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| Question |
| **Should a manufactured tourniquet compared with an improvised tourniquet be used for adults and children with severe, life-threatening external bleeding?** |
| **Population:** | Adults and children with severe, life-threatening external bleeding |
| **Intervention:** | Manufactured tourniquets |
| **Comparison:** | Improvised tourniquets (e.g. bandanas, ties/cravat, trouser belts) |
| **Main outcomes:** | Death owing to bleeding, cessation of bleeding (restoration of hemostasis), and time to hemostasis, death from any cause, decrease in bleeding, and adverse effects (e.g. wound infection, limb loss, re-bleeding, pain related to an intervention). Where possible, the Evidence to Decision tables also include information regarding outcomes related to provider ability to use / ease of use / feasibility / satisfaction (for method of bleeding control) and predictors of use/response (for method of bleeding control). |
| **Setting:** | All studies performed in the out-of-hospital setting (direct evidence), as well as studies providing indirect evidence about the effects of interventions collected in combat (military) settings, simulations (i.e. human volunteers, human cadaver or other models excluding animal models), and studies performed in the hospital setting, that clinical content experts judged as performed in sufficiently similar conditions to still be informative.  |
| **Perspective:** | Of the first aid provider and/or patient |
| **Background:** | Traumatic injury is a leading cause of morbidity and mortality and a major cause of death from traumatic injury is uncontrolled bleeding. Tourniquets and hemostatic dressings have the potentially to prevent morbidity and mortality from traumatic bleeding. Therefore, it is easy to see that first aid care is essential to help prevent injury related morbidity and mortality, as injured persons can exsanguinate from severe injuries in only a few minutes.Current first aid recommendations for an individual with severe, life-threatening external bleeding includes applying direct pressure as standard therapy. Tourniquets and hemostatic dressings have been found to control bleeding effectively, therefore may be considered for use when standard measures are unable to control hemorrhage or in the situation where a first aid provider is unable to use standard first aid practices (for tourniquets) or for body areas where a tourniquet cannot be applied or is unable to control bleeding (for hemostatic dressings). There is no or limited data supporting the use of pressure points, elevation, or localized cold therapy.  |
| **Conflict of interests:** | None identified |

# Assessment

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| ProblemIs the problem a priority? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no○ Probably yes● Yes○ Varies○ Don't know | Traumatic injury is the leading cause of injury related morbidity and mortality throughout the world, resulting in millions of hospitalizations each year. The leading cause of preventable mortality in injured patients is uncontrolled hemorrhage {Jacobs 2014 67}. Hemorrhage is cited as the primary cause of death in 35% of traumatic mortalities and often contributes to death ultimately attributed to other causes {Kauvar 2006 S3}. In addition, trauma related deaths disproportionality affects those in low- and middle-income countries where well established pre-hospital trauma systems may not exist (World Health Organization 2018). | While direct manual pressure is the gold standard for hemorrhage control in life-threatening bleeding, the addition of a tourniquet could provide better hemorrhage control or enhance the effect of direct manual pressure. It may be easier for a first aid provider to access an improvised tourniquet therefore it is important to determine if these are appropriate or if manufactured tourniquets perform better.  |
| Desirable EffectsHow substantial are the desirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial○ Small● Moderate○ Large○ Varies○ Don't know |

