Scholar: Pilot and Validation Studies ISSN: 2689-7644
Volume 4 Issue 2 Pages: 10 – 12 DOI:10.32778/SPVS.71366.2023.41

Improvised tourniquets can cease blood flow in a crisis situation

Authors: Brian N. Fink, PhD, MPH[1], Jeff W. Schneiderman, BS, EMTP, EMSI[2], Shaza Aouthmany, MD[3]

Affiliations:

1) University of Toledo School of Population Health, Toledo, OH 2) University of Toledo Program Director, EMS Education, Toledo, OH 3) University of Toledo, Emergency Medicine, Toledo, OH

Keywords: mass casualty incident, active shooter, band, windlass

Abstract:

Introduction:

In a crisis, such as an active shooter situation, the use of a tourniquet or tourniquets may be necessary for the preservation of life. Depending on the location of the incident and the body sizes of the victims, what materials are used for the band and windlass will ultimately vary.

Methods:

We used an ultrasound with one improvised tourniquet example of a phone receiver and necktie, which one could arguably find in places including but not limited to a school, healthcare facility, shopping mall, and sports arena; to prove the concept of blood flow cessation. This IRB-approved study used a gentleman with a height of six feet and a weight of 225 pounds.

Results:

When the necktie (the improvised band) and the phone receiver (the improvised windlass) were used together as a tourniquet on the forearm of the gentleman, his arterial blood flow stopped, as determined by visual inspection of the ultrasound screen.

Conclusion:

Though some research indicates improvised tourniquets will fail, this will not likely not stop people from administering bleeding control assistance during a crisis. We wanted to prove the concept that an improvised tourniquet can work at ceasing the flow of blood, thereby not fail. If the proper band and windlass are used, blood flow can be stopped and a life can be saved.

Article History: Date received: 08/12/2023 Date revised: 01/15/2024 Date accepted: 01/16/2024
Corresponding Author: Brian N. Fink **E-mail:** brian.fink2@utoledo.edu

Introduction:

Commercial tourniquets, such as the Combat Application Tourniquet (CAT), are readily available for purchase on the internet for a cost of approximately $30. While it would be ideal if everyone on the planet owned at least one commercial tourniquet and always carried it with them, it is unrealistic. A recent, retrospective review of intentional mass casualty incidents recommends that planners at public venues equip their sites with supplies to treat a minimum of twenty victims.[1]

In the United States, mass shootings happen frequently. Without a commercial tourniquet on your person, you must do whatever necessary to prevent the loss of life. Use of an improvised tourniquet may be your only option and it will give a victim the chance to survive their injuries. Though there is research and concern that an improvised tourniquet will fail,[2] failure depends on a variety of factors that may or may not include what was used.[2,3] We wanted to determine if a necktie and a phone receiver used as the strap and windlass, respectively, can completely stop an extremity bleed, just like its commercial counterpart.

Methods:

Following University of Toledo Institutional Review Board (IRB) approval (#300125-UT), we assessed the efficacy of both a combat application tourniquet (CAT) and an improvised tourniquet by applying each one, separately, on a forearm of a living human being who was six feet tall and weighed 225 pounds. After applying each tourniquet, using a handheld, portable ultrasound; we visually determined blood flow cessation by watching the screen and observing the cessation of arterial pulse.

ISSN: 2689-7644
Volume 4 Issue 2 Pages: 10 – 12
DOI:10.32778/SPVS.71366.2023.41

The improvised tourniquet consisted of a necktie (100% polyester, Ralph Marlin® ice cream tie) as the strap and a phone receiver as the windlass. While these items may not be ubiquitous, it would be fair to say they are commonly found in venues including, but not limited to, healthcare facilities, schools, shopping malls, restaurants, places of worship, and office buildings.

Results:

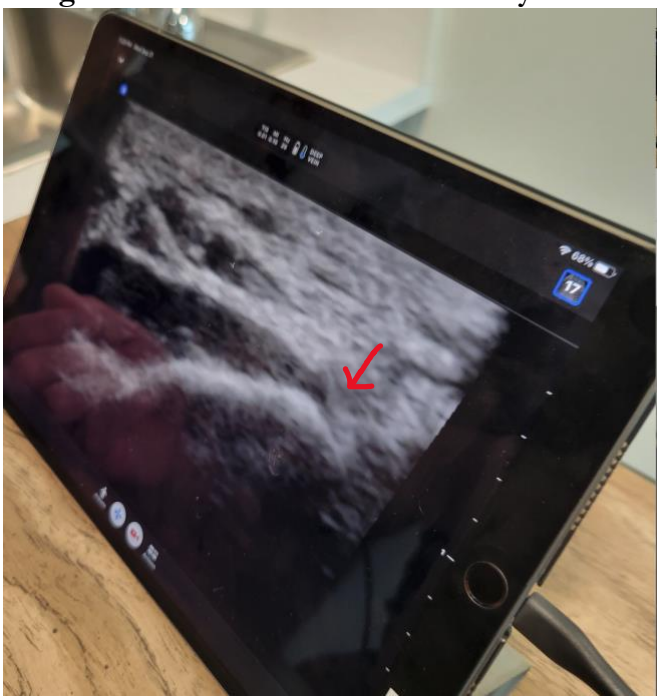
We observed that the improvised tourniquet, consisting of the necktie and phone receiver, did stop blood flow and ceased the arterial pulse. This did cause our participant significant pain, so we did remove the tourniquet as soon as possible following our ultrasound screen observation and photos taken (Image 1).

