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Variation in body temperature following blind, peripheral nerve stimulator and ultrasound guided RUMM block using 2% lignocaine in calves

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Abstract
The study was planned to be undertaken with the objective to evaluate the variation in body temperature following blind, peripheral nerve stimulator and ultrasound guided RUMM block using 2% lignocaine in calves. Twenty four calves were randomly distributed among four groups with six animals each- Groups A (anatomical landmark approach), B (nerve stimulator guidance), C (ultrasound guidance) and D (ultrasound-cum-peripheral nerve stimulator guidance). Rectal temperature was recorded by an inbuilt sensor of the multipara monitor before, immediately after drug administration and then at definite time intervals for a total of 180 minutes in all the groups. Data collected was subjected to statistical analysis following standard statistical procedures. In all the groups, there was a non-significant ($p>0.05$) increase in the body temperature at 1 minute post-procedure. Further, a non-significantly varying pattern of body temperature was observed until the end of the observation. The results of the study indicate that the use of 2% lidocaine via different techniques for RUMM blockade in calves did not alter the body temperature. Therefore, the body temperature cannot be taken as a reliable predictor of regional block success or failure.

Keywords: Body temperature, calves, lignocaine, peripheral nerve stimulator, RUMM block, ultrasound

Introduction
General anesthesia is never a good choice for large ruminants, owing to its side effects and equipment required for large animal anesthesia. Regional anesthetic techniques, being inexpensive are continuously evolving in veterinary medicine. Their use facilitates clinical work with the animal in the standing position, while providing analgesia with minimal adverse effects (Re *et al.*, 2016). Other benefits of regional anesthesia include reduced requirements of other anesthetic agents, effective analgesia (Edmondson, 2008; Ansón *et al.*, 2017; Hagag and Tawfiek, 2018) [2-4], minimal cardiopulmonary alterations, limited amount of equipment, minimized veterinary supervision, lowered cost of the procedure and avoidance of other known complications of general anesthesia (Skarda and Tranquilli, 2007) [5]. The use of objective methods to locate the target nerves, such as nerve stimulation and ultrasound, has reduced the failure rates associated with many of the techniques previously performed blindly (Lewis *et al.*, 2015; Munirama and McLeod, 2015) [6, 7] and decreased the incidence of block-related complications such as inadvertent vascular puncture (Campoy *et al.*, 2010) [8]. Nerve stimulation allows the inference of nerve location based on the electrical current required to elicit an effector muscle response, while ultrasound allows real-time visualization of the nerve, the needle-to-nerve relationship and the injectate distribution, which overcome the limitations of nerve stimulation (Portela *et al.*, 2013) [9]. When the two modalities i.e., peripheral nerve stimulator and ultrasound guidance are used together, they act synergistically. Rather than being biased toward one given modality, best overall results can be obtained by utilizing the advantages offered by each, used together when possible (Ralf *et al.*, 2008) [10].
Nerve blocks prevent regional manifestation of the major thermo-regulatory defenses including sweating, vasoconstriction, and shivering. This peripheral inhibition of thermoregulatory defenses is a major cause of hypothermia during regional anesthesia.
Regional anesthesia also impairs the central thermoregulatory control and the amount of inhibition is proportional to block height (Leslie and Sessler, 1996) [11]. Regional anesthesia typically causes core hypothermia; however, patients often feel warmer after induction

of anesthesia (Sessler and Ponte, 1990; Glosten *et al.*, 1992) [13]. But hypothermia commonly goes undetected during regional anesthesia.

Peri-operative hypothermia is a common and serious complication of anesthesia and surgery and is associated with many adverse peri-operative outcomes. It prolongs the duration of action of anesthetics (Leslie and Solly, 1995) [14]. Mild core hypothermia increases thermal discomfort (Kurz *et al.*, 1995) [15], and is associated with delayed post-anaesthetic recovery (Lenhardt *et al.*, 1997) [16]. Hypothermia adversely affects antibody and cell-mediated immune defenses (Wenisch *et al.*, 1996) [17], as well as the oxygen availability in the peripheral wound tissues. Furthermore mild hypothermia triples the incidence of post-operative adverse myocardial events (Frank *et al.*, 1997) [18]. Thus, even mild hypothermia contributes significantly to patient care costs and needs to be avoided. Etiologies of peri-operative increase in temperature include infection, non-infectious inflammation, or allergic reactions (Kotani *et al.*, 1997) [19]. Various drugs e.g. penicillins or anticholinergics may provoke an increase in temperature in patients undergoing surgery (Rosenberg *et al.*, 1986) [20]. Early post-operative rise in temperature may be caused by a normal inflammatory response induced by surgical stress rather than a postoperative infection and it may just be a manifestation of peri-operative stress (Negishi *et al.*, 2001) [21]. The anesthetic technique used during surgery appears to have little effect on post-operative fever (Thong *et al.*, 2002) [22]. However, if core temperature remains elevated for an extended period or develops at a later postoperative stage, infection is usually the cause (Freischlag and Busuttil, 1983) [23].