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| **Certainty assessment** | **№ of patients** | **Effect** |
| --- | --- | --- |
| **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **manufactured tourniquet** | **improvised tourniquet** | **Relative(95% CI)** | **Absolute(95% CI)** |
| Cessation of bleeding - Simulation (assessed with: absence of pulse via vascular Doppler) |
| 4 | observational studies  | serious a | not serious  | serious b | serious c | none  | In general, across studies (350 observations manufactured and 110 improvised), higher rates of cessation/absence of pulse occurred with manufactured tourniquets. Guo et al. {Guo 2011 151} in which tourniquets were self-applied in the lower extremity, reported 85-100% cessation with manufactured but 60-75% with improvised tourniquets; King et al /{King 2006 1061} in which tourniquets were self-applied, cessation occurred in 80% with pneumatic tourniquet and 30% with tie/cravat, and 90% with surgical tubing. Failure (palpable pulse, audible Doppler signal, or mechanical failure) was assessed in healthy participants by Heldenberg et al. {Heldenberg 2015 1}: 23% failure with manufactured, and 38% failure with improvised tourniquet. In Lyles 2015 21, hemorrhage ceased in 100% of manikins using manufactured CAT, 40% using improvised bandage, and 10% using improvised bandana. Effectiveness of the CAT exceeded effectiveness of both the bandage and bandana tourniquets (p<0.001).  |

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 | Four simulation studies with healthy volunteers and manikins demonstrated greater benefit with manufactured tourniquets in terms of cessation of pulse or fluid flow. There were also fewer failures.  |
| Undesirable EffectsHow substantial are the undesirable anticipated effects? |
| Judgement | Research evidence | Additional considerations |
| ○ Large○ Moderate● Small○ Trivial○ Varies○ Don't know |

| **Certainty assessment** | **№ of patients** | **Effect** | **Certainty** | **Importance** |
| --- | --- | --- | --- | --- |
| **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **manufactured tourniquet** | **improvised tourniquet** | **Relative(95% CI)** | **Absolute(95% CI)** |
| Complications / adverse events - Simulation (assessed with: Pain) |
| 3 | observational studies  | serious a | not serious  | serious d | serious c | none  | All three studies (330 observations with manufactured and 70 improvised) showed greater pain with the improvised tourniquets in healthy participants. Mean pain was 3 or less with manufactured, but from 3.7 - 3.9 with the improvised tourniquet in King et al.{King 2006 1061}(scale 0-5 whereby score 5 = could not tolerate) (p values not given). In Gup et al. {Guo 2011 151}, pain was slightly lower with manufactured tourniquets than with improvised tourniquets (0.95-1.5 versus 1.9-2.4, on a scale of 0-3 whereby score 3 = very painful) (p values not given). Heldenberg {Heldenberg 2015 1} reported less pain with the manufactured than with improvised tourniquet (4.1 versus 1.3, scale 1 to 5 whereby score 5 is 'no pain') (p values not given).  | ⨁◯◯◯VERY LOW  | IMPORTANT  |

