies in sheep and dogs revealed higher heart rate when propofol was used alone (Kim and Jang, 1999). All anaesthetic combinations decreased heart rate significantly ($P < 0.01$) five minutes after induction, and it remained low during maximum depth of anaesthesia, and after recovery from anaesthesia with XK and XT, whereas heart rate returned almost to normal range after recovery from anaesthesia with XP. This corresponds well with the findings of Alkattan (2012) who reported deep sedation and bradycardia 1 - 3 minutes after injection of xylazine. This is due to decreased cardiac output caused by vagal activity. This result is similar to that of Ruffolo *et al.* (1993) where significant decrease in heart rate was found after administration of xylazine. Lumb and Jones (1996) observed decreased heart rate with thiopentone sodium. Significant decrease in systemic arterial blood pressure with a concurrent decrease in systemic vascular resistance after anaesthesia with XK was seen by Coulson *et al.* (1989). Increased heart rate with thiopentone and depression of the cardiac portion of the vagal centre has been recorded (Paddleford, 1999; Sogawa *et al.*, 2012). Cardiovascular depression observed might be due to the effect of the α_2 -agonist, decreases heart rate due to central and peripheral suppression of the sympathetic trunk, and its hypotensive effects (Lumb and Jones, 1996).

Table 2. Effects of anaesthetic agents on heart rate in pigs

| Groups | Heart rate/minute | | | After recovery from anaesthesia |
|--------|------------------------------|--------------------------------------|-------------------------------------|---------------------------------|
| | 5 min prior to premedication | 5 min after induction of anaesthesia | During maximum depth of anaesthesia | |
| P | 95.8 ± 4.0 | 99.5 ± 4.2** | 92.8 ± 3.4 | 93.8 ± 2.7 |
| XP | 97.5 ± 2.5 | 90.0 ± 2.9** | 85.5 ± 2.5 | 96.3 ± 2.0** |
| XK | 98.8 ± 3.3 | 90.0 ± 2.9** | 85.8 ± 3.8** | 93.0 ± 2.7** |
| XT | 102.0 ± 2.2 | 91.8 ± 2.0** | 86.8 ± 2.8** | 96.5 ± 1.7 |

Values are presented as mean SEM, *Significant ($P < 0.05$) ** Highly significant ($P < 0.01$)

P - Propofol; XP - Xylazine-Propofol; XK - Xylazine-Ketamine; XT- Xylazine-Thiopentone

Table 3. Effects of anaesthetic agents on rectal temperature in pigs

| Groups | Rectal temperature (°F) | | | After recovery from anaesthesia |
|--------|------------------------------|--------------------------------------|-------------------------------------|---------------------------------|
| | 5 min prior to premedication | 5 min after induction of anaesthesia | During maximum depth of anaesthesia | |
| P | 102.9 ± 0.1 | 102.4 ± 0.2** | 101.8 ± 0.1** | 102.6 ± 0.2 |
| XP | 102.6 ± 0.4 | 102.0 ± 0.4** | 101.6 ± 0.4** | 102.4 ± 0.5** |
| XK | 102.3 ± 0.4 | 101.8 ± 0.3* | 101.5 ± 0.3** | 102.0 ± 0.3 |
| XT | 102.8 ± 0.3 | 101.7 ± 0.6* | 101.2 ± 0.7* | 101.9 ± 0.6 |

Values are presented as mean ± SEM, *Significant ($P < 0.05$), ** Highly significant ($P < 0.01$)

P - Propofol; XP - Xylazine-Propofol; XK - Xylazine-Ketamine; XT- Xylazine-Thiopentone

Rectal temperature decreased significantly ($P < 0.01$) five minutes after induction, and during maximum depth of anaesthesia in P and XP after recovery from anaesthesia. A significant ($P < 0.05$) decrease in rectal temperature was observed five minutes after induction and during maximum depth of anaesthesia with XK and XT. Decrease in rectal temperature may be attributed to decrease in metabolic rate, and increase in heat loss (Paddleford, 1999) due to inhibition of skeletal muscle, peripheral vasodilatation and inactivation of the hypothalamic thermoregulatory centres (Kumar and Sharma, 1986; Sessler, 1994).

Slight to moderate salivation was observed in all pigs of groups P and XP. It has been reported that negligible salivation was observed with xylazine-propofol combination (Mirakhur *et al.*, 1988; More *et al.*, 1993). Profound salivation, urination, protrusion of tongue and shivering were observed with XT. These results correspond with Hofmeister *et al.* (2008) who reported protrusion of the tongue, which might be due to relaxation of pharyngeal muscles.

Table 6. Behaviour in pigs during anaesthesia

| Groups | Salivation | Lacrimation | Defecation | Urination | Protrusion of tongue | Shivering |
|--------|------------|-------------|------------|-----------|----------------------|-----------|
| P | - | - | - | - | - | - |
| XP | + (2) | - | - | + (2) | + (1) | - |
| XK | + (2) | - | - | + (1) | + (1) | - |
| XT | + (3) | - | - | + (2) | + (3) | + (2) |

+ Present; - Absent, Number indicates No. of pigs manifesting signs

P- Propofol; XP- Xylazine-Propofol; XK- Xylazine-Ketamine; XT- Xylazine-Thiopentone

Conclusions

Respiration and heart rates and rectal temperature are important during general anaesthesia of pigs. P and XP combination seems to be suitable for general anaesthesia, but XP is more suitable due to less effect on these clinical signs in pigs in Bangladesh.

Acknowledgements

The author is especially grateful to Dr. Md. Nure Alam Siddiki, Veterinary Surgeon, Taraganj, Rangpur and herd owner Mr. Prodip Horizone for their cooperation and encouragement throughout the study period.

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