Appendix B

First Aid Task Force – 2025 Evidence Updates
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2025 Evidence Update
FA 7110 – Recognition of Anaphylaxis by First Aid Providers

Worksheet Author(s): Daniel Meyran, Pascal Cassan
Task Force: First Aid
Date Approved by SAC Representative: 11 October 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults and children experiencing anaphylaxis
Intervention: Description of any specific symptoms to the first aid provider
Comparators: Absence of any specific description
Outcomes: Anaphylaxis recognition (Critical).
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) are eligible for inclusion. Case series and case reports will also be considered for inclusion. As it is anticipated that there will be insufficient studies from which to draw a conclusion, the minimum number of cases for a case series to be included has been reduced for the default of 5 to 1 by the review team.
Timeframe: All years and all languages are included as long as there is an English abstract

Year of last full review: October 2023

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST (2023 CoSTR):
First aid providers should not be expected to recognize the signs and symptoms of anaphylaxis without repeated episodes of training and encounters with victims of anaphylaxis.

Current Search Strategy
1 Pubmed: (Rerun Search strategy from December 1, 2023 to Jully, 3 2024).
Results: 226
((((((("recogni"[Title/Abstract] OR "knowledge*"[Title/Abstract] OR "skill*"[Title/Abstract] OR "educat*"[Title/Abstract] OR "information*"[Title/Abstract] OR "train*"[Title/Abstract]) AND ("anaphyla*"[Title/Abstract] OR "epinephrin*"[Title/Abstract] OR "adrenalin*"[Title/Abstract] OR "epi pen*"[Title/Abstract] OR "epipen*"[Title/Abstract])) OR (("underus*"[Title/Abstract] OR "under us*"[Title/Abstract] OR "underutili*"[Title/Abstract] OR "under utili*"[Title/Abstract]) AND ("anaphyla*"[Title/Abstract] OR "epinephrin*"[Title/Abstract] OR "adrenalin*"[Title/Abstract] OR "epi pen*"[Title/Abstract] OR "epipen*"[Title/Abstract])) OR (("comfort*"[Title/Abstract] OR "discomfort*"[Title/Abstract] OR "dis comfort*"[Title/Abstract] OR "uncomfortable"[Title/Abstract] OR "confiden*"[Title/Abstract] OR "empower*"[Title/Abstract]) AND ("anaphyla*"[Title/Abstract] OR "epinephrin*"[Title/Abstract] OR "adrenalin*"[Title/Abstract] OR "epi pen*"[Title/Abstract] OR "epipen*"[Title/Abstract])) OR ("manage*"[Title/Abstract] AND "anaphyla*"[Title/Abstract])) AND ("Patient Education as Topic"[MeSH Terms] OR "Self Administration"[MeSH Terms] OR "Self-Management"[MeSH Terms] OR ("layperson*"[Title/Abstract] OR "lay person*"[Title/Abstract] OR "laypeople*"[Title/Abstract] OR "lay people*"[Title/Abstract] OR "nonprofessional*"[Title/Abstract] OR "non professional*"[Title/Abstract]) OR ("parent"[Title/Abstract] OR "parents"[Title/Abstract] OR "parental"[Title/Abstract] OR "communit*"[Title/Abstract] OR "teacher*"[Title/Abstract] OR "caregiver*"[Title/Abstract] OR "care giver*"[Title/Abstract] OR "personnel*"[Title/Abstract] OR "school*"[Title/Abstract] OR "child care worker*"[Title/Abstract] OR "childcare worker*"[Title/Abstract] OR "aide*"[Title/Abstract]) OR ("patient*"[Title/Abstract] AND ("educat*"[Title/Abstract] OR "train*"[Title/Abstract] OR "manage*"[Title/Abstract] OR "instruct*"[Title/Abstract] OR "confiden*"[Title/Abstract] OR "complian*"[Title/Abstract] OR "adheren*"[Title/Abstract])) OR "self manage*"[Title/Abstract] OR "First Aid"[MeSH Terms] OR "Emergency Medical Technicians"[MeSH Terms] OR ("first aid*"[Title/Abstract] OR "first respon*"[Title/Abstract] OR "EMT"[Title/Abstract] OR "emergency medical technician*"[Title/Abstract] OR "paramedic*"[Title/Abstract] OR "para medic*"[Title/Abstract] OR "ambulance*"[Title/Abstract]))) NOT ("Animals"[MeSH Terms] NOT ("Animals"[MeSH Terms] AND "Humans"[MeSH Terms]))) NOT ("comment"[Publication Type] OR "editorial"[Publication Type] OR "news"[Publication Type] OR "newspaper article"[Publication Type])) AND (2023/12/2:2024/7/3[pdat])*

2 Cochrane: (Rerun Search strategy from December 1, 2023 to Jully, 3 2024).
Results: 177

#	Searches	Results
1	((recogni* or knowledge* or skill* or educat* or information* or train*) AND (anaphyla* or epinephrin* or adrenalin* or epi-pen* or epipen*)):ti,ab,kw	1365