 | There was pain; however, pain was more severe with the use of improvised tourniquets. There are also studies that looked at failure; however mostly due to application and not breakage. |
| Certainty of evidenceWhat is the overall certainty of the evidence of effects? |
| Judgement | Research evidence | Additional considerations |
| ● Very low○ Low○ Moderate○ High○ No included studies | The certainty of the evidence across all outcomes was determined to be very low. Certainty downgrades were due to risk of bias, indirectness and imprecision.  | All evidence is very low certainty.  |
| ValuesIs there important uncertainty about or variability in how much people value the main outcomes? |
| Judgement | Research evidence | Additional considerations |
| ○ Important uncertainty or variability○ Possibly important uncertainty or variability● Probably no important uncertainty or variability○ No important uncertainty or variability | No research evidence identified.  | Like other forms of hemostasis for control of severe, life-threatening bleeding, the outcomes of reduced mortality and control of bleeding are valued. The main goal is to have rapid, effective bleeding cessation.There is no specific research evidence regarding the value of tourniquets specifically.  |
| Balance of effectsDoes the balance between desirable and undesirable effects favor the intervention or the comparison? |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison○ Probably favors the comparison○ Does not favor either the intervention or the comparison○ Probably favors the intervention● Favors the intervention○ Varies○ Don't know | Research demonstrates that either type of tourniquets cease flow, or pulse; however, manufactured tourniquets performed better than improvised tourniquets. In general, across studies (350 observations of manufactured and 110 of improvised), higher rates of cessation/absence of pulse occurred with manufactured tourniquets. Guo et al {Guo 2011 151} in a study where tourniquets were self-applied to the lower extremity, reported 85-100% cessation with manufactured but 60-75% with improvised tourniquets; King et al {King 2006 1061} in a study where tourniquets were self-applied, reported cessation occurred in 80% with pneumatic tourniquets and 30% with use of a tie/cravat, and 90% with use of surgical tubing. Failure (palpable pulse, audible Doppler signal, or mechanical failure) was assessed in healthy participants in one study {Heldenberg 2015 1}, reporting 23% failure rate with manufactured tourniquets, and 38% failure rate with improvised tourniquets. In a simulation study {Lyles 2015 21}, hemorrhage ceased in 100% of manikins using manufactured windlass (CAT) tourniquet, 40% with use of an improvised bandage, and in 10% using an improvised bandana. Effectiveness of the windlass tourniquet exceeded effectiveness of both the bandage and bandana tourniquets (p<0.001). | For the specific circumstance of an injury with life-threatening bleeding in a location that is amenable to use of a tourniquet, the desirable effects (cessation of pulse or blood flow) compared with the undesirable effects (pain) probably favor use of the intervention. |
| Resources requiredHow large are the resource requirements (costs)? |
| Judgement | Research evidence | Additional considerations |
| ○ Large costs● Moderate costs○ Negligible costs and savings○ Moderate savings○ Large savings○ Varies○ Don't know | No research evidence identified. We were able to review medical supply catalogs and sales websites.  | At an individual level the cost of a single tourniquet to control life threatening bleeding is minimal and the benefits are high. To create a system so that every responder has the capability to control life threatening bleeding is high. The larger the system the higher the expense.There would be a cost to purchase and stock devices as well as training to implement them. Training costs would include development of material, training aids, instructor training and first aid provider training.Based on review of these sites, tourniquets and hemostatic dressings have a somewhat similar cost [Cost of tourniquet in Belgium: 37€ (CAT) or 39€ (SOFT).]CAT approximately $50 USDTourniquet in Japan costs approximately 25 USD (approximately 1% of the cost of an AED). There are more than 500,000 AEDs in Japan. If we require the same number of tourniquets as AEDs, it will cost 12,500,000 USD. It seems reasonable in Japan. |
| Certainty of evidence of required resourcesWhat is the certainty of the evidence of resource requirements (costs)? |
| Judgement | Research evidence | Additional considerations |
| ○ Very low○ Low○ Moderate○ High● No included studies | No research evidence identified.  | Very little data is available to assess the individual and population cost of tourniquet implementation. The cost of these devices can be found online. |
| Cost effectivenessDoes the cost-effectiveness of the intervention favor the intervention or the comparison? |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison○ Probably favors the comparison○ Does not favor either the intervention or the comparison● Probably favors the intervention○ Favors the intervention○ Varies○ No included studies | While weak evidence, simulation studies demonstrate that there is a greater benefit in manufactured tourniquets compared with improvised tourniquets.  | The costs of being prepared for the unlikely event of an uncontrollable bleed likely to be high from a system point of view but are also moderately high from an individual point of view. In specific situations, such as military/combat settings in which 1) application of manual pressure or hemostatic dressings is not feasible while under fire; 2) loss of life of both injured soldier and rescuer soldier puts the rest of the unit at risk and 3) tourniquet cost may be less to the organization than for the general public, cost-effectiveness likely favors the intervention.AED saves about 1,000 neurological favorable lives every year in Japan. If tourniquets can save 10 patients every year, Japan feels this would be cost-effective.Improvised tourniquets were successful in some instances and would be cheaper, however the failure rate is higher than manufactured devices, making these higher risk for allowing continued bleeding. The benefit of better outcomes with manufactured devices is felt to outweigh the cost difference. |
| EquityWhat would be the impact on health equity? |
| Judgement | Research evidence | Additional considerations |
| ○ Reduced● Probably reduced○ Probably no impact○ Probably increased○ Increased○ Varies○ Don't know | No research evidence | As these agents offer an expense above direct manual pressure alone, this may reduce health equity to rural areas that may be less likely to afford tourniquets but may benefit most due to prolonged transport times. In addition, on a systems level, some organizations may not be able to purchase these due to the cost.Training and deployment costs will also be required, which may also reduce equity.  |
| AcceptabilityIs the intervention acceptable to key stakeholders? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no○ Probably yes○ Yes● Varies○ Don't know | [Wall PL](https://www.ncbi.nlm.nih.gov/pubmed/?term=Wall%20PL%5BAuthor%5D&cauthor=true&cauthor_uid=25494426), [Welander JD](https://www.ncbi.nlm.nih.gov/pubmed/?term=Welander%20JD%5BAuthor%5D&cauthor=true&cauthor_uid=25494426), [Smith HL](https://www.ncbi.nlm.nih.gov/pubmed/?term=Smith%20HL%5BAuthor%5D&cauthor=true&cauthor_uid=25494426), [Buising CM](https://www.ncbi.nlm.nih.gov/pubmed/?term=Buising%20CM%5BAuthor%5D&cauthor=true&cauthor_uid=25494426), [Sahr SM](https://www.ncbi.nlm.nih.gov/pubmed/?term=Sahr%20SM%5BAuthor%5D&cauthor=true&cauthor_uid=25494426)**.** What do the people who transport trauma patients know about tourniquets? [J Trauma Acute Care Surg.](https://www.ncbi.nlm.nih.gov/pubmed/25494426) 2014 Nov;77(5):734-742.* Survey respondents included 27 basic, 1 intermediate, and 75 paramedic emergency medical technicians; 1 registered nurse; 4 firefighters without medical certifications; 2 respondents not yet certified; and 1 respondent not listing certifications.
* Twenty-five had used tourniquets: 5 in military and 22 in civilian settings.
* Tourniquet knowledge was poor for all groupings (with or without tourniquet experience, military experience, all certifications, all years of experience): 91% did not understand that wider tourniquets require less pressure for arterial occlusion, 69% did not know that stopping venous flow without arterial is harmful, and 37% did not know the correct tourniquet locations for distal limb injuries. Of the 81 on a service and without military experience, 44 had received any tourniquet training; 14 of the 44 had commercial emergency tourniquet access, and 27 indicated their service had a tourniquet protocol. Of the 37 on a service with no tourniquet training, 5 had access to a commercial emergency tourniquet, and 5 indicated their service had a tourniquet protocol.

