ONR/MARCORSYSCOM TOURNIQUET EVALUATION

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ATACCC 2005

15 August – 18 August 2005

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Project Goal

Test 5 candidate tourniquets (Tqt) for their application time and their ability to occlude blood flow.

1. Combat Application Tourniquet (CAT)
2. Mechanical Advantage Tourniquet (MAT)
3. One Handed Tourniquet
   i. OHT1 (1” width)
   ii. OHT2 (2” width)
4. Tourni-Kwik
5. Quickette

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Technical Approach/Methodology

1. Pre-application Exercise
2. Immerse Tqt in blood analog solution and roll in sand
3. Apply Tqt while blindfolded and seated or lying supine (5 min time limit)
   i. Upper arms
   ii. Thighs
4. Doppler flow call
5. Electrical impedance plethysmography

Repeat sequence on remaining extremities.

Order effects minimized.

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Results & Discussion

Table
Number of Tourniquet Applications (n) and Failures

		Failure Type	
Tourniquet	**n**	Mechanical	Application
CAT	40	1	0
MAT	40	2	0
OHT1	17	0	0
OHT2	23	0	1
QUICK	40	12	0
TK	40	1	0

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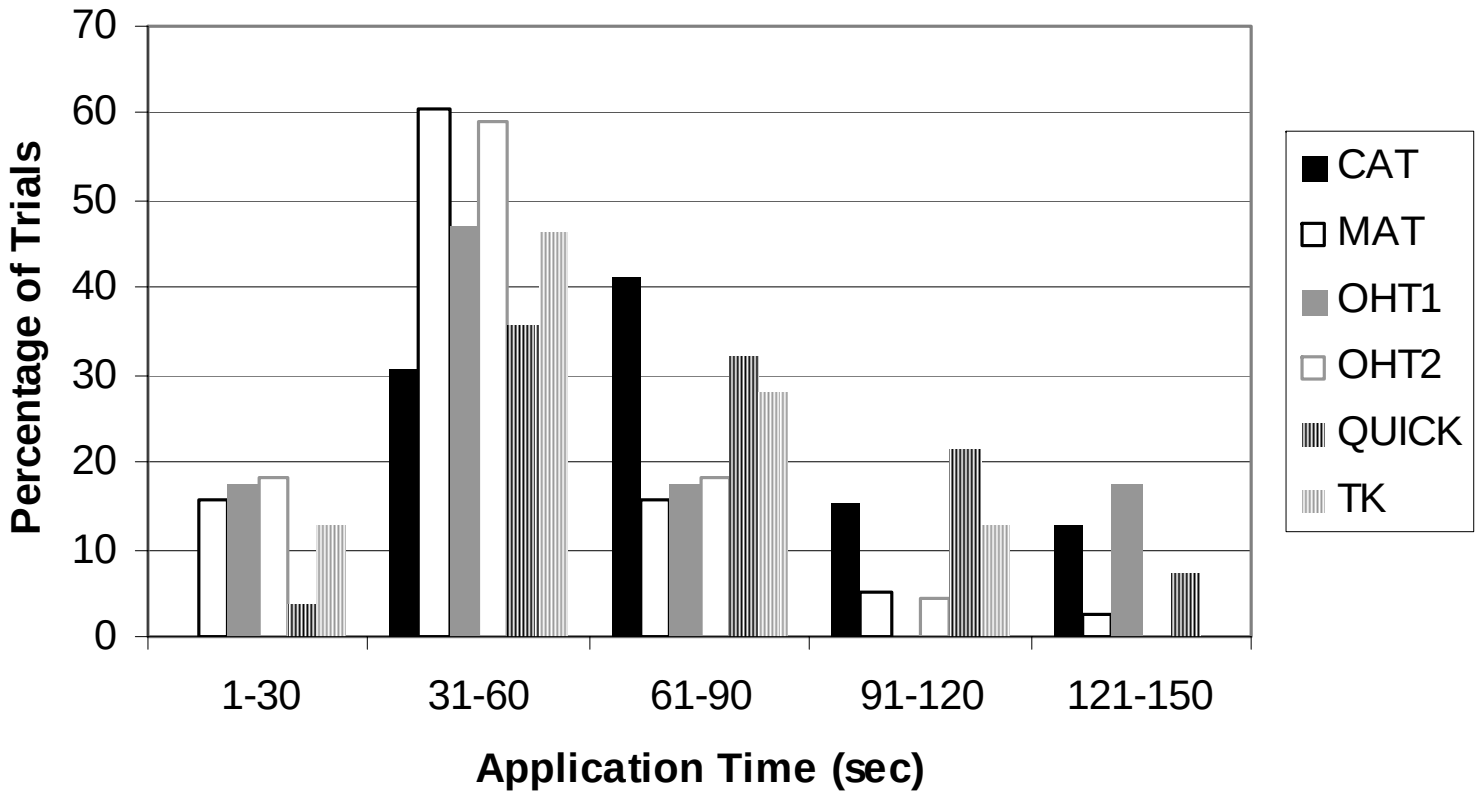