2	((underus* or under-us* or underutili* or under-utili*) and (anaphyla* or epinephrin* or adrenalin* or epi-pen* or epipen*)):ti,ab,kw	16
3	((comfort* or discomfort* or dis-comfort* or uncomfortable or confiden* or empower*) and (anaphyla* or epinephrin* or adrenalin* or epi-pen* or epipen*)):ti,ab,kw	1128
4	(manage* AND anaphyla*):ti,ab,kw	373
5	#1 OR #2 OR #3 OR #4	2515
6	MeSH descriptor: [Patient Education as Topic] explode all trees	10927
7	MeSH descriptor: [Self Administration] explode all trees	956
8	MeSH descriptor: [Self-Management] explode all trees	1278
9	(layperson* OR lay-person* OR laypeople* OR lay-people* OR nonprofessional* OR non-professional*):ti,ab,kw	1271
10	(parent OR parents OR parental OR communit* OR teacher* OR caregiver* OR care-giver* OR personnel* OR school* OR 'child care worker*' OR 'childcare worker*' OR aide*):ti,ab,kw	174925
11	(patient* AND (educat* OR train* OR manage* OR instruct* OR confiden* OR complian* OR adheren*)):ti,ab,kw	339234
12	(self-manage*):ti,ab,kw	12046
13	MeSH descriptor: [First Aid] explode all trees	137
14	MeSH descriptor: [Emergency Medical Technicians] explode all trees	225
15	(first aid* OR first respon* OR EMT OR emergency medical technician* OR paramedic* OR para-medic* OR ambulance*):ti,ab,kw	87957
16	#6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15	536812
17	#5 AND #16 with Cochrane Library publication date Between Apr 2023 and Dec 2023	**177**

3 Embase: (Rerun Search strategy from from December 1, 2023 to Jully, 3 2024)
Results: 472

#	Searches	Results
1	(recogni*:ti,ab,kw OR knowledge*:ti,ab,kw OR skill*:ti,ab,kw OR educat*:ti,ab,kw OR information*:ti,ab,kw OR train*:ti,ab,kw) AND (anaphyla*:ti,ab,kw OR epinephrin*:ti,ab,kw OR adrenalin*:ti,ab,kw OR 'epi pen*':ti,ab,kw OR epipen*:ti,ab,kw)	1146
2	(underus*:ti,ab,kw OR 'under us*':ti,ab,kw OR underutili*:ti,ab,kw OR 'under utili*':ti,ab,kw) AND (anaphyla*:ti,ab,kw OR epinephrin*:ti,ab,kw OR adrenalin*:ti,ab,kw OR 'epi pen*':ti,ab,kw OR epipen*:ti,ab,kw)	22
3	(comfort*:ti,ab,kw OR discomfort*:ti,ab,kw OR 'dis comfort*':ti,ab,kw OR uncomfortable:ti,ab,kw OR confiden*:ti,ab,kw OR empower*:ti,ab,kw) AND (anaphyla*:ti,ab,kw OR epinephrin*:ti,ab,kw OR adrenalin*:ti,ab,kw OR 'epi pen*':ti,ab,kw OR epipen*:ti,ab,kw)	367
4	manage*:ti,ab,kw AND anaphyla*:ti,ab,kw	578
5	#1 OR #2 OR #3 OR #4	3307
6	'patient education'/exp	5666
7	'drug self administration'/exp	711
8	'self medication'/exp	728
9	(layperson*:ti,ab,kw OR 'lay person*':ti,ab,kw OR laypeople*:ti,ab,kw OR 'lay people*':ti,ab,kw OR nonprofessional*:ti,ab,kw OR 'non professional*':ti,ab,kw)	617
10	(parent:ti,ab,kw OR parents:ti,ab,kw OR parental:ti,ab,kw OR communit*:ti,ab,kw OR teacher*:ti,ab,kw OR caregiver*:ti,ab,kw OR 'care giver*':ti,ab,kw OR	152028

	personnel*:ti,ab,kw OR school*:ti,ab,kw OR 'child care worker*':ti,ab,kw OR 'childcare worker':ti,ab,kw OR 'childcare workers':ti,ab,kw OR aide*:ti,ab,kw)	
11	patient*:ti,ab,kw AND (educat*:ti,ab,kw OR train*:ti,ab,kw OR manage*:ti,ab,kw OR instruct*:ti,ab,kw OR confiden*:ti,ab,kw OR complian*:ti,ab,kw OR adheren*:ti,ab,kw)	281371
12	'self manage*':ti,ab,kw	3897
13	'layperson'/exp	360
14	'first aid'/exp	483
15	'rescue personnel'/exp	482
16	('first aid*':ti,ab,kw OR 'first respon*':ti,ab,kw OR emt:ti,ab,kw OR 'emergency medical technician*':ti,ab,kw OR paramedic*:ti,ab,kw OR 'para medic*':ti,ab,kw OR ambulance*:ti,ab,kw)	9006
17	#6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16	413044
18	#5 AND #17	409
19	#18 NOT ([conference abstract]/lim OR [editorial]/lim OR [erratum]/lim OR [letter]/lim OR [note]/lim)	474
20	#19 NOT ([animal cell]/lim OR [animal experiment]/lim OR [animal model]/lim OR [animal tissue]/lim)	472
		472

Database searched: PubMed, Embase, Cochrane library
Time Frame:– updated from end of last search (October 28, 2023): 2023, December 1, 2023 – July 3, 2024
Date Search Completed: July 3, 2024
Search Results (Number of articles identified and number identified as relevant):
PubMed: n=226
EMBASE: n=472
COCHRANE LIBRARY: n=177
OTHERS SOURCES: n=0
Total result before de-duping: 875
Total results after de-duping: 734
Number of relevant articles identified: 4

Summary of Evidence Update:
No new RCTs or observational studies involving recognition of anaphylaxis by first-aid providers was identified.