[Ross EM](https://www.ncbi.nlm.nih.gov/pubmed/?term=Ross%20EM%5BAuthor%5D&cauthor=true&cauthor_uid=29455698), [Redman TT](https://www.ncbi.nlm.nih.gov/pubmed/?term=Redman%20TT%5BAuthor%5D&cauthor=true&cauthor_uid=29455698), [Mapp JG](https://www.ncbi.nlm.nih.gov/pubmed/?term=Mapp%20JG%5BAuthor%5D&cauthor=true&cauthor_uid=29455698), [Brown DJ](https://www.ncbi.nlm.nih.gov/pubmed/?term=Brown%20DJ%5BAuthor%5D&cauthor=true&cauthor_uid=29455698), [Tanaka K](https://www.ncbi.nlm.nih.gov/pubmed/?term=Tanaka%20K%5BAuthor%5D&cauthor=true&cauthor_uid=29455698), [Cooley CW](https://www.ncbi.nlm.nih.gov/pubmed/?term=Cooley%20CW%5BAuthor%5D&cauthor=true&cauthor_uid=29455698), [Kharod CU](https://www.ncbi.nlm.nih.gov/pubmed/?term=Kharod%20CU%5BAuthor%5D&cauthor=true&cauthor_uid=29455698), [Wampler DA](https://www.ncbi.nlm.nih.gov/pubmed/?term=Wampler%20DA%5BAuthor%5D&cauthor=true&cauthor_uid=29455698). Stop the Bleed: The Effect of Hemorrhage Control Education on Laypersons' Willingness to Respond During a Traumatic Medical Emergency. [Prehosp Disaster Med.](https://www.ncbi.nlm.nih.gov/pubmed/29455698) 2018 Apr;33(2):127-132. * Trainers used a pre-event questionnaire to assess participant’s knowledge and attitudes about tourniquets and responding to traumatic emergencies. Each training course included an individual evaluation of tourniquet placement, 20 minutes of didactic instruction on hemorrhage control techniques, and hands-on instruction with tourniquet application on both adult and child mannequins. The primary outcome was the willingness to use a tourniquet in response to a traumatic medical emergency.
* When initially asked if they would use a tourniquet in real life, 64.2% (140/218) responded "Yes." Following training, 95.6% (194/203) of participants responded that they would use a tourniquet in real life.
* When participants were asked about their comfort level with using a tourniquet in real life, there was a statistically significant improvement between their initial response and their response post training (2.5 versus 4.0, based on 5-point Likert scale; P<.001).
* It was found that a short educational intervention can improve laypersons' self-efficacy and reported willingness to use a tourniquet in an emergency.

