

Use of an ice vest to elicit a cold response in neonatal lambs

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Introduction The ability of the neonatal lamb to respond to cold stress is considered vital to the likelihood of its survival in many sheep production systems. Various methods have been used to assess the neonatal lamb cold responses including progressively cooled water baths (Slee *et al.* 1990), temperature controlled chambers (Alexander 1961) and noradrenaline and other drug treatments which stimulate brown fat metabolism thereby mimicking a real cold exposure (Slee *et al.* 1987). This study compared body temperature responses induced by an ice vest to those induced by a noradrenaline challenge as a means of assessing individual lamb variation in cold responses.

Materials and methods The ice vest (IV) was similar to a small dog coat with an ice pack inserted to cover the lamb dorsally. Four treatments were used: C (control; coat with no ice insert worn for 20 minutes; n=10); 10min (ice vest worn for 10 minutes; n=10); 20min (ice vest worn for 20 minutes; n=10); 30min (ice vest worn for 30 minutes; n=10). All IV treatments occurred between 3 and 6 hours after birth. At 12 hours after birth, each lamb was given a 150µg/kg birth weight injection of noradrenaline (NA). Rectal temperature (RT) was logged every minute to measure the lamb's response. From the temperature response curves (Figure 1A and B), peak RT, time to peak RT, length of response, area under the curve, difference between peak and basal RT and time to reach basal +2sd RT were calculated. Data were analysed using PROC GLM in SAS 9.1. A Spearman rank correlation coefficient was calculated for these parameters to compare rankings between the IV and NA challenges.

Results and Discussion RT response curves are shown in Figure 1. For the IV challenge peak RT and time to reach peak RT did not differ across treatments. However the difference between peak and basal RT was significantly lower ($P<0.05$) for C lambs compared to 10min, 20min and 30min ($C=0.46^{\circ}\text{C}$, 10min = 0.73°C , 20min = 0.72°C , 30min = 0.77°C ; $se=0.06$). Length of response and AUC was significantly higher for 20min lambs compared to C and 10min lambs however it was not significantly different to 30min lambs. This was possibly due to the latter group beginning to approach their basal metabolic rate while the ice vest was worn as the time to reach basal +2sd following ice vest removal was significantly shorter for 30min lambs compared to all other lambs (30min=2.9 mins, C= 9.8 mins, 10min= 16.4 mins, 20min= 19.6 mins; $se= 3.24$ mins). The NA challenge elicited a significantly higher response compared to the cold challenge for peak RT (40.20°C vs 39.79°C), time to peak RT (23.98min vs 8.51 min), length of response (59.78min vs 32.18 min), AUC (2344.50 vs 1234.63) and difference between peak and basal RT (0.94°C vs 0.63°C). This suggests that an individual lamb's response to the NA challenge may not accurately reflect their ability to respond to a cold challenge. The non-significant Spearman rank correlation between the two challenges further supports this.

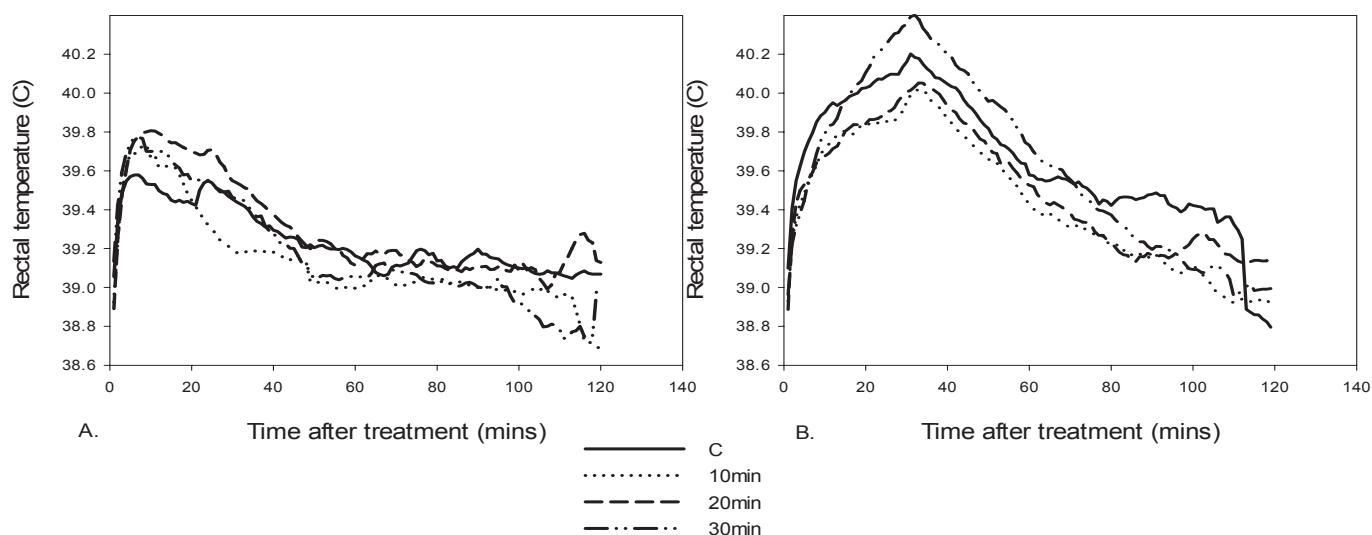


Figure 1 Rectal temperature response curves for each cold challenge (A) and noradrenaline challenge (B).

Conclusion From this study it appears that the ice vest could be a useful technique in determining the relative cold response capacity of a neonatal lamb but longer exposure times may be necessary. It appears that a single injection of noradrenaline at a dose of 150µg/kg may not accurately reflect the capacity of a lamb to respond to cold exposure.

References

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