One ILCOR guideline "2023 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations" was identified[1]. This guideline identified the last ILCOR First Aid Task Force treatment recommendation about recognition of anaphylaxis[1]. This treatment recommendation is based on a scoping review [1].

As we extended and selected in our last scoping review articles in the field of recognition of anaphylaxis about educational intervention, action plan and protocol, knowledge and Factors associated with the underuse of epinephrine auto-injectors we have selected in the same fields 3 news observational studies.

- One mixed study systematic review aimed to explore parents' self-reported experiences and information needs regarding recognition and management of pediatric anaphylaxis[2].
- One observational study aimed to describe the clinical prehospital presentation of first-time anaphylactic patients by medical professionals[3].
- One before and after study aimed to determine the effect of food allergies and anaphylaxis management training on teachers' self-efficacy[4].

Summary of the selected studies
Guidelines
In 2023, the ILCOR First-Aid task force realize a scoping review to update of recognition of anaphylaxis in the 2023 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations [1]. The search identified 949 unique articles, of which 18 underwent full-text review. No study identified specific signs or symptoms that may be used by first aid providers in the identification of anaphylaxis, several surveys reported improvement in the ability to

recognize anaphylaxis immediately after individual or community-level educational engagements. The ILCOR FATF did not identify news evidence to change the last treatment recommendations or to pursue a new systematic review of this topic.

Systematic review

In 2022, Rahman[2] realizes a mixed-studies systematic review to explore parents' self-reported experiences and information needs regarding recognition and management of pediatric anaphylaxis. Forty studies (93%) reported parent experiences relating to their child's anaphylaxis. Themes were categorized around: 1) recognizing an anaphylactic reaction; 2) managing and responding to an anaphylactic reaction; 3) emotional impact of caring for a child at risk of anaphylaxis; and 4) interactions with the health system and healthcare providers (HCPs). Nine studies (7 qualitative, 1 quantitative, 1 mixed method) contributed data on parents' experiences around recognizing an anaphylactic reaction. Three qualitative studies reported on parents' experiences related to their ability to identify commonly occurring signs and symptoms of a reaction (e.g., breathing difficulty, swollen face, skin rash). Parents who were aware of the known allergens were vigilant and were able to identify a reaction right away and associate it with an allergen intake. In contrast, the most qualitative data reflected on parent's inability to recognize a reaction because they didn't know the symptoms; they were uncertain and didn't know about the food or allergen causing the reaction; or they didn't want to believe or accept their child had anaphylaxis. Quantitative data complemented these findings by indicating that parent's ability to recognize anaphylaxis differed depending on perceived severity of their child's food allergy.

Observational studies

Clinical presentation of anaphylaxis

In 2019, Holst Gudichsen[3] realized a retrospective register-based study of patients referred to an allergy centre, from 2019 to 2021 [3]. 444 adult patients (≥ 18 years) with suspected anaphylaxis were referred. Of the 444 patients included in this study, 256 (57.7%) had been in contact with the EMS. Of the 244 patients with available EMS records, 115 (47.1%) had symptoms corresponding to a WAO score of 3–5, with 62 (25.4%) being graded as WAO 5. Cutaneous symptoms were observed in 223 (91.4%) of all cases. The second-most frequent manifestations were symptoms from the central nervous system (n = 94, 38.5%) and the cardiovascular system (n = 54, 22.1%). For the distribution of the predominant symptoms in patients with anaphylaxis and the corresponding vital parameters, see Table 1 where the patients are stratified according to the severity of the allergic reaction (WAO grade 0–2, and WAO grades 3, 4, and 5). Patients treated prehospitally had a significantly more severe degree of anaphylaxis than patients only treated within the hospital. Patients with allergies progressing to severe anaphylaxis most often are treated prehospitally before transport to emergency departments. The authors conclude that education concerning the immediate treatment of severe anaphylaxis should primarily be targeted towards prehospital care providers

Table 1: Patient characteristics upon first prehospital presentation (n = 244)

EMS WAO grade	0-2	3	4	5	Total	*P*-value
Number of patients	129	26	27	62	244	
Vital parameters						
Systolic blood pressure (No. of observations)	143.5 (127-155) n=128	142.5 (120.75-158.75)	137 (115.5-154) n=26	88 (72.75-121) n=62	136 (110.5-152.5) n=240	0.015
Heart rate (No of observations)	88 (74-98.25) n=126	89 (80.5-95) n=25	89 (74.5-101.5) n=26	80 (67.5-92.25) n=62	85 (72-97) n=239	0.885
Oxygen saturation (No of observations)	98 (96-99) n=127	98(95.75-100) n=26	97.5 (95-100) n=26	95 (92-96) n=61	97 (94.5-98.5) n=240	0.0001
Respiratory rate (No of observation)	18 (16-20) n=115	20 (18-24) n=22	20 (18-25) n=22	20 (18-22) n=52	18 (16-20) n=211	0.0001
Clinical symptoms (%)						
Central nervous system	24 (18.6)	4 (15.4)	6 (22.2)	60 (96.8)	94 (38.5)	
Gastrointestinal tract	2 (1.6)	7 (26.9)	1 (3.7)	28 (45.2)	38 (15.6)	
Cardiovascular	11 (8.5)	6 (23.1)	11 (40.7)	26 (41.9)	54 (22.1)	
Upper airways	15 (11.6)	4 (15.3)	27 (100)	15 (24.2)	61 (25)	
Lower airways	9 (7)	18 (69.2)	6 (22.2)	6 (9.7)	39 (16)	
Cutaneous	125 (96.9)	24 (92.3)	23 (85.2)	51 (82.3)	223 (91.4)	

