The Veterinary Journal 197 (2013) 515–518

Contents lists available at SciVerse ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Short Communication

Comparing lidocaine, bupivacaine and a lidocaine–bupivacaine mixture as a metacarpal block in sheep

Ignacio Lizarraga [a,*], Emily Janovyak [a], Thierry Beths [b,1]

[a] Department of Pathobiology, Ross University School of Veterinary Medicine, P.O. Box 334, Basseterre, Saint Kitts and Nevis
[b] Department of Clinical Sciences, Ross University School of Veterinary Medicine, P.O. Box 334, Basseterre, Saint Kitts and Nevis

ARTICLE INFO

Article history:
Accepted 21 December 2012

Keywords:
Sheep
Lidocaine
Bupivacaine
Local anaesthesia
Peripheral nerve block

ABSTRACT

Mechanical sensory blocking effects in the metacarpi of rams were compared following perineural injection of saline, 2% lidocaine (LIDO), 0.5% bupivacaine (BUPI), and a 1:1 (volume/volume) mixture of LIDO–BUPI. Saline was also administered in the contralateral metacarpi. Compared with the saline treatment and contralateral controls, the various treatments induced larger area under the curve (AUC) values 0–60 min post-treatment (AUC_{0-60}). Administration of BUPI and LIDO–BUPI also induced larger AUC_{60-120} values ($P < 0.01$). The AUC_{0-60} and AUC_{60-120} values with LIDO were less than those achieved with LIDO–BUPI and BUPI ($P < 0.001$), and AUC_{60-120} values with LIDO–BUPI were less than those obtained with BUPI ($P < 0.05$). Anaesthesia occurred within 5 min following the administration of all local anaesthetics and lasted longer in the case of BUPI (110.0 ± 47.3 min) than with LIDO (40.0 ± 13.2 min) ($P < 0.01$). The duration of anaesthesia was 86.9 ± 66.0 min with the LIDO–BUPI combination. Thus this combination offered no apparent advantages over the use of BUPI alone.

Lidocaine and bupivacaine combinations are used clinically to induce rapid and long-lasting sensory nerve blocks but there is conflicting information about their properties (Seow et al., 1982; Magee et al., 1983; Adetunji et al., 2001; Lawal and Adetunji, 2009). The aim of this study was to assess the onset, duration and the degree of metacarpal sensory block with 2% lidocaine (LIDO) and 0.5% bupivacaine (BUPI) alone and in combination (1:1) in rams. Following approval by the institutional ethical authority of Ross University School of Veterinary Medicine, four healthy Barbados Blackbelly rams (30.0–40.5 kg bodyweight and between 1 and 1.5 years old) were pen-housed and fed Guinea grass and concentrates twice daily. Water was provided ad libitum.

Two animals at a time were taken to a room with a controlled temperature of 24 °C. The right and left metacarpi were fitted with nociceptive devices consisting of a 2 mm diameter, blunt-ended pin pressed against the skin (Lizarraga et al., 2008). The force applied was incrementally increased (approximately 0.5 N/s) until the animal withdrew the stimulated leg (i.e. the nociceptive threshold) or 20 N was reached. At either point the applied force was recorded and removed. After a period of acclimatization of 10–15 min, five nociceptive thresholds were measured at 2–3 min intervals. At this point, the various treatments were injected and the thresholds measured again for up to 360 min. Whether the left or right metacarpi were stimulated first was alternated at all timepoints.

In a double control, cross-over, Latin-square, randomised, operator-blind design, saline (0.9%, 2 mL; negative control), LIDO HCl (Lidocaine HCl 2%, Hospira; 2 mL; pH 6.02), BUPI HCl (Marcaine 0.5%, Hospira; 2 mL; pH 5.19), and a LIDO HCl (1 mL)–BUPI HCl (1 mL) mixture (pH 5.96) were given SC into one forelimb to block the metacarpus. The contralateral forelimb was treated with saline (0.9%, 2 mL) as a negative control. The dorsal common and ulnar nerves in the dorsal aspect, and the median and ulnar nerves in the palmar aspect of the limb (Skarda, 1996) were sequentially injected by the same anaesthetist (0.5 mL for each treatment). The right limb was injected first and the completion of the last injection for each limb was considered time zero for that limb. At least 1 week elapsed between trials on each ram (Table 1).

Hourly areas under the threshold vs. time curves for 0–60 to 300–360 min (AUC_{0-60} to $AUC_{300-360}$) after treatment for individual forelimbs (baseline subtracted) were determined using the trapezoidal method. Differences between treatments and paired controls were assessed using repeated measures ANOVA followed by Tukey's test. Differences among treatments were analysed using one-way ANOVA followed by Bonferroni's test. Duration of anaesthesia, defined as the time elapsed between time 0 and the last time the cut-off point was reached, was assessed between treat-

* Corresponding author. Tel.: +869 465 4161x1395.
E-mail address: ilizarraga@rossvet.edu.kn (I. Lizarraga).
[1] Current address: Faculty of Veterinary Science, University of Melbourne, Werribee, Victoria, Australia.

1090-0233/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.tvjl.2012.12.029

Table 1
Distribution of treatments for each of the forelimbs of the four rams (279, 289, 302, and 286) used in the eight treatment trials (T). Each row represents each week. The shaded boxes represent the treated limb and the open boxes represent the contralateral limb injected with saline solution as negative control. LFL, left forelimb; RFL, right forelimb; BUPI, bupivacaine; LIDO, lidocaine.

