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SHORT REPORT

Comparison of surf lifesaver pressure point control and a commercial arterial tourniquet for major lower limb haemorrhage: A randomised controlled crossover pilot trial

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Abstract

Objective: This pilot study compared non-medically trained surf lifesavers' (SLS) ability, after infographic training, to occlude the femoral artery using a pressure point (PP) *versus* an arterial tourniquet (AT).

Methods: Using a crossover design, eight SLS applied PP and AT to a participant's leg to occlude the femoral artery. Arterial flow, application time and perceived difficulty were recorded.

Results: PP achieved 89.7% and 50.8% blood flow reduction for PP and AT, respectively. Average application time was 50.63 and 113.5 s for PP and AT, respectively. Perceived difficulty using a Likert scale from 0 to 10 (0 being no difficulty and 10 being maximal difficulty) was 2.75 and 3.50 for PP and AT, respectively.

Conclusion: Infographic-trained SLS showed superior blood flow occlusion using PP. This pilot study will inform a larger trial for untrained beachgoers.

Key words: *femoral artery, haemostatic technique, massive haemorrhage, pressure point, tourniquet.*

Introduction

Limb trauma leading to arterial injury, such as that inflicted by a shark encounter, can be rapidly fatal.

International first-aid consensus[1] for major haemorrhage recommends the use of an arterial tourniquet (AT) as first-line treatment to control life-threatening external bleeding. The use of 'pressure points' (PP) where pressure is applied directly over a major artery proximal to the injury is not recommended due to low certainty of evidence.[1] The advantage of the AT is its capacity to continuously maintain pressure during victim transport. However, an AT is not readily and immediately available for use by first responders in non-military environments.

Since the 2020 international first-aid recommendations,[1] two further studies using PP have been published revealing reduction in blood flow by 90% in all subjects.[2,3] This reduction was maintained for up to 3 min in 97% of subjects.[3] The use of volunteers with medical training in these studies has led to concerns about the generalisability of these findings.

Although optimal first-aid management would involve rapid expert application of an AT, this is practically not possible by first responders in remote locations. Response time for a priority 1 Queensland ambulance is on average 8–17 min.[4] A patient with arterial injury requires immediate bystander first aid. To date the application of a commercial AT by medically untrained bystanders has not yet been evaluated and neither has the use of PP. Therefore, the objective of the present study was to investigate the ability of surf lifesavers (SLS) educated with an infographic to occlude the femoral artery using two different techniques: PP to the inguinal region and AT to the upper thigh.

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Methods

Trial design

A randomised, crossover design was used; participants completed both interventions and served as the recipient of the interventions. The pilot trial was reported according to the CONSORT extension statement to randomised pilot and feasibility trials.[5] Using the randomisation software in Microsoft excel a researcher generated a random allocation sequence for the order of interventions which was then assigned to participants. This pilot trial aimed to evaluate the feasibility of the procedural design and the ability to blind assessors to the intervention being received, as well as to generate preliminary estimates of effect size to inform a larger trial which will be based on medically untrained beachgoers (Appendix S1).

Ethics approval statement

The present study obtained ethics approval from Bond University Human Research Ethics Committee (JF01036). Informed consent was obtained from all participants.

Participants

SLS were chosen for this pilot trial, as they patrol beaches and are often the first responders for people who have been attacked by sharks. Eight SLS adults aged between 18 and 50 years, with no formal medical training beyond basic first aid, were eligible for the pilot trial. Participants completed a two-stage screening process through a questionnaire and ultrasound assessment to ensure participant suitability and safety. The study was conducted at the SLS club house.

Procedure details

Participants were assigned to perform PP and AT in their randomised order. The procedures were illustrated through two infographics. In the PP infographic, participants were instructed to apply pressure using their fist with their full body weight in the inguinal region at the midpoint of the inguinal crease as per the previous research.[2] For the AT technique, participants applied an AT to the recipient's upper thigh after reviewing an infographic adapted from manufacturer's instructions.[6] The time taken to review the infographic and complete each technique was recorded. The difficulty level of each technique was assessed using a Likert rating scale from 0 to 10 (0 being no difficulty and 10 being most difficult).