Conjonctival	26 (20.2)	4 (15.4)	4 (14.8)	3 (4.8)	37 (15.2)	
Other	16 (12.4)	2 (7.7)	1 (3.7)	3 (4.8)	22 (9)	

Educational intervention

In an observational study, Yıldırım[4] investigates the effects of food allergies and anaphylaxis management training on teachers' self-efficacy in managing food allergies and anaphylaxis. In all, 90 teachers were selected using convenience sampling. Data were collected before and immediately after the training on School Personnel's Self-Efficacy in Managing Food Allergy and Anaphylaxis at School Scale. A training program that consisted of 60-minutes sessions was conducted. There was a significant difference between the teachers' self-efficacy levels before (22.76±8.94) and after the training (32.81±6.09), and self-efficacy levels significantly increased ($p < .05$). The authors concluded that training increased the teachers' self-efficacy in managing food allergies and anaphylaxis

Relevant Guidelines, Systematic Reviews or Scoping Review

Organization (if relevant); Author; Year Published	**Guideline or systematic review**	**Topic addressed or PICO(S)T**	**Number of articles identified**	**Key findings**	**Treatment recommendations or conclusion**
Berg (2023) [1]	Guideline	P: Adults and children experiencing anaphylaxis I: The description of any specific symptoms to the first aid provider C: Absence of any specific description O: Recognition of anaphylaxis S: RCTs and nonrandomized studies (non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies), case series or reports, gray literature, social media publications, non–peer-reviewed studies, unpublished studies, conference abstracts and trial protocols were eligible for inclusion. All relevant publications in any language were included as long as there was an English abstract. T: All years to September 19, 2022	7	None of the studies identified specific signs or symptoms that may be used by first aid providers in the identification of anaphylaxis, several surveys reported improvement in the ability to recognize anaphylaxis immediately after individual or community-level educational engagements. New initiatives to improve recognition and management of anaphylaxis should be studied to evaluate their effectiveness and efficiency.	First aid providers should not be expected to recognize the signs and symptoms of anaphylaxis without repeated episodes of training and encounters with individuals with anaphylaxis.

Rahman (2022) {Rahman 2023}	Systematic review	To explore parents' self-reported experiences and information needs regarding recognition and management of pediatric anaphylaxis for developing KT tools (i.e., infographics, educational videos) to help parents of children at risk of anaphylaxis respond to acute events efficiently.	43 studies included in the review: - 22 quantitative studies, - 19 qualitative studies, - 2 mixed method studies.	Findings are developed in 2 domains: - parents' experiences. - parents' information needs. In parent's experiences, one topic is about **(Inability to recognize an anaphylactic reaction** 9 studies of variable quality contributed data on parents' experiences around recognizing an anaphylactic reaction. - 3 qualitative studies reported on parents' experiences related to their ability to identify commonly occurring signs and symptoms of a reaction (e.g., breathing difficulty, swollen face, skin rash). Parents who were aware of the known allergens were vigilant and were able to identify a reaction right away and associate it with an allergen intake. - In contrast, most of the qualitative data reflected on parent's inability to recognize a reaction because they didn't know the symptoms; they were uncertain and didn't know about the food or allergen causing the reaction; or they didn't want to believe or accept their child had anaphylaxis. Quantitative data complemented these findings by indicating that parent's ability to recognize anaphylaxis differed de- pending on perceived severity of	This review highlighted that for many parents managing an acute anaphylactic reaction is frightening and stressful, leading to significant emotional burden. Coupled with the unpredictability and uncertainty of the reactions, these feelings often stemmed from gaps in crucial knowledge about anaphylaxis allergens, lack of information regarding management and HCP support. F Furthermore, the authors indicated in their conclusion that although parents lack knowledge and competency, they are interested to acquire more information and search for helpful resources in order to feel more confident in their ability when responding to a reaction. This highlights the importance of developing practical resources for parents while addressing contextual aspects and knowledge gaps.

				their child's food allergy.	