[Sidwell RA](https://www.ncbi.nlm.nih.gov/pubmed/?term=Sidwell%20RA%5BAuthor%5D&cauthor=true&cauthor_uid=29155270), [Spilman SK](https://www.ncbi.nlm.nih.gov/pubmed/?term=Spilman%20SK%5BAuthor%5D&cauthor=true&cauthor_uid=29155270), [Huntsman RS](https://www.ncbi.nlm.nih.gov/pubmed/?term=Huntsman%20RS%5BAuthor%5D&cauthor=true&cauthor_uid=29155270), [Pelaez CA](https://www.ncbi.nlm.nih.gov/pubmed/?term=Pelaez%20CA%5BAuthor%5D&cauthor=true&cauthor_uid=29155270). Efficient Hemorrhage Control Skills Training for Healthcare Employees. [J Am Coll Surg.](https://www.ncbi.nlm.nih.gov/pubmed/29155270) 2018 Feb;226(2):160-164. * More than 1,000 individuals were trained, and there were survey data for 870 participants. More than 40% of participants worked in nonclinical roles and 29% had no first aid or medical training. After completing skills training, 98% of participants indicated that they would be likely to take action to assist a bleeding victim and that they could correctly apply direct pressure or a tourniquet to control severe bleeding.
 | Studies demonstrate that both lay and emergency medical services providers are willing to apply tourniquets. The intervention may be more acceptable to stakeholders with specific requirements (e.g., military) for hands-free control of bleeding.Many providers have no (or limited) experience with tourniquets. Commercial tourniquets are widely used by emergency services in France including Red Cross and other voluntary organizations.These changes to more widely accepted use are recent and work will be needed to overcome the historical bias associated with the use of tourniquets.Acceptability may however vary by region. |
| FeasibilityIs the intervention feasible to implement? |
| Judgement | Research evidence | Additional considerations |
| ○ No○ Probably no○ Probably yes○ Yes● Varies○ Don't know | Heldenberg E, Aharony D, Wolf T, Vishne T. Evaluating new types of tourniquets by the Israeli Naval special warfare unit. Disaster Mil Med. 2015 1: 1.* The CAT had the highest assessment score by the operators, followed by the SOFTT and IRT (4.6±0.6, 4.0±1.0, 2.1±1.0, respectively). Both arm as well as the self-application, were faster for CAT as compared to SOFTT (13 ± 4 sec and 21 ± 8 sec versus 18 ± 7 sec and 54 ± 69 sec, respectively). CAT and SOFTT thigh applications were much quicker (19 ± 7 sec and 24 ± 7 sec, respectively) as compared to the IRT, which on average took at least twice as long to place (53 ± 23 sec). The IRT thigh application failure rate was 38%, as compared to 22% and 23% for the CAT and SOFTT, respectively. SOFTT arm application failure rate was lower than the CAT application failure rate (6% and 10%, p = 0.266). CAT application failure rate was lower when self-application was used (SOFTT 20%, CAT 14%, p = 0.5).
* No evidence demonstrating that wet tourniquets either prolonged application time or increased tourniquet application failure rate, at all anatomical sites, was found. Medics had no advantage as compared to the non-medic operators regarding tourniquet's application. Generally, non-medic operators placed the tourniquets faster, though medics were quicker in self-applying the SOFTT (37 ± 58 sec as opposed to 55 ± 69 sec, p = 0.236). Operator failure rates while applying arm CAT were higher as compared with the SOFTT application (12% versus 2%, p < 0.04). Failure rates of the improvised tourniquet application (35%) were higher as compared with both the CAT and SOFTT (23 and 21%, respectively), though without statistical significance. No difference was found in self-application failure rate (18%), of the latter two tourniquets. Medic failure rates of CAT and SOFTT arm application did not differ (8% and 10%, respectively, p = 1). Thigh CAT application was more effective than that of the IRT (21% and 40% failure, respectively, p = 0.019). Medics’ CAT self-application was more effective than SOFTT (11% versus 22% failure, respectively) but without statistical significance.
* The participant's assessed of the tourniquets’ manipulation and storage parameters in a scale of 1-5 (1- the lowest score and 5 – the highest one). The CAT was assessed as the preferred device (a score of 4.6 ± 0.6), followed by the SOFTT (4.0 ± 1.0) and the IRT (2.1 ± 1.0) (p < 0.0001).