Figure 1. Percentage of tourniquet trials within arbitrarily selected 30-sec application latency time intervals. Arm and leg applications are pooled since there were no statistical differences in mean application times between upper and lower extremities. Illustrated data are limited to trials in which the subject was able to apply the tourniquet within 150 sec.

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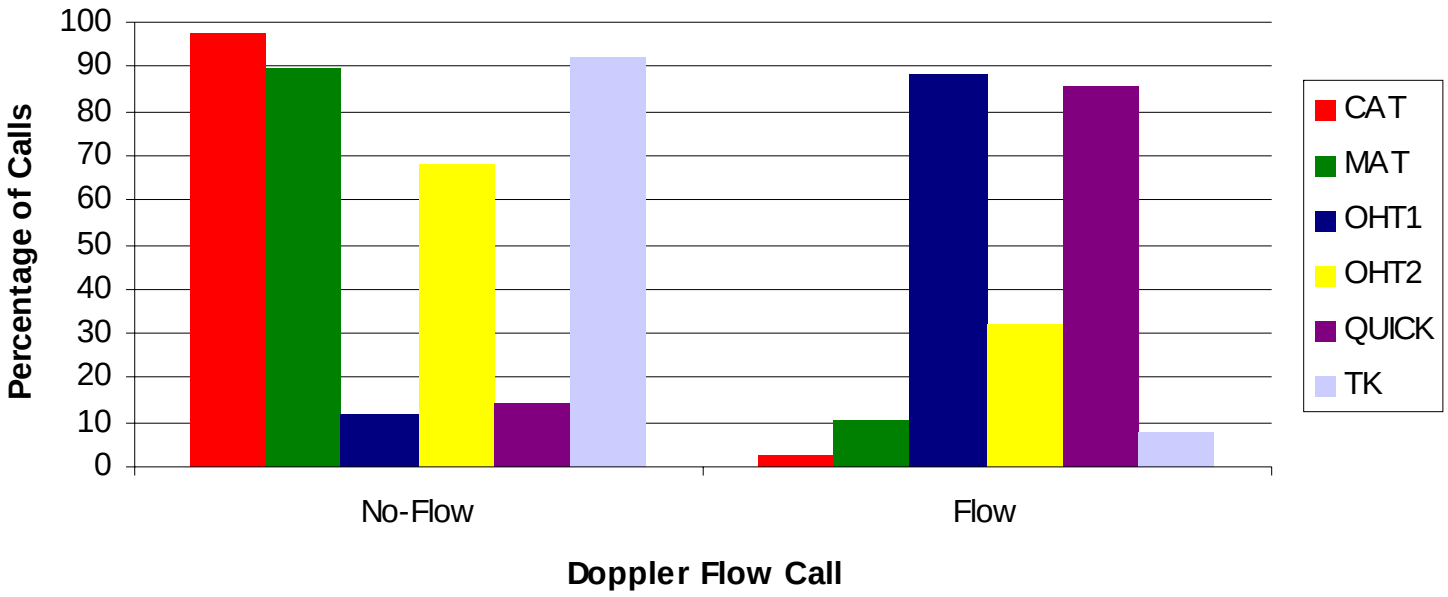

Figure 2. Percentage of Doppler flow calls across tourniquets. Illustrated data are limited to trials in which the subject was able to apply the tourniquet within the 5-min allowed.