Keeping the scenario in view the study was planned to be undertaken with the objective to evaluate the variation in body temperature following blind, peripheral nerve stimulator and ultrasound guided Radial, Ulnar, Median and Musculocutaneous (RUMM) nerve block using 2% lignocaine in calves.

Materials and Methods

The study was conducted at Division of Veterinary Surgery and Radiology, Faculty of Veterinary Sciences and Animal Husbandry, SKUAST-Kashmir/Mountain Livestock Research Institute (MLRI) Manasbal. Twenty four young calves irrespective of sex in the age group up to six months, with the mean weight (50±10 kg) were used for the study. The animals were housed under similar managemental conditions. On each calf two experimental procedures were performed with an interval of two weeks. The animals were randomly distributed among four groups with six animals each based on the different techniques - Group A (by anatomical land mark approach), Group B (by peripheral nerve stimulator), Group C (under ultrasound guidance) and Group D (under both ultrasound and peripheral nerve stimulator guidance). A peripheral nerve stimulator cum locator (Inmed ™) with shielded needles (5 cm and 20 gauge; 14 cm and 20 gauge) and an ultrasound system (TELEMED CAB) with a 5-10 MHz linear transducer were used for peripheral nerve stimulator and ultrasound guided mid-humeral RUMM nerve block in calves in lateral recumbency respectively. Rectal temperature was recorded by an inbuilt sensor of the multipara monitor (CONTEC™) at before the block, immediately after drug administration and then at definite time intervals for a total of 180 minutes in all the groups. Data collected was subjected to statistical analysis following standard statistical procedures *viz.* analysis of variance (ANOVA) using statistical software (SAS), SAS Incorporation, USA, licensed to Division of Agricultural Statistics, SKUAST-Kashmir, Srinagar.

Results

The results of this study have been shown in table 1 and figure 1. In group A, the mean body temperature before the start of the study was 101.48±0.15 ^{0} F. The value did not undergo any significant alteration with time and decreased non-significantly ($p>0.05$) towards the end of the observation period (180 minutes) where the value was recorded as 101.28±0.15 ^{0} F. In the animals of group B, body temperature followed a non-significantly ($p>0.05$) decreasing trend from the pre-injection interval (101.80±0.16 ^{0} F) up to 90 minutes (101.68±0.19 ^{0} F) post-injection and thereafter showed a non-significantly ($p>0.05$) decreasing pattern up to 180 minutes (101.73±0.20 ^{0} F). Similarly in group C, the body temperature showed a non-significantly ($p>0.05$) decreasing trend from 0 minute (101.20±0.13 ^{0} F) up to 30 minutes (101.10±0.12 ^{0} F), a non-significantly ($p>0.05$) increasing pattern from 60 (101.13±0.15) to 120 minutes (101.22±0.14) and a further non-significantly ($p>0.05$) decreasing trend up to 180 minutes (101.15±0.12 ^{0} F). In group D, the mean body temperature prior to the block was 101.63±0.10 ^{0} F. The value did not undergo any significant change with time and non-significantly decreased ($p>0.05$) up to 10 minutes (101.50±0.15), increased up to 60 minutes (101.55±0.15) and increased again up to 120 minutes (101.50±0.13). Towards the end of the observation period (180 minutes), the value again increased non-significantly ($p>0.05$) to 101.53±0.12 ^{0} F. In nutshell, in all the groups, there was a non-significant ($p>0.05$) increase in the body temperature at 1 minute post-procedure. Further, a non-significantly varying pattern of body temperature was observed in all the groups until the end of the observation.