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Aim/Study Type/Design/Location/Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Holst Gudichsen (2024) [3].	**Study aim:** investigate the clinical presentation of allergic patients the first time they presented with symptoms leading the clinician to suspect anaphylaxis prehospitally or in the ED, and (2) the primary contact point with the health care system for these patients. **Study Type:** Prospective register-based study **Design:** Non-RCT **Location** : Odense C,Denmark. **Study size:** 536 adult patients had a first-time referral to the Allergy Centre with a suspected anaphylactic reaction during the period 1 January 2019–31 December 2021.	**Population:** Adult patients (≥ 18 years) with a first-time referral to the Allergy Centre for a suspected anaphylactic reaction **Intervention:** First-time referral to the Allergy Centre for a suspected anaphylactic reaction **Comparison:** no comparison **Outcomes:** - Clinical presentation (including vital parameters)	244 patients, 115 (47.1%) had symptoms corresponding to a WAO score of 3–5, with 62 (25.4%) being graded as WAO 5. Cutaneous symptoms were observed in 223 (91.4%) of all cases. The second-most frequent manifestations were symptoms from the central nervous system (n = 94, 38.5%) and the cardiovascular system (n = 54, 22.1%. More results in table 1.	The first encounter with the health care system for patients with severe anaphylaxis most often is with the emergency medical system. Educational initiatives should be targeted the prehospital care provider. The physicians manning the EDs and the general practitioners, however, should be aware of anaphylaxis per se, as the patients´ subsequent diagnostic work-up at the Allergy Centres is dependent on their identification of cases of anaphylaxis.
Yildirim A. (2023) {Yildrim 2023}	**Study aim**: To determine the effect of food allergies and anaphylaxis management training on Turkish teachers' Self-efficacy. **Study Type:** non-RCT **Design:** quasi-experimental method with a pretest-posttest without a control group design. **Location:** Izmir, Turkey **Study size:** 90 teachers participate in the study from May to September 2019	**Population**: Teachers of Turkish's school. ` **Intervention**: Training on Food Allergy and Anaphylaxis Management program at School for Teachers (60 minutes) **Comparison**: Pre and post test questionnaire after training **Outcomes:** knowledge assessed with the Turkish version of	The teachers' self-efficacy in managing food allergies and anaphylaxis before and after training was for 4. Recognize anaphylaxis symptoms: (mean±SD) before: 2.48±1.30; after: 4.16±0.89 (p=0.000). The teachers' responses to the SPSMFAA-T and its subscales before and after training was for	This study found that food allergies and anaphylaxis management training provided at schools effectively improved teachers' self-efficacy in managing food allergies and anaphylaxis.

		the School Personnel's Self-Efficacy in Managing Food Allergy and Anaphylaxis Scale (SPSMFAA-T).	Anaphylaxis management: : (mean±SD) before: 7.52±3.29, after: 2.40±2.42; t=-13.373 (p=0.000)	

Reviewer Comments:
Like with the 2023 EvUp, no new studies involving recognition of anaphylaxis by first aid providers were identified and the findings from the 2023 ILCOR CoSTR on recognition of anaphylaxis by first aid providers remain unchanged. The few studies examining education methods in this EvUp confirm the conclusion of our scoping review publish in 2023. No SysRev is warranted.

Reference list:

Berg, K. M., Bray, J. E., Ng, K. C., Liley, H. G., Greif, R., Carlson, J. N., Morley, P. T., Drennan, I. R., Smyth, M., Scholefield, B. R., Weiner, G. M., Cheng, A., Djärv, T., Abelairas-Gómez, C., Acworth, J., Andersen, L. W., Atkins, D. L., Berry, D. C., Bhanji, F., Bierens, J., … Collaborators (2023). 2023 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces. *Circulation*, *148*(24), e187–e280. https://doi.org/10.1161/CIR.0000000000001179

Berg, K. M., Bray, J. E., Ng, K. C., Liley, H. G., Greif, R., Carlson, J. N., Morley, P. T., Drennan, I. R., Smyth, M., Scholefield, B. R., Weiner, G. M., Cheng, A., Djärv, T., Abelairas-Gómez, C., Acworth, J., Andersen, L. W., Atkins, D. L., Berry, D. C., Bhanji, F., Bierens, J., … ; and Collaborators (2024). 2023 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces. *Resuscitation*, *195*, 109992. https://doi.org/10.1016/j.resuscitation.2023.109992

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Rahman, S., Elliott, S. A., Scott, S. D., & Hartling, L. (2022). Children at risk of anaphylaxis: A mixed-studies systematic review of parents' experiences and information needs. *PEC innovation*, *1*, 100018. https://doi.org/10.1016/j.pecinn.2022.100018

Yıldırım, A., & Haney, M. O. (2023). Effects of training on teachers' food allergy and anaphylaxis management self-efficacy levels. *Allergologia et immunopathologia*, *51*(4), 158–163. https://doi.org/10.15586/aei.v51i4.849

2025 Evidence Update
FA 7111 – Second Dose of Epinephrine for Anaphylaxis

Worksheet Author(s): Jestin Carlson
Task Force: First Aid
Date Approved by SAC Representative: 2 October 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Among adults and children experiencing severe anaphylaxis requiring the use of epinephrine
Intervention: does administration of a second dose of epinephrine
Comparators: compared with administration of only one dose
Outcomes: change resolution of symptoms, adverse effects, complications
Study Designs: Included - randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, uninterrupted time series, controlled before-and-after studies, cohort studies). Excluded - studies not reporting on our selected outcomes and those without an English language abstract

Year of last full review: 2021

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest a second dose of epinephrine be administered by autoinjector to adults and children with severe anaphylaxis whose symptoms are not relieved by an initial dose (weak recommendation, very low-quality evidence).

