**Clinical question.**
When direct pressure fails to stop bleeding does the application of a tourniquet improve outcome?

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

**State if this is a proposed new topic or revision of existing worksheet:** Revision of existing worksheet

**Conflict of interest specific to this question**
Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? No conflict of interest

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

**Embase:** – Bleeding or hemorrhage AND emergency treatment

**Medline:** – MESH search: Hemorrhage AND Emergency Care (in Pub med that includes First aid, bleeding, etc) AND Tourniquet; Hemorrhage AND Tourniquet (Keyword MeSH); Hemostatic techniques AND emergency care; Hemostatic techniques AND emergency treatment

Wounds and injuries AND Emergency care AND hemostatic techniques

**Cochrane Library** (Cochrane Central Register of Controlled Trials, Cochrane Database of Systemic Reviews, Cochrane DSR, ACP Journal Club, and DARE, All EBM Reviews): - Hemmorhage expl (in Ovid includes all subheadings

- **State inclusion and exclusion criteria**
  Last 5 years. Exclusions – Review articles

- **Number of articles/sources meeting criteria for further review:**
  129. Of these 14 were finally cited
## Summary of evidence

### Evidence Supporting Clinical Question

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
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<tbody>
<tr>
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<tr>
<td>Kragh 2008;S38(E)</td>
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<td>Lakstein 2003;S221(E)</td>
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<td>Beekley 2008;S28 (E)</td>
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<td>Kragh 2007;274 (E)</td>
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<td>2</td>
<td>3</td>
<td>4</td>
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**Level of evidence**

Outcomes – Please define outcomes for this question, place them after letters below and use letters to identify studies which evaluate this outcome

- **A** = 
- **B** = 
- **C** = 
- **D** = 
- **E** = Hemorrhage control

*Italics = Animal studies*
### Evidence Neutral to Clinical question

<table>
<thead>
<tr>
<th>Good</th>
<th>Kokki 1998;418 (A)</th>
<th></th>
<th>Landi 1995;89 (C) (B)</th>
<th>Mohler 1999;213 (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fair</td>
<td>Wakai 2001;922 (A)</td>
<td>Savvidis 1999;141 (C) (B)</td>
<td>Calkins 2000;379 (D)</td>
<td>Kornbluth 2003;909 (C)</td>
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<tr>
<td>Poor</td>
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</table>

#### Level of evidence

1 2 3 4 5

Outcomes (same as above) – Please define outcomes for this question, place them after letters below and use letters to identify studies which evaluate this outcome

A = Metabolic Effects  
B = Recovery of function  
C = Neurologic complication  
D = Tourniquet type  
E = Hemorrhage control  
**Italics** = Animal studies

### Evidence Opposing Clinical Question

<table>
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<th>Good</th>
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<tbody>
<tr>
<td>Fair</td>
<td></td>
<td></td>
<td></td>
<td>Pilgram-Larsen 1992;2188 (E)</td>
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<td>Poor</td>
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</tbody>
</table>

#### Level of evidence

1 2 3 4 5

Outcomes (same as above) – Please define outcomes for this question, place them after letters below and use letters to identify studies which evaluate this outcome

A =  
B = Recovery of function  
C =  
D = Hemorrhage control  
**Italics** = Animal studies
There are no studies on the use of tourniquets to control hemorrhage in civilian populations. All information has to be extrapolated from experience in the operating room and under battle conditions. One human study (Pillgram-Larsen 1992; 2188) showed direct pressure to be superior to a tourniquet in controlling hemorrhage when applied by trained lay people clearing mines. Bleeding continued after application of a tourniquet and could be controlled by removing the tourniquet and applying direct pressure. In contrast, military field studies (Lackstein 2003; S221; Beekley 2008; S28; Kragh 2008; S38) show that tourniquets have saved lives. Complications from tourniquets can include nerve injury, vascular injury, muscle injury, and skin necrosis as a result of crushing the tissue beneath the tourniquet (Landi, AA 1995; 89). An animal study (Mohler 1999; 213) showed that the muscle impairment is directly related to the pressure applied. Complications range from minor and self-limiting (Savvidis 1999; 141) to permanent disabilities (Kornbluth 2003; 909), and even death. In addition to local effects, complications can result from limb ischemia (Wakai 2001; 922). The effects may become systemic after release of the tourniquet (reperfusion injury). Complications are related to occlusion time (Kokki 1998; 418). Safe limits of time, pressure, and the advisability of intermittent tourniquet release are still controversial. Most authorities agree that occlusion under two hours appears to be safe. Surgical experience is that amputation of the limb is mandatory without removal of the tourniquet if it has been in place for six or more hours (Fasol 1989; 467) but longer ischemic times have been tolerated (Kragh 2007; 274). Long ischemic times lead to gas gangrene and systemic reperfusion effects that can prove fatal.

**Citation List**


Fair; LOE 5 Supporting


Neutr; Fair; LOE 5


Neutral; Good; LOE 1


Neutral; Fair; LOE 5

Supporting; Poor; LOE 5


Supporting; Fair; LOE 5


Supporting; Fair; LOE 5


Neutral; Good; LOE 5


Neutral; Good; LOE 5


Opposing; Fair; LOE 4


Neutral; Fair; LOE 4


Neutral; Fair; LOE 3