Once the participant understood the method, they then applied AT or PP in the order they were randomised to the recipient. A 5 min wash out period occurred between the techniques to maintain blinding of the assessor. Arterial flow in the distal femoral artery was recorded using a linear transducer (Phillips ultrasound unit, lumify 4.0, L12-4). The participant indicated to the researcher that the technique was applied. The sonographer then measured the arterial flow velocity. The peak systolic velocity (cm/s) was measured using pulsed-wave Doppler ultrasound both before and during the intervention.[7] The clinician sonologist was blinded to each procedure using a bed sheet between participants and wore noise cancelling headphones. The participant then completed the second technique on the same leg, and the above procedure was repeated. Three measures were recorded and averaged for both baseline and during application.

Outcomes

The primary outcome of interest was percentage reduction in blood flow. Secondary outcomes included whether full blood flow cessation was achieved (i.e. 100% peak systolic velocity reduction), application time and perceived difficulty of application. To determine the effectiveness of blinding, clinician sonologists were asked to state which technique they believed was applied first.

Continuous outcomes were reported as mean (±standard deviation) and median (interquartile range). Binary outcomes were reported as number and percentage of total. As this was a pilot trial, formal sample size determination and hypothesis testing were not conducted.

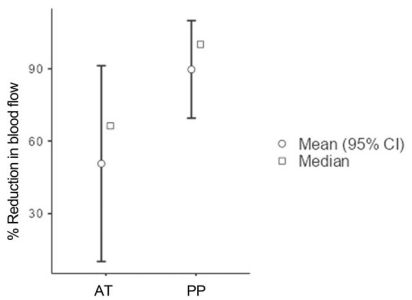

Figure 1. *Box plot presenting mean and median reductions (expressed as a percentage) in blood flow following the application of pressure point (PP) and arterial tourniquet (AT). CI, confidence interval.*

TABLE 1. *Descriptive information for all surf lifesavers* (n = *8)*

	Mean (SD)	Median (IQR)
Age (years)	35.6 (10.6)	37.5 (14.0)
Limb circumference (cm)	51.6 (3.2)	51.0 (6.0)
Time to apply PP (s)	50.6 (16.0)	45.5 (20.0)
Time to apply AT (s)	114.0 (32.9)	126.0 (54.5)
Perceived difficulty for AT (0–10)†	3.5 (2.3)	3.0 (3.5)
Perceived difficulty for PP (0–10)†	2.8 (2.8)	1.50 (4.5)

†Perceived difficulty was measured from 0 (no difficulty) to 10 (maximal difficulty). IQR, interquartile range; SD, standard deviation.

TABLE 2. *Comparison of pressure point (PP) and arterial tourniquet (AT) methods on arterial blood flow*

	PP (SD)	AT (SD)
Number of participants	8	8
Mean reduction in blood flow expressed as percentages†	89.7 (29.1)	50.8 (58.5)
Full blood flow occlusion‡	7 (87.5%)	4 (50%)
Clinician sonologist guesses first technique§	0/2 (0%)	2/6 (33%)

†Reduction in blood flow was measured through peak systolic velocity. ‡Full blood flow occlusion was determined if no flow was measured when the technique was applied. §To determine effectiveness of blinding, the sonographer was asked to guess which of the two techniques were applied first. SD, standard deviation.

Results

The mean reduction in blood flow was 89.7% for PP and 50.8% for AT. Full blood flow occlusion was observed in 87.5% of participants (seven out of eight) for PP and in 50% of participants (four out of eight) for AT. The mean difference between the two measures was 39.0% in favour of PP. Average application time was 50.63 and 113.5 s for PP and AT, respectively. Participants rated the mean perceived difficulty as 2.8 and 3.5 for PP and AT, respectively. The clinician sonologist correctly guessed the first technique applied in only two out of eight participants. All participants tolerated receiving the techniques and no adverse events were recorded (Fig. 1).

Key results specific to demographics and outcomes are illustrated in Tables 1 and 2.

Conclusion

The results of this small pilot study suggest PP may be more effective, faster and easier to apply than AT in reducing arterial blood flow when applied by SLS participants. Blinding methods appeared effective, indicating sonographers were able to determine an unbiased estimate of the primary outcome. The study indicates that when the only form of training is an infographic and the cohort being assessed is not formally medically trained, the PP technique shows promise as an alternative to AT. It may be considered that PP is a lifesaving technique and bridging measure until a more definitive solution is available. A larger, randomised crossover trial is indicated to formally assess the effectiveness of PP compared to AT for the occlusion of femoral blood flow in medically untrained beachgoers.

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Competing interests

None declared.

Data availability statement

The data that supports the findings of this study are available in the supplementary material of this article.

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Supporting information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Appendix S1. Pilot trial procedure.