**Clinical question.**

When direct pressure fails to stop bleeding does the administration of a tourniquet improve outcome?

*Is this question addressing an intervention/therapy, prognosis or diagnosis? Intervention*

State if this is a proposed new topic or revision of existing worksheet: Review of 2005 worksheet

**Conflict of interest specific to this question**

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet?  
- Susanne Schunder-Tatzber has no intellectual or financial conflicts of interest.

**Search strategy (including electronic databases searched).**

Medline: MESH words *tourniquets* and text word *Trauma*, tourniquets and hemorrhage, tourniquet and emergency, tourniquets and First Aid, tourniquet and pre hospital, tourniquet and adverse effects; extremity bleeding and stop bleeding, Fist Aid and stop bleeding, limb bleeding and stop bleeding, severe bleeding and stop bleeding, hemorrhage & wounds & First Aid, hemorrhage & wounds and pre hospital, compression bandage, pressure bandage & control bleeding, severe extremity hemorrhage & control bleeding, hemorrhage & pressure dressing,

MEDLINE -Current (1970 - Current)  
All EBM Reviews – Cochrane Library (Cochrane Database of Systematic Reviews (CDSR)  
Review of the European First Aid Guidelines  
Relevant article were also searched for other citations and via hand search

• **State inclusion and exclusion criteria**

Training text without scientific evidence, overview on history on the application of tourniquets were excluded. Reviews and Metaanalysis were included.

• **Number of articles/sources meeting criteria for further review:**

52 articles were reviewed, 32 taken into closer consideration for the citation list and 22 finally cited – studies on types of tourniquet devices and papers not directly relevant to the First Aid setting (mainly tourniquets in surgical setting) were excluded in the final version.
### Summary of evidence

#### Evidence Supporting Clinical Question

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<th>Level of evidence</th>
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**Evidence neutral to clinical question**

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<td>Kam (Review) 2001A,C</td>
<td>Mohler 1999 A, C</td>
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<td>Sapega A 1985</td>
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<td></td>
<td>Brodie 2007 E</td>
<td>German 1997 A</td>
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<td>Gunji 2003 A</td>
<td>Iwama 2002 A</td>
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<td>Korth 200 A</td>
<td>Richey; 2007 E</td>
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**Evidence opposing clinical question**

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**Husum H. 2003 E**

**Van de Velde (Metanalysis), 2006E**

**J. Navein 2003 E**
REVIEWER’S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

As medical history literature shows, there seems to over the centuries an endless controversy if there is a need for the usage of tourniquets in pre-hospital care and First Aid and if this is a beneficial or harmful procedure.

In the papers written in the last 20 years the controversy continues and only very limited scientific data is available to develop a more evidence-based decision, on what should be thought to lay persons in First Aid courses. Very interesting was the fact that we find in many papers a very passionate argumentation and the expression “we believe”, when recommending the usage of tourniquets (e.g., Kalish 2008) – very unique in comparison to other scientific medical literature in EBM times!

On the first sight the increase of papers with a military background in the last years seemed to give evidence that tourniquets might be useful devices and might safe lives of wounded soldiers of the battlefields. If we have a closer look on these data, they do not demonstrate that tourniquets were really superior to other means of stopping a limb hemorrhage – because non of these studies compare the usage of tourniquets with other means of stopping the bleeding – like any kind of pressure bandages and they often have very little numbers of patients (4 - 11 in Kalish 2008, 7 in Dorlac 2007, Kragh 2008, 38, Kragh 2009) included in their studies.

Very impressive is the study from the UK (Brodie 2007), which demonstrated that the number of patients arrived with a tourniquet in their field hospitals shows an 20 fold increase, after a tourniquet devices was given to the soldiers – and again no evidence is shown that this is beneficial to the outcome.

On the contrary a Norwegian group working in low income countries in establishing an emergency service (Husum 2003) demonstrated that their local staff managed to cope with 227 land-mine induced limb bleeding without the application of tourniquets.


Taking into account studies which describes that about one third/ 22%/15% of the patients with an applied tourniquet still were bleeding when arriving in hospital ward, because the device was not effective (Kragh, 2008; Lakestein 2003, Beekely 2008) and that up to 18% of the tourniquet applied were rated as “non-indicated” (Beekely 2008) the usage of tourniquet as means of First Aid should be limited to combat situations, where quick method of stopping the bleeding is a tactical and not a medical decision – especially in the light of multiple studies on adverse effects of tourniquets.
**Citation List**

1.  
   **J Trauma 2008 Feb;64(2 Suppl):S28-37; discussion S37**

   **Prehospital Tourniquet Use in Operation Iraqi Freedom: Effects on Hemorrhage Control and Outcomes**

   Beekley AC; Sebesta JA; Blackbourne LH; Herbert GS; Kauvar DS; Baer DG; Walters TJ; Mullenix PS; Holcomb JB

   Department of General Surgery, Madigan Army Medical Center, Fort Lewis, WA 98431-1100, USA.