[King DR](https://www.ncbi.nlm.nih.gov/pubmed/?term=King%20DR%5BAuthor%5D&cauthor=true&cauthor_uid=23536455), [van der Wilden G](https://www.ncbi.nlm.nih.gov/pubmed/?term=van%20der%20Wilden%20G%5BAuthor%5D&cauthor=true&cauthor_uid=23536455), [Kragh JF Jr](https://www.ncbi.nlm.nih.gov/pubmed/?term=Kragh%20JF%20Jr%5BAuthor%5D&cauthor=true&cauthor_uid=23536455), [Blackbourne LH](https://www.ncbi.nlm.nih.gov/pubmed/?term=Blackbourne%20LH%5BAuthor%5D&cauthor=true&cauthor_uid=23536455). Forward assessment of 79 prehospital battlefield tourniquets used in the current war. [J Spec Oper Med.](https://www.ncbi.nlm.nih.gov/pubmed/23536455) 2012 Winter;12(4):33-8.* Tourniquet applications (79) were performed by special operations combat medics (47, 59%), flight medics (17, 22%), combat medics (12, 15%), and general surgeons (3, 4%). Most tourniquets were Combat Application Tourniquets (71/79, 90%). With tourniquets in place upon arrival at the FST, most limbs (83%, 54/65) had palpable distal pulses present; 17% were pulseless (11/65). Of all tourniquets, the use was venous in 83% and arterial in 17%. In total, there were 14 arterial injuries, but only 5 had effective arterial tourniquets applied.

[Tien HC](https://www.ncbi.nlm.nih.gov/pubmed/?term=Tien%20HC%5BAuthor%5D&cauthor=true&cauthor_uid=18656043), [Jung V](https://www.ncbi.nlm.nih.gov/pubmed/?term=Jung%20V%5BAuthor%5D&cauthor=true&cauthor_uid=18656043), [Rizoli SB](https://www.ncbi.nlm.nih.gov/pubmed/?term=Rizoli%20SB%5BAuthor%5D&cauthor=true&cauthor_uid=18656043), [Acharya SV](https://www.ncbi.nlm.nih.gov/pubmed/?term=Acharya%20SV%5BAuthor%5D&cauthor=true&cauthor_uid=18656043), [MacDonald JC](https://www.ncbi.nlm.nih.gov/pubmed/?term=MacDonald%20JC%5BAuthor%5D&cauthor=true&cauthor_uid=18656043). An evaluation of tactical combat casualty care interventions in a combat environment. [J Am Coll Surg.](https://www.ncbi.nlm.nih.gov/pubmed/18656043) 2008 Aug;207(2):174-8. * Six patients had eight tourniquets applied. Five tourniquets were applied to four patients appropriately and saved their lives. There was one case of misuse where a venous tourniquet was applied.