Current Search Strategy
(((((("multiple dose"[TI] or "multiple doses"[TI] or repeat[TI] or second dose[TI] or second doses[TI]) AND epinephrine[TI])))) OR ((((((("Epinephrine"[Mesh] OR Epinephrine[TIAB] OR Adrenaline[TIAB] or adrenalin[TIAB]))) AND (("administration and dosage" [Subheading] OR "therapeutic use" [Subheading:NoExp] OR "repeat epinephrine"[TIAB] OR dose[TIAB] OR dosage[TIAB] or doses[TIAB] or "second injection"[TIAB] or "next injection"[TIAB] or "2 injections"[TIAB] or "two injections"[TIAB] or Twinject[TIAB] or "additional injection"[TIAB] or "additional injections"[TIAB] OR "repeated injection"[TIAB] or "repeated injections"[TIAB] or "repeat injection"[TIAB] or "repeat injections"[TIAB] or multiple[TIAB])))) AND ((("Anaphylaxis"[Mesh] OR Anaphylaxis[TIAB] or anaphylactic[TIAB] or "severe allergic reaction"[TIAB] or "severe allergic reactions"[TIAB]) AND ("therapy" [Subheading:NoExp] OR "drug therapy" [Subheading] OR "prevention and control" [Subheading])))))))) NOT ((animals[mh] NOT humans[mh]) NOT ("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp]))

Database searched: Pubmed

Time Frame:
Last Review – 3 January 2021 1; updated search dates – 3 June 2020 to 1 June 2023; updated search dates – 1 January 2023 – 2 October 2024

Date Search Completed: 2 October 2024

Search Results:
Results – 107; Relevant – 1

Summary of Evidence Update:

Study Acronym; Author; Year Published	Aim of Study; Study Type; Study Size (N)	Patient Population	Study Intervention (# patients) / Study Comparator (# patients)	Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)	Relevant 2° Endpoint (if any); Study Limitations; Adverse Events

Casale, 2023, 152[5]	**Study Aim:** Compare pharmacokinetics and pharmacodynamics between three different epinephrine delivery approaches. **Study Type:** Phase 1 trial phase 1, randomized, 6-treatment, 6-period, 2-part crossover study.	**Inclusion Criteria:** Adults comparing 2.0 mg intranasally, 0.3 mg via autoinjector, and 0.3 mg via manual intramuscular injection	**Intervention:** N=59 **Comparison:** N=59	**1° endpoint:** Pharmacokinetics and pharmacodynamics after initial and repeated doses at multiple time points. Mean peak plasma levels were 339 pg/mL for manual intramuscular injection, 481 pg/mL for intranasal, and 753 pg/mL for autoinjector.	**Study Limitations:** Examined pharmacokinetics and pharmacodynamics. Unable to determine need for repeated doses or benefit of repeated doses. **Comments** Epi may be administered via multiple different routes.

Reviewer Comments:
Insufficient literature to support a SysRev or ScopRev at this time.

Reference list:

Casale, 2023, 152

Casale TB, Ellis AK, Nowak-Węgrzyn A, Kaliner M, Lowenthal R, Tanimoto S. Pharmacokinetics/pharmacodynamics of epinephrine after single and repeat administration of neffy, EpiPen, and manual intramuscular injection. J Allergy Clin Immunol. 2023 Dec;152(6):1587-1596. doi: 10.1016/j.jaci.2023.08.007. Epub 2023 Aug 19. PMID: 37604314.

2025 Evidence Update
FA 7113 -- Removal of Foreign Body Airway Obstruction

Worksheet Author(s): Richard N. Bradley
Task Force: First Aid
Date Approved by SAC Representative: October 10, 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults and children with foreign body airway obstruction
Intervention: Interventions to remove foreign body airway obstruction, such as finger sweep, back slaps, abdominal thrusts, chest thrusts, and suction-based airway clearance devices
Comparators: No action
Outcomes: Any clinical outcome
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies), case series (≥5 cases) are eligible for inclusion. Case reports of injuries/ complications will be eligible. All languages will be included as long as there is an English abstract. Unpublished studies (e.g., conference abstracts, trial protocols), animal studies, manikin studies, cadaver studies will be excluded.

Year of last full review: 2019

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest that back slaps are used initially in patients with a FBAO and an ineffective cough (weak recommendation, very low certainty evidence).
We suggest that abdominal thrusts are used in adults and children with a FBAO and an ineffective cough where back slaps are ineffective (weak recommendation, very low certainty evidence).
We suggest that rescuers consider the manual extraction of visible items in the mouth (weak recommendation, very low certainty of evidence).
We suggest against the use of blind finger sweeps in patients with a FBAO (weak recommendation, very low certainty evidence).
We suggest that appropriately skilled individuals consider the use of Magill forceps to remove FBAO in OHCA patients with a FBAO (weak recommendation, very low certainty evidence).
We suggest that chest thrusts are used in unconscious patients with a FBAO (weak recommendation, very low certainty evidence).
We suggest that bystanders undertake interventions to support FBAO removal as soon as possible after recognition (weak recommendation, very low certainty evidence).