   Beekley A.C et al.,, The Journal of Trauma, 2008;, 64, S 28- 37

   **LOE:**  5

   **Quality of Evidence:**  fair

   Publication Type: Journal Article

   PMID: 0018376169

2.  
   **J Spec Oper Med 2009 Winter;9(1):74-7**


   **Tourniquet use in combat trauma: UK military experience**

   Brodie S; Hodgetts TJ; Ollerton J; McLeod J; Lambert P; Mahoney P

   Academic Department of Military Emergency Medicine, Royal Centre for Defence Medicine.

   **LOE:**  5

   **Quality of Evidence:**  fair

   Publication Type: Journal Article

   PMID: 0019813352

3.  
   **J Trauma 2005 Jul;59(1):217-22**

   **Mortality from Isolated Civilian Penetrating Extremity Injury J Trauma.**

   Dorlac WC; De Bakey ME; Holcomb JB; Fagan SP; Kwong KL; Dorlac GR; Schreiber MA; Persse DE; Moore FA; Mattox KL

   US Army Institute of Surgical Research, Fort Sam Houston, TX 78234-6315, USA.

   **LOE:**  5

   **Quality of Evidence:**  poor

   Publication Type: Journal Article

   PMID: 0016096567

4.  
   **Tourniquets: a review of current use with proposals for expanded prehospital use**

   Doyle GS; Taillac PP
Division of Emergency Medicine, Department of Medicine, University of Utah, Salt Lake City, Utah, USA.

**LOE: 5**  
**Quality of Evidence: fair**

Publication Type: Journal Article; Review  
PMID: 0018379924


**Adhesion receptors and cytokine profiles in controlled tourniquet ischaemia in the upper extremity.**

Germann G; Drucke D; Steinau HU

Departments of Plastic, Hand and Burn Surgery, BG-Trauma Centre, Ludwigshafen, Germany.

**LOE: 5**  
**Quality of Evidence: fair**

Publication Type: Journal Article  
PMID: 0009457587


**Nitric oxide synthase expressions in mice skeletal muscle subjected to ischemia/reperfusion injury.**

Gunji H; Kurisaki E; Suto M; Abe S; Hiraiwa K

Department of Legal Medicine, Fukushima Medical University School of Medicine, Fukushima 960-1295, Japan.

**LOE: 5**  
**Quality of Evidence: good**

Publication Type: Journal Article  
PMID: 0012935594


**Rural prehospital trauma systems improve trauma outcome in low-income countries: a prospective study from North Iraq and Cambodia.**

Husum H; Gilbert M; Wisborg T; Van Heng Y; Murad M

Tromsøe Mine Victim Resource Center, Norway.

**LOE: 5**  
**Quality of Evidence: good**

Publication Type: Comparative Study; Evaluation Studies; Journal Article; Research Support, Non-U.S. Gov't  
PMID: 0012813342

Circulatory, respiratory and metabolic changes after thigh tourniquet release in combined epidural-propofol anaesthesia with preservation of spontaneous respiration.

Iwama H; Kaneko T; Ohmizo H; Furuta S; Ohmori S; Watanabe K

Anaesthesia, Centrl Aizu General Hospital, Aizuwakamatsu city, Japan.

**LOE: 5**

**Quality of Evidence: good**

Publication Type: Journal Article
PMID: 0012073947

9. JEMS 2008 Aug;33(8):44-6, 49-50, 52, 54

The return of tourniquets. Original research evaluates the effectiveness of prehospital tourniquets for civilian penetrating extremity injuries.

Kalish J; Burke P; Feldman J; Agarwal S; Glantz A; Moyer P; Serino R; Hirsch E

Beth Israel Deaconess Medical Center, Boston, MA, USA.

**LOE: 5**

**Quality of Evidence: poor**

**Comments on Study:** From 1999 to 2006 patients with penetrating extremity wounds who were brought to the Emergency Department after the application of a prehospital tourniquet were identified from a retrospective review. Only 11 patients were included in this review. In this study is quite unclear if other means of stopping the bleeding have been administered and what is about their outcome, even in some of the patients is argued, that it “is possible that these patients could have had their hemorrhage controlled with other methods.” They believe (!) that these interventions should be more routinely be administered.

Publication Type: Evaluation Studies; Journal Article
PMID: 0018692730

10. Anaesthesia 2001 Jun;56(6):534-45

The arterial tourniquet: pathophysiological consequences and anaesthetic implications.

Kam PC; Kavanagh R; Yoong FF; Kavanagh R

Department of Anaesthesia and Pain Management, University of Sydney at the Royal North Shore Hospital, St Leonards, NSW 2065, Australia.

**LOE: 5**

**Quality of Evidence: good**

Publication Type: Journal Article; Review
PMID: 0011412159
11. Anesthesiology 2000 Dec;93(6):1407-12

Tourniquet-induced changes of energy metabolism in human skeletal muscle monitored by microdialysis.

Korth U; Merkel G; Fernandez FF; Jandewerth O; Dogan G; Koch T; van Ackern K; Weichel O; Klein J

Department of Anesthesiology, Faculty of Clinical Medicine Mannheim, University of Heidelberg, Germany.