T	Ram 279		Ram 289		Ram 302		Ram 286	
	LFL	RFL	LFL	RFL	LFL	RFL	LFL	RFL
1	BUPI	Saline	Saline	Saline	LIDO	Saline	Saline	LIDO-BUPI
2	Saline	LIDO	LIDO-BUPI	Saline	Saline	BUPI	Saline	Saline
3	Saline	LIDO-BUPI	BUPI	Saline	Saline	Saline	LIDO *	Saline
4	LIDO	Saline	Saline	LIDO-BUPI	BUPI	Saline	Saline	Saline
5	Saline	Saline	LIDO	Saline	Saline	LIDO-BUPI	BUPI	Saline
6	LIDO-BUPI	Saline	Saline	BUPI *	Saline	Saline	Saline	LIDO
7	Saline	BUPI	Saline	Saline	Saline	LIDO	LIDO-BUPI	Saline
8	Saline	Saline	Saline	LIDO	LIDO-BUPI	Saline	Saline	BUPI

* Data from LIDO at trial (T) 3 and BUPI at T6 were not included in the analysis since only a partial block that did not reach the 20 N cut-off, was achieved.

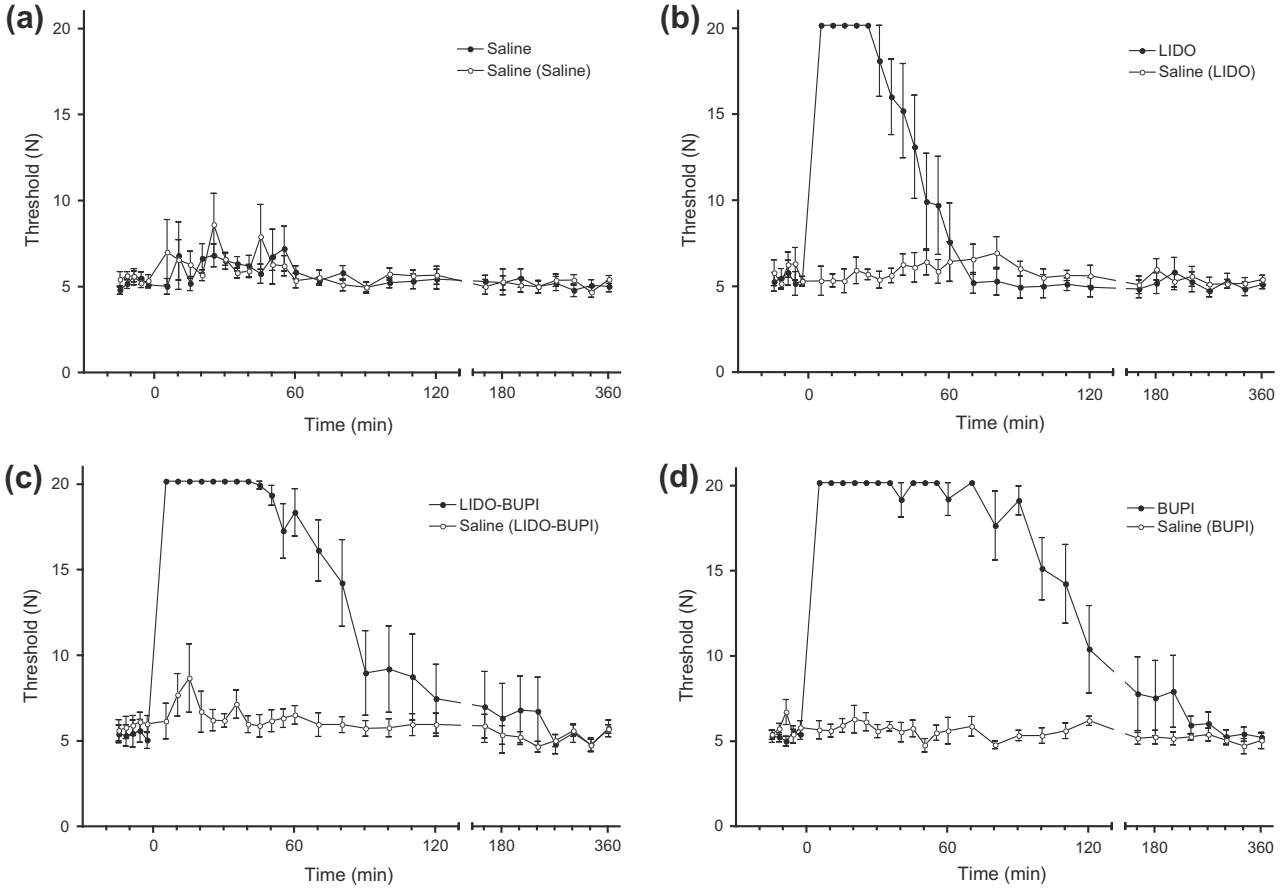

Fig. 1. Time course illustrating the effect of perineural administration of (a) saline (0.9% 2 mL), (b) lidocaine (LIDO) (2%, 2 mL), (c) lidocaine (2%, 1 mL) plus bupivacaine (0.5%, 1 mL) (LIDO–BUPI), and (d) bupivacaine (BUPI) (0.5%, 2 mL) taken together with the contralateral administration of saline solution (0.9% 2 mL) on mechanical nociceptive thresholds. Treatments were injected at time 0 min. Data are mean ± SD of 7–8 forelimbs of four rams.

ments using Kruskal–Wallis followed by Dunn's tests. The GraphPad Prism program (v4.0b for Macintosh) was used throughout and $P < 0.05$ was considered significant.

Local anaesthetics produced incomplete blocks on two occasions (Table 1) and these data were not analysed. Fig. 1 illustrates the effects of treatments and their contralateral saline controls on