Current Search Strategy: ("airway obstruction/therapy"[MeSH Major Topic] AND "Heimlich"[Title]) OR ("asphyxia/therapy"[MeSH Major Topic] AND "eating"[MeSH Major Topic]) OR ("airway obstruction/therapy"[MeSH Terms] AND ("first aid/adverse effects"[MeSH Major Topic] OR "foreign bodies/therapy"[MeSH Major Topic] OR "first aid"[MeSH Major Topic] OR "resuscitation/methods"[MeSH Major Topic] OR "emergency medical services/methods"[MeSH Major Topic])) OR ("airway obstruction/complications"[MeSH Major Topic] AND "foreign bodies/therapy"[MeSH Terms])
Database searched: Medline
Time Frame: updated from end of last search August 2019
Date Search Completed: September 20, 2024
Search Results: 48 articles identified. 13 identified as relevant.
Summary of Evidence Update:
1 This evidence update identified 13 new publications since the previous CoSTR and the last Structured Review. Some of these represent prospective or independent retrospective studies. There is a risk of some data duplication in publication of data reported to manufacturers by end users of airway clearance devices.
2 The evidence suggests that regardless of which treatment is provided first, it is common for more than one intervention to be required for relief of a foreign body airway obstruction.
3 The evidence from Dunne 2024 suggests that back blows are more effective than chest or abdominal thrusts.
Relevant Guidelines or Systematic Reviews

Organization (if relevant); Author; Year Published	Guideline or systematic review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
ILCOR Couper 2020	Systematic Review	Effectiveness of interventions to treat foreign body airway obstructions	69 eligible from 1,370 articles reviewed	1. Early bystander removal is associated with improved neurologically intact survival. 2. All key interventions were effective in relieving airway obstructions. 3. There is evidence of harm for key interventions.	Early bystander intervention following foreign body airway obstruction is associated with improved outcome. All included interventions were effective in relieving obstructions.
AHA 2018	Guideline	FBAO	1	n/a	Lay rescuers not taught FBAO for unresponsive adults. Conscious adults: abdominal thrusts only. Unconscious adults: CPR. Conscious infants with FBAO: back blocks & abdominal thrusts. Conscious children with FBAO: abdominal thrusts. Unconscious infants & children: CPR & remove visible foreign body
American Red Cross 2019	Guideline	FBAO	1	n/a	Conscious adults & children: back blows & abdominal thrusts. Conscious infants: back blows & chest thrusts. Unconscious, any age: CPR ACDs are an option.
ANZCOR 2024	Guideline	FBAO	1	n/a	1. Conscious: 5 back blows & 5 chest thrusts.

					2. Unconscious: CPR
ERC Olasveengen 2021	Guideline	FBAO	1	n/a	Conscious: 5 back blows & 5 abdominal thrusts. Unconscious: CPR
International Federation of Red Cross and Red Crescent Societies 2022	Guideline	FBAO	1	n/a	Conscious adults & children: back blows & abdominal thrusts. Conscious infants: back blows & chest thrusts. Unconscious, any age: CPR

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	**Study Type/Design; Study Size (N)**	**Patient Population**	**Primary Endpoint and Results (include P value; OR or RR; & 95% CI)**	**Summary/Conclusion Comment(s)**
Bhanderi 2020	**Study Type:** Case series. n=27.	**Inclusion Criteria:** User-reported use of the DeChoker in the UK.	**1° endpoint:** Relief of FBAO, 26 0f 27 cases successful.	User-initiated reports of use of the DeChoker provided some evidence of effectiveness for the important outcome of relief of FBAO.
Costable 2024	Case series. n=299.	User-reported use of LifeVac in children to the manufacturer, Jan 2014 -20.	Injuries/complications; 0 adverse outcomes in 299 cases.	Operator-initiated reports of use of LifeVac in children aged 5 years and under provided some evidence of a low risk for injuries and complications. There is likely data overlap with Gal 2020.
Dunne 2023	Case series. n=186.	Independent data collection from individuals who had self-reported use of LifeVac or DeChoker to the manufacturer, Jul 21 – Jun 23.	Relief of FBAO: 178 of 186 (96%) cases	Independent reports of use of any airway clearance device provided some evidence of effectiveness for the important outcome of relief of FBAO.
Dunne 2024	Retrospective chart review. n=709.	All patients with FBAO attended by EMS in Alberda during 2018-21.	Relief of FBAO. 492 of 643 (90%) of bystander BLS interventions resulted in relief of FBAO.	Back blows demonstrated better outcomes than other interventions. For the important outcome relief of obstruction, abdominal thrusts as a first intervention had an OR of 0.57 (0.39 -0.62)