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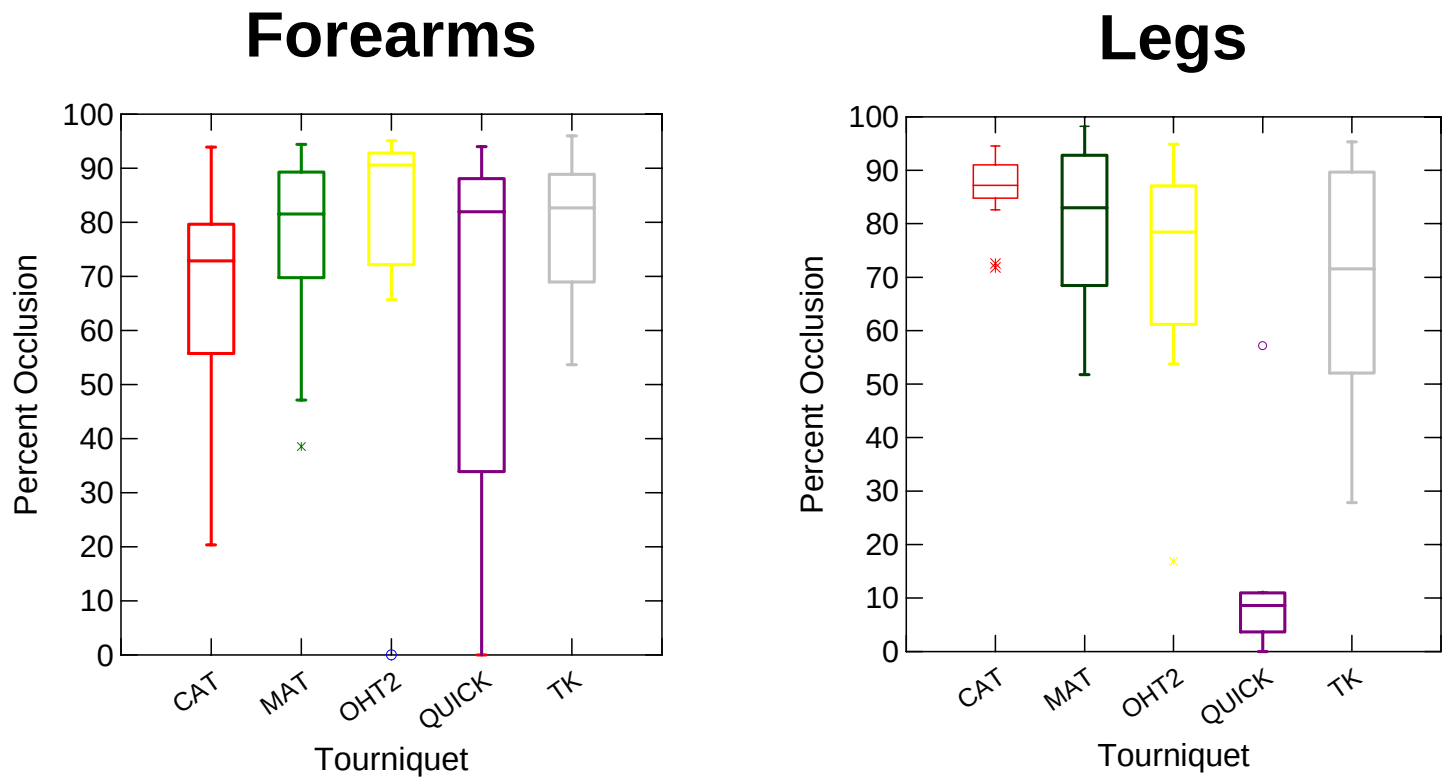

Figure 3. Percentage of arterial occlusion as indicated by IPG. Post-application IPG blood flows were decreased in too few trials (n=3) with OHT1 to warrant inclusion here. Illustrated data for the other tested units are limited to trials in which post-application IPG blood flows were decreased.