Table 1: The mean ± se values of body temperature (of) in different groups at various intervals of RUMM block in calves

Time (minutes)	Groups			
	A	B	C	D
0	101.48±0.15^{abA}	101.80±0.16^{bA}	101.20±0.14^{aA}	101.63±0.10^{bA}
1	101.33±0.17^{abA}	101.75±0.17^{bA}	101.20±0.13^{aA}	101.60±0.12^{abA}
5	101.31±0.16^{abA}	101.77±0.20^{bA}	101.17±0.13^{aA}	101.53±0.15^{abA}
10	101.28±0.19^{abA}	101.75±0.19^{bA}	101.17±0.14^{aA}	101.50±0.14^{abA}
15	101.30±0.17^{abA}	101.72±0.20^{bA}	101.17±0.14^{aA}	101.52±0.14^{abA}
30	101.28±0.17^{abA}	101.70±0.20^{bA}	101.10±0.12^{aA}	101.53±0.16^{abA}
60	101.28±0.17^{abA}	101.68±0.20^{bA}	101.13±0.15^{aA}	101.55±0.15^{abA}
90	101.28±0.16^{abA}	101.68±0.20^{bA}	101.13±0.15^{aA}	101.52±0.15^{abA}
120	101.28±0.15^{aA}	101.70±0.21^{aA}	101.22±0.14^{aA}	101.50±0.13^{aA}
150	101.28±0.17^{abA}	101.73±0.21^{bA}	101.15±0.13^{aA}	101.53±0.13^{abA}
180	101.28±0.15^{abA}	101.73±0.20^{bA}	101.15±0.13^{aA}	101.53±0.12^{abA}

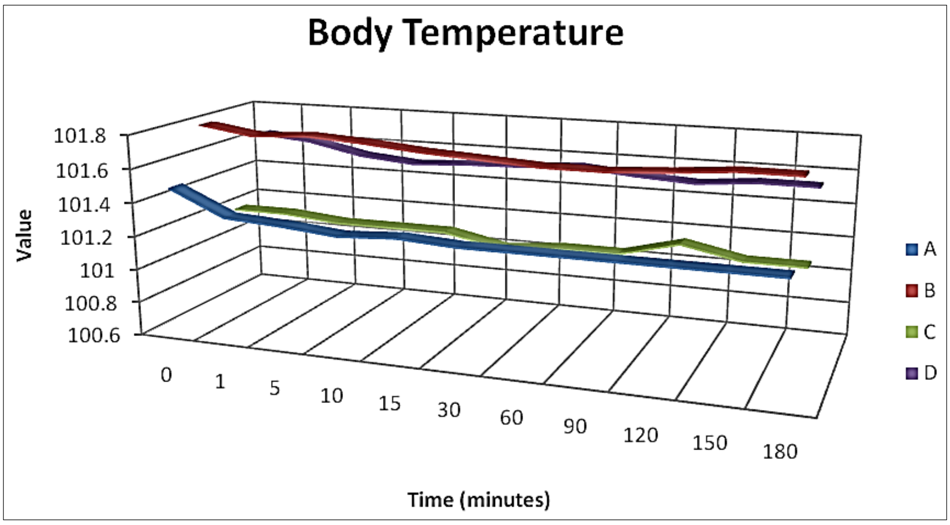

Fig 1: Showing variation of body temperature in different groups at different observational intervals

Discussion

Among all physiological parameters that are sensitive to the tiniest changes in domestic animals, temperature is the most classically measured and the most related to an important number of varied functions of the organism, such as nutrition, reproduction, activity, stress responses, and obviously preservation of health. Body temperature is modified when animals are placed in situations of stress or pain, as shown by Stewart *et al.* (2007, 2008 and 2010) [24-26] in calves, who attributed this modification to a consequence of the alterations in blood flow through capillary beds, mediated by sympathetic regulations. Rectal temperature is considered the reference for body temperature measurement and researchers have adapted devices for cows such as Reuter *et al.* (2010) [27] or for horses Green *et al.* (2005) [28] in order to record temperature continuously and automatically. In this study rectal temperature was recorded by an inbuilt sensor of the multi-parameter monitor.

There was a non-considerable increase in the body temperature all the groups at 1 minute post-procedure (table 1) which may be due to the struggling and restraint of the animal during pin prick. Further, a non-significantly varying pattern of body temperature was observed in all the groups until the end of the observation. Same results were observed by Ghadirian and Vesal (2013) [29] and Ghadirian *et al.* (2016) [30] in sheep after using 2% lidocaine for brachial plexus block.

Conclusion

There was a non-significant variation in body temperature in all the groups throughout the study period but remained within the normal range. The results of the study led to the conclusion that the use of 2% lidocaine via different techniques for RUMM blockade in calves did not alter the body temperature which advocates that the dose selected did not breach the safety margin. Further, the body temperature cannot be taken as a reliable predictor of regional block success or failure.

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