[Sidwell RA](https://www.ncbi.nlm.nih.gov/pubmed/?term=Sidwell%20RA%5BAuthor%5D&cauthor=true&cauthor_uid=29155270), [Spilman SK](https://www.ncbi.nlm.nih.gov/pubmed/?term=Spilman%20SK%5BAuthor%5D&cauthor=true&cauthor_uid=29155270), [Huntsman RS](https://www.ncbi.nlm.nih.gov/pubmed/?term=Huntsman%20RS%5BAuthor%5D&cauthor=true&cauthor_uid=29155270), [Pelaez CA](https://www.ncbi.nlm.nih.gov/pubmed/?term=Pelaez%20CA%5BAuthor%5D&cauthor=true&cauthor_uid=29155270). Efficient Hemorrhage Control Skills Training for Healthcare Employees. [J Am Coll Surg.](https://www.ncbi.nlm.nih.gov/pubmed/29155270) 2018 Feb;226(2):160-164. * More than 1,000 individuals were trained, and there were survey data for 870 participants. More than 40% of participants worked in nonclinical roles and 29% had no first aid or medical training. After completing skills training, 98% of participants indicated that they would be likely to take action to assist a bleeding victim and that they could correctly apply direct pressure or a tourniquet to control severe bleeding.

Ross EM, [Mapp JG](https://www.ncbi.nlm.nih.gov/pubmed/?term=Mapp%20JG%5BAuthor%5D&cauthor=true&cauthor_uid=29239763), [Redman TT](https://www.ncbi.nlm.nih.gov/pubmed/?term=Redman%20TT%5BAuthor%5D&cauthor=true&cauthor_uid=29239763), [Brown DJ](https://www.ncbi.nlm.nih.gov/pubmed/?term=Brown%20DJ%5BAuthor%5D&cauthor=true&cauthor_uid=29239763), [Kharod CU](https://www.ncbi.nlm.nih.gov/pubmed/?term=Kharod%20CU%5BAuthor%5D&cauthor=true&cauthor_uid=29239763), [Wampler DA](https://www.ncbi.nlm.nih.gov/pubmed/?term=Wampler%20DA%5BAuthor%5D&cauthor=true&cauthor_uid=29239763). The Tourniquet Gap: A Pilot Study of the Intuitive Placement of Three Tourniquet Types by Laypersons. [J Emerg Med.](https://www.ncbi.nlm.nih.gov/pubmed/29239763) 2018 Mar;54(3):307-314. * Novice tourniquet users were randomized to apply one of three commercially available tourniquets (Combat Action Tourniquet [CAT; North American Rescue, LLC, Greer, SC], Ratcheting Medical Tourniquet [RMT; m2 Inc., Winooski, VT], or Stretch Wrap and Tuck Tourniquet [SWAT-T; TEMS Solutions, LLC, Salida, CO]) in a controlled setting. Individuals with formal medical certification, prior military service, or prior training with tourniquets were excluded. The primary outcome of this study was successful tourniquet placement.
* Of 236 possible participants, 198 met the eligibility criteria. Demographics were similar across groups. The rates of successful tourniquet application for the CAT, RMT, and SWAT-T were 16.9%, 23.4%, and 10.6%, respectively (p = 0.149). The most common causes of application failure were: inadequate tightness (74.1%), improper placement technique (44.4%), and incorrect positioning (16.7%).
 | Tourniquets have been used in the emergency medical services and lay provider first aid setting however, the data regarding implementation of these is limited. There are legal and prescribing barriers in some countries such as Belgium and Australia. However, there is the consideration that if first aid guidelines recommend tourniquets this may help overcome those barriers. Training issues must be considered for either agent. In some countries, such as Australia, hemostatic dressings are only available through a prescription, making access potentially difficult.Commercial tourniquets are widely used by emergency services in France including Red Cross and other voluntary organizations.Feasibility may however vary by region. |