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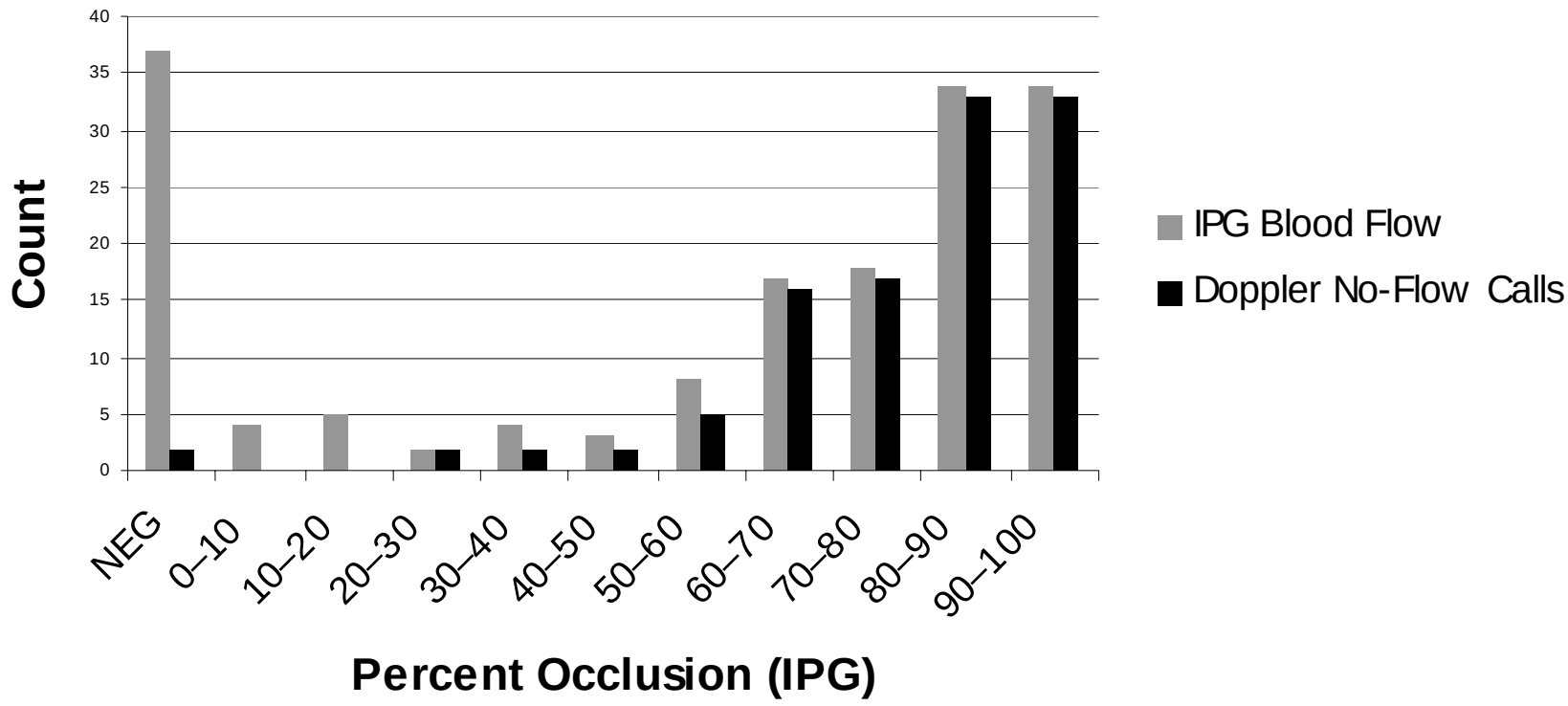

Figure 4. Frequency distributions of occlusion efficacy and corresponding Doppler No-Flow calls for all trials (n = 166) in which IPG blood flow data were successfully acquired. The bin labeled “NEG” gives the counts for cases in which IPG blood flow was *increased* after tourniquet application. Substantial IPG blood flow (20-40%) remained in large numbers of trials for which Doppler No-Flow calls were made.

