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Magnetic Resonance Imaging of the Effects of an Ice Bag Treatment on Peroneal Artery Diameter

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OBJECTIVE

To quantify the effects of a 25-minute ice bag treatment on peroneal artery diameter using magnetic resonance angiogram.

DESIGN

Prospective cross-sectional study.

SETTING

Hospital with Magnetic Resonance (MR) room.

PARTICIPANTS

A convenience sample of 16 healthy adults between the ages of 21 and 35 (24.88 ± 4.3 years) were recruited, 9 female and 7 males; with a mean height and weight of 170.34cm and 75.73Kg, respectively. Skinfold thickness was between 3.5 and 15mm (7.25 ± 3.77 mm) at the treatment site. Participants were excluded from the study if they had any criteria excluding them from getting an MR Angiogram (MRA), any blood flow impairments, an allergy to ice, or if they were younger than 18.

INTERVENTION

A skinfold caliper measurement was obtained on the lateral calf to estimate the underlying adipose tissue. A T*3 weighted MRA was used to observe the changes in peroneal artery diameter at baseline, during treatment, and after treatment in 5-minute intervals. Treatment was the application of a crushed ice bag to the lateral lower leg for 25 minutes. An ImageJ plug-in enabled the measurement of the diameter of the peroneal artery.

MAIN OUTCOME MEASURES

The dependent variable was peroneal artery diameter (mm) with the independent variable time. A repeated measures ANCOVA was conducted for the dependent variable peroneal artery diameter (mm) with the independent variable time (baseline, 5 min post ice, 10 min post ice, 15 min post ice, 20 min post ice, 25 min post ice, 5 min post ice removal, 10 min post ice removal, 15 min post ice removal, and 20 min post ice removal). If the main effect for time was significant the a priori comparison of each time point to baseline was evaluated. The covariate included was skinfold thickness. Alpha level was set at <0.05 for all analyses.

RESULTS

The repeated measures ANCOVA revealed to be significant for time $F(9,135)=21.32$, $p=0.01$, $\eta^2=0.59$, $1-\beta=0.99$, but not for the covariate skinfold thickness ($p>0.05$). Following up with the pairwise comparison between each time point and the baseline condition, 10 minutes post ice application was statistically significant from baseline ($p=0.01$, mean difference= 0.28 mm). Statistical significance to baseline remained until 10 minutes post ice removal ($p<0.05$). At 15 minutes post ice removal there was no statistical significance compared to baseline. The inter-rater reliability for measuring peroneal artery diameter was good to excellent (range of 0.67-0.87) and the intra-rater reliability was excellent (range of 0.88-0.96).

CONCLUSION

During a 25-minute crushed ice bag treatment, statistically significant vasoconstriction occurred at the 10th minute and remained until 10 minutes post ice removal. This indicates that vasoconstriction occurs within 10 minutes of ice bag application. Additionally, skinfold thickness did not impact peroneal artery diameter. Future research should investigate the effects of cryotherapy on peroneal vessel diameter while the patient is active rather than sedentary.

KEY WORDS: *Cryotherapy, Vasoconstriction, Vessel Diameter, Blood flow*