# Summary of judgements

|  | **Judgement** |
| --- | --- |
| **Problem** | No | Probably no | Probably yes | **Yes** |  | Varies | Don't know |
| **Desirable Effects** | Trivial | Small | **Moderate** | Large |  | Varies | Don't know |
| **Undesirable Effects** | Large | Moderate | **Small** | Trivial |  | Varies | Don't know |
| **Certainty of evidence** | **Very low** | Low | Moderate | High |  |  | No included studies |
| **Values** | Important uncertainty or variability | Possibly important uncertainty or variability | **Probably no important uncertainty or variability** | No important uncertainty or variability |  |  |  |
| **Balance of effects** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | **Probably favors the intervention** | Favors the intervention | Varies | Don't know |
| **Resources required** | Large costs | **Moderate costs** | Negligible costs and savings | Moderate savings | Large savings | Varies | Don't know |
| **Certainty of evidence of required resources** | Very low | Low | Moderate | High |  |  | **No included studies** |
| **Cost effectiveness** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | **Probably favors the intervention** | Favors the intervention | Varies | No included studies |
| **Equity** | Reduced | **Probably reduced** | Probably no impact | Probably increased | Increased | Varies | Don't know |
| **Acceptability** | No | Probably no | Probably yes | Yes |  | **Varies** | Don't know |
| **Feasibility** | No | Probably no | Probably yes | Yes |  | **Varies** | Don't know |

# Type of recommendation

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| --- | --- | --- | --- | --- |
| Strong recommendation against the intervention | Conditional recommendation against the intervention | Conditional recommendation for either the intervention or the comparison | Conditional recommendation for the intervention | Strong recommendation for the intervention |
| ○  | ○  | ○  | X  | ○  |

# Conclusions

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| Recommendation |
| We suggest that first aid providers use manufactured tourniquets rather than improvised tourniquets for people with severe, life threatening external bleeding (weak recommendation, based on very low certainty of evidence). |
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| Justification |
| * The Task Force was strongly influenced by 2 observational studies (Guo 2011 151, Lyles 2015 21) that demonstrated an improvement in simulated bleeding cessation when using a manufactured tourniquets compared with the use of improvised tourniquets (85-100% manufactured compared with 10-75% improvised tourniquets).
* We recognize that the use of tourniquets provides an added material and training expense that may increase healthcare disparity in some cases. We also recognize that implementation of tourniquet use on a small or large scale may not be feasible in some areas.
* While we understand that manufactured tourniquets can be placed inappropriately, we feel the evidence demonstrates that there is a higher likelihood of appropriate application of a tourniquet when a manufactured tourniquet is used compared with an improvised tourniquet.
* The Task Force believes, however, that when faced with life-threatening bleeding from a limb, an improvised tourniquet is better than no tourniquet. In situations when a manufactured tourniquet is not available we suggest the use of an improvised tourniquet, made to appropriate specifications (e.g. wide and tight) when faced with severe, life-threatening limb bleeding.
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| Subgroup considerations |
| N/A |

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| Implementation considerations |
| Training materials would need to be developed and be flexible from country to country (or region to region). |

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| Monitoring and evaluation |
| Groups who implement the device should track use and success of use (and adverse events) |

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| Research priorities |
| Studies comparing the effectiveness of various types of tourniquets in the first aid setting and if the devices can be used appropriately by first aid providers. It is also important to determine if first aid providers are able to recognize wounds that would be amenable to tourniquets. |

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