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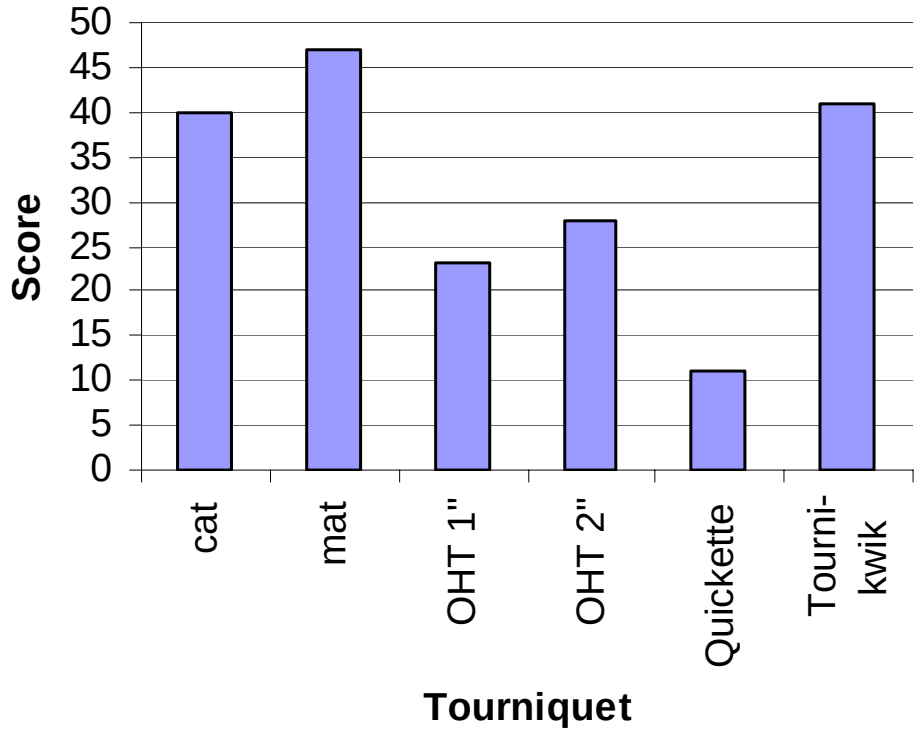

Figure 5 Totals of subjective rank scores ascribed by the test subjects to the six tourniquets evaluated in this work.

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Conclusions & Recommendations

1. All tourniquets except the OHT1 and Quickette performed reasonably well on arms and legs, with median occlusion efficacies exceeding 70%. The occlusion efficacies of the OHT1 and Quickette were poor or inconsistent.

2. The Quickette had an unacceptably high mechanical failure rate (30%).

3. The occlusion efficacies of the CAT, MAT, OHT2, and Tourni-Kwik were statistically indistinguishable. These tourniquets also had low mechanical failure rates and clinically acceptable application times.

4. The MAT and OHT2 are two or more times heavier than the other candidate tourniquets, while the MAT and Quickette occupy the most stowage volume.

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Conclusions & Recommendations

5. Based on subjective impressions, test subjects ranked the MAT as their overall favorite, followed closely by the Tourni-Kwik and the CAT. The other 3 tourniquets were ranked substantially lower.

6. Familiarization training should accompany deployment of any self-applied tourniquet, because simple perusal of the instructions provided by the manufacturer is not sufficient to ensure proper application when the need arises.

7. Additional research is recommended to investigate increases in blood flow that might occur with inadequate tourniquet application.