LOE: 5
Quality of Evidence: good

Publication Type: Clinical Trial; Journal Article; Randomized Controlled Trial; Research Support, Non-U.S. Gov't
PMID: 0011149434


Extended (16-hour) tourniquet application after combat wounds: a case report and review of the current literature.

Kragh JF; Baer DG; Walters TJ

Bone and Soft Tissue Trauma Research Program, US Army Institute of Surgical Research, Fort Sam Houston, TX 78234-6315, USA.

Publication Type: Case Reports; Journal Article
PMID: 0017414556


Survival with emergency tourniquet use to stop bleeding in major limb trauma.

Kragh JF; Walters TJ; Baer DG; Fox CJ; Wade CE; Salinas J; Holcomb JB

US Army Institute of Surgical Research, Fort Sam Houston, TX, USA.

LOE: 5
Quality of Evidence: fair

Publication Type: Journal Article
PMID: 0019106667


Practical use of emergency tourniquets to stop bleeding in major limb trauma.

Kragh JF; Walters TJ; Baer DG; Fox CJ; Wade CE; Salinas J; Holcomb JB

US Army Institute of Surgical Research, Fort Sam Houston, TX 78234-6315, USA.

LOE: 5
Quality of Evidence: fair

Publication Type: Journal Article

**Tourniquets for hemorrhage control on the battlefield: a 4-year accumulated experience.**

Lakstein D; Blumenfeld A; Sokolov T; Lin G; Bssorai R; Lynn M; Ben-Abraham R

Israel Defense Force Medical Corps, Tel-Aviv University, Israel.

**LOE: 5**  
**Quality of Evidence: good**

Publication Type: Journal Article  
PMID: 0012768129


**Effects of tourniquet compression on neuromuscular function.**

Mohler LR; Pedowitz RA; Lopez MA; Gershuni DH

Department of Orthopaedics, University of California, San Diego 92103-8894, USA.  
**LOE: 5**  
**Quality of Evidence: good**

Publication Type: Journal Article; Research Support, U.S. Gov't, Non-P.H.S.  
PMID: 0010078146


**The Tourniquet Controversy.**

Navein J; Coupland R; Dunn R

Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland, USA.  
**LOE: 5**  
**Quality of Evidence: fair**  
**Comments on Study:** Report from the workshop of ICRC „Care in the field for victims of weapons of war” on pre-hospital care of war and mine- injured in 2001- does not recommend to teach in lay- persons FA courses in peaceful environment.

Publication Type: Journal Article; Review  
PMID: 0012768128


**Tourniquets for the control of traumatic hemorrhage: a review of the literature**
Richey SL

CRT Saginaw Valley State University, University Village 453-5D 7400 Bay Road, University Center, Michigan 48710.

LOE: 5
Quality of Evidence: fair
Comments on Study: Review on tourniquet articles – and they recommend to de-emphasize their use and focus instead in early medical assistance and the use of direct pressure to control bleeding. In combat situation they recommend the use of tourniquets to gain control of life.

Publication Type: Journal Article
PMID: 0017958899

Optimising Tourniquet Application and Release time in Extremity Surgery.

Sapega AA; Heppenstall RB; Chance B; Park YS; Sokolow D

LOE: 5
Quality of Evidence: good

Publication Type: Journal Article; Research Support, U.S. Gov't, Non-P.H.S.; Research Support, U.S. Gov't, P.H.S.
PMID: 0003968122

An Evaluation of Tactical Combat Casualty Care Intervention in Combat environment.

Tien HC; Jung V; Rizoli SB; Acharya SV; MacDonald JC

Trauma Program and Department of Surgery, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ontario, Canada.

LOE: 4
Quality of Evidence: poor

Publication Type: Journal Article; Research Support, Non-U.S. Gov't
PMID: 0018656043

European First Aid Guidelines

Van de Velde S; Broos P; Van Bouwelen M; De Win R; Sermon A; Verduyckt J; Van Tichelen A; Lauwaert D; Vantroyen B; Tobback C; Van den Steene P; Villere S; Mieres CU; Gobl G; Schunder S; Monsieurs K; Bierens J; Cassan P; Davoli E; Sabbe M; Lo G; De Vries M; Aertgeerts B

Training Department, Belgian Red Cross-Flanders, Motstraat 40, 2800 Mechelen, Belgium.
LOE:  5 Meta-analysis with Guideline process
Quality of Evidence: fair
Comments on Study: In this process the topic “Bleeding” was as well assessed and the leaded to the recommendation that a tourniquet should not be applied (Recommendation D)

Publication Type: Journal Article; Practice Guideline; Research Support, Non-U.S. Gov’t
PMID: 0017157974

Tourniquet-induced systemic inflammatory response in extremity surgery.
Wakai A; Wang JH; Winter DC; Street JT; O'Sullivan RG; Redmond HP
Department of Academic Surgery, Cork University Hospital, Cork, Ireland.
LOE: 3B
Quality of Evidence: fair

Publication Type: Clinical Trial; Journal Article; Randomized Controlled Trial
PMID: 0011706341