# New Technique for Measuring Limb Occlusion Pressure Facilitates Personalized Tourniquet Systems: A Randomized Trial

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**Introduction/Purpose:** Optimal tourniquet safety depends on accurately determining the minimum pressure necessary to achieve a bloodless surgical field, known as a patient's limb occlusion pressure (LOP). However, LOP is not yet routinely measured in all patients due to limitations of current techniques. We have evaluated a novel technique for measuring the LOP through the tourniquet cuff that overcomes many limitations of current LOP measurement techniques.

**Methods:** The new technique of measuring LOP involves the use of unique dual-purpose disposable tourniquet cuffs along with a tourniquet instrument containing LOP calculation sensors and software.
A randomized crossover multicenter trial with 143 pre-surgical or post-surgical patients enrolled in the study. Pneumatic cuffs were applied to the non-operative upper and lower limbs and LOP was measured using the new technique and the Doppler ultrasound technique.
For each patient a set of four LOP measurements was taken, using the new technique (experimental) and the Doppler technique (control) on one upper and one lower limb.
Blinding was achieved during LOP measurement by using two experimenters and blinding the experimenter who measured the LOP using Doppler ultrasound from the LOP reading using the new automatic technique. Participants were blinded from all LOP measurement results by keeping the displays of measurement equipment out of their view.

**Results:** The differences between the new technique and Doppler technique were neither statistically nor clinically significant and the new technique is as robust as the Doppler technique. The results of this study can be used to develop personalized tourniquet systems consisting of unique dual-purpose cuffs connected to instruments suitable for measuring tourniquet LOP with the new measurement technique. The simplicity, effectiveness, and accuracy of this technique should lead to broader clinical usage and acceptance of LOP measurement, thus leading to safer, personalized pressures in surgical tourniquet applications.

**Conclusion:** The new technique is equally robust as the Doppler technique. Both techniques worked successfully in the 252 limbs from which usable data was collected. Of the 34 limbs for which there were data collection errors or exclusion, only two measurements were excluded because of an instrument error using the automatic technique compared to one measurement excluded because of a Doppler technique measurement error.

**Table 4 LOP Difference (New-Doppler)**

| Limb | No. of Limbs | Diff. (mmHg, Mean ± SD) | Std. Error Mean (mmHg) | 95% Confidence interval of the difference (mmHg) | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| Upper | 134 | 0.99 ±7.79 | 0.67 | -0.34 | 2.32 |
| Lower | 118 | 0.08 ±15.03 | 1.38 | -2.66 | 2.82 |
| Combined | 252 | 0.56 ±11.73 | 0.74 | -0.90 | 2.02 |

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