Image 1: Improvised tourniquet

100% polyester, Ralph Marlin® ice cream tie and phone receiver as the windlass

As expected, we observed the same cessation of arterial blood flow with the commercial tourniquet (Image 2).

Image 2: Ultrasound of occluded artery



Red Arrow: Arterial occlusion location

This demonstrates an improvised tourniquet, with sturdy strap and windlass and proper technique, can stop bleeding.

Discussion:

What we have done is demonstrate the concept that stopping the bleed with an improvised tourniquet can work. However, we must include the caveat that depending on the size of the victim, a different windlass and/or strap may be necessary or multiple tourniquets may need to be applied for the cessation of blood flow. Without a strong, sturdy windlass, improvised tourniquets are destined to fail.[4] While it would be ideal for everyone to carry a commercial tourniquet on their person at all times, this is not feasible and more of an aspiration in an ideal world. However, there may be windlasses (and straps) available in a crisis, such as an active shooter situation. The general public needs to have situational awareness of what possible tools may exist in any environment.

Potential, effective windlasses, depending on the location, may include but are not limited to the following when outdoors, including entertainment venues: stick, fishing pole, trowel, cultivator, cane, microphone, and microphone stand. When inside a building, such as but not limited to a school, hospital,

or shopping mall, one could use a phone receiver, intravenous pole, stethoscope, golf club, baseball bat, broomstick, rolling pin, metal spoon, paintbrush, jack handle, and wrench.

For sturdy straps, clothing is always an option. Examples include but are not limited to: necktie, scarf, shirt, pantyhose, and a towel. These may seem like "last resort" devices because of their improvisational nature. However, in life-and-death situations, use of an improvised tourniquet may truly be the first and only resort for stopping the bleed before emergency responders arrive. A securing mechanism (e.g., duct tape) may not be available and thus the rescuer may be unable to treat others.[4]

Conclusion:

Though the pain of secured, improvised tourniquet will be great, in addition to the existing wound pain, it is temporary and may prevent death. Given the choice of not having a commercial tourniquet in your possession and allowing a victim to exsanguinate, or applying an improvised tourniquet, we would hope both the victim and rescuer will choose life and choose the tourniquet.

Author Contributions:

Brian N. Fink was the principal investigator and lead the implementation of this study, did the data entry, analysis, and assisted writing the manuscript. Jeff W. Schneiderman assisted in writing the manuscript, served as the test subject for the tourniquet, and helped use the venous doppler. Shaza Aouthmany assisted in writing the manuscript and interpreting the venous doppler results.

Funding Sources: None.

Potential Conflicts of Interest Disclosures:

The authors disclose that there were no conflicts of interest or financial support in the development of this project. All data is authentic and accurate.

References:

1) Goolsby C, Strauss-Riggs K, Rozenfeld M, Charlton N, Goralnick E, Peleg K, et al. Equipping Public Spaces to Facilitate Rapid Point-of-Injury Hemorrhage Control After Mass Casualty. Am J Public Health. 2019 Feb;109(2):236-241. doi: 10.2105/AJPH.2018.304773. Epub 2018 Dec 20.
2) Altamirano MP, Kragh JF Jr, Aden JK 3rd, Dubick MA. Role of the Windlass in Improvised Tourniquet Use on a Manikin Hemorrhage Model. J Spec Oper Med. 2015 Summer;15(2):42-46. doi: 10.55460/DTPO-G5OG.
3) Kragh JF Jr, Wallum TE, Aden JK 3rd, Dubick MA, Baer DG. Which Improvised Tourniquet Windlasses Work Well and Which Ones Won't? Wilderness Environ Med. 2015 Sep;26(3):401-5. doi: 10.1016/j.wem.2014.12.028. Epub 2015 Mar 12.
4) Rohrich C, Plackett TP, Scholz BM, Hetzler MR. Proficiency in Improvised Tourniquets for Extremities: A Review. J Spec Oper Med. 2019 Fall;19(3):123-127. doi: 10.55460/5XTW-C355.