				compared to back blows. For the critical outcome of survival to discharge, abdominal thrusts as a first intervention had an OR of 0.20 (0.07 – 0.59) compared to back blows.
Gal 2020	Case series. n=21.	User-reported use of LifeVac in children to the manufacturer, Jan 2014 -20.	Relief of FBAO. 21 of 21 cases successful.	User-initiated reports of the use of the LifeVac in children aged 5 years and under provided some evidence of a low risk for injuries and complications.
Jensen 2019	Retrospective observational. n=121.	Out-of-Hospital Cardiac Arrest with FBAO in Copenhagen from 2016-8.	Survival. Mortality was higher when cardiac arrest with FBAO when not treated by bystanders (50% vs. 30.2%).	Bystander interventions for FBAO in cardiac arrest demonstrated effectiveness.
McKinley 2022	Case series. n=42.	User-reported use of LifeVac in adults to the manufacturer, Jan 2014 – Jul 20.	Relief of FBAO: 38 0f 42 (90%) cases.	User-initiated reports of use of the LifeVac in adults provided some evidence of effectiveness.
MOCHI-retro Norii 2021	Case series. n=8.	Use of a vacuum cleaner as an intervention for FBAO in Japan.	Relief of FBAO: 3 0f 8 (37%) of cases.	This study provides some evidence that suction-based devices may be effective.
MOCHI Norii 2024	Prospective observational. n=407.	Out-of-hospital FBAO patients that went to EDs in Japan, Apr 2020 – Mar 23.	1-month survival: hazard ratio 0.55 (95% CI 0.39-0.77) Neurologically intact survival: adjusted OR 2.18 (95% CI 1.23-3.95)	This study provides evidence that interventions for FBAO may be effective.
Pawlukiewicz 2021	Case report. n=1.	Adverse event after abdominal thrust	In this case an unintended effect of abdominal thrusts was cholesterol embolus with arterial occlusion	This study provides some evidence that abdominal thrusts may be harmful.
Wang 2022	Case report. n=1.	Adverse event after abdominal thrust	In this case an unintended effect of abdominal thrusts was ventricular rupture.	This study provides some evidence that abdominal thrusts may be harmful.
Wolthers 2024	Retrospective observational	Out-of-Hospital Cardiac Arrest with FBAO in Denmark, 2016-22.	30-day survival. Bystander FBAO interventions in 79 of 321 cases. aOR for bystander intervention: 1.47 (95% CI 0.553-3.648).	This study does not provide conclusive evidence that bystander intervention is effective for FBAO after cardiac arrest (95% CI for aOR for 30-day survival crosses 1.0).

Reviewer Comments:

Airway clearance devices are increasing in prevalence. Currently, there are no treatment recommendations regarding these devices. ILCOR should update the systematic review on Foreign Body Airway Obstruction.

Reference list:

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American Red Cross. Adult & Child Choking: Symptoms and First Aid [Internet]. Red Cross. 2019. [cited 2024 Oct 10]. Available from: https://www.redcross.org/take-a-class/resources/learn-first-aid/adult-child-choking

ANZCOR. Guideline 4 – Airway [Internet]. 2024. [cited 2024 Oct 10]. Available from: https://www.anzcor.org/home/basic-life-support/guideline-4-airway/

Bhanderi BG, Palmer Hill S. Evaluation of DeChoker, an Airway Clearance Device (ACD) Used in Adult Choking Emergencies Within the Adult Care Home Sector: A Mixed Methods Case Study. Front Public Health. 2020 Dec 9;8:541885. doi: 10.3389/fpubh.2020.541885. PMID: 33425826; PMCID: PMC7793855. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7793855/

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Couper K, Abu Hassan A, Ohri V, Patterson E, Tang HT, Bingham R, Olasveengen T, Perkins GD; International Liaison Committee on Resuscitation Basic and Paediatric Life Support Task Force Collaborators. Removal of foreign body airway obstruction: A systematic review of interventions. Resuscitation. 2020 Nov;156:174-181. doi: 10.1016/j.resuscitation.2020.09.007. Epub 2020 Sep 16. PMID: 32949674. https://linkinghub.elsevier.com/retrieve/pii/S0300-9572(20)30455-X

Dunne CL, Viguers K, Osman S, Queiroga AC, Szpilman D, Peden AE. A 2-year prospective evaluation of airway clearance devices in foreign body airway obstructions. Resusc Plus. 2023 Nov 8;16:100496. doi: 10.1016/j.resplu.2023.100496. PMID: 38026136; PMCID: PMC10658362. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10658362/

Dunne CL, Cirone J, Blanchard IE, Holroyd-Leduc J, Wilson TA, Sauro K, McRae AD. Evaluation of basic life support interventions for foreign body airway obstructions: A population-based cohort study. Resuscitation. 2024 Aug;201:110258. doi: 10.1016/j.resuscitation.2024.110258. Epub 2024 May 31. PMID: 38825222. https://www.resuscitationjournal.com/article/S0300-9572(24)00151-5/fulltext

Gal LL, Pugleisi P, Peterman D. Resuscitation of choking victims in a pediatric population using a novel portable non-powered suction device: Real world data. Pediatr Ther. 2020;10:e371. https://vitalvac.com/wp-content/uploads/2024/07/estudo-2.pdf

International Federation of Red Cross and Red Crescent Societies. International First Aid Resuscitation and Education Guidelines 2020 [Internet]. Global First Aid Reference Centre. 2022 [cited 2024 Oct 9]. Available from: https://www.globalfirstaidcentre.org/resource/international-first-aid-resuscitation-and-education-guidelines-2020-2/

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McKinley MJ, Deede J, Markowitz B. Use of a Novel Portable Non-powered Suction Device in Patients With Oropharyngeal Dysphagia During a Choking Emergency. Front Med (Lausanne). 2022 Feb 2;8:742734. doi: 10.3389/fmed.2021.742734. PMID: 35186960; PMCID: PMC8847721. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8847721/

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Norii T, Igarashi Y, Yoshino Y, Nakao S, Yang M, Albright D, Sklar DP, Crandall C. The effects of bystander interventions for foreign body airway obstruction on survival and neurological outcomes: Findings of the MOCHI registry. Resuscitation. 2024 Jun;199:110198. doi: 10.1016/j.resuscitation.2024.110198. Epub 2024 Apr 4. PMID: 38582443. https://www.resuscitationjournal.com/article/S0300-9572(24)00091-1/fulltext

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Pawlukiewicz AJ, Merrill DR, Griffiths SA, Frantz G, Bridwell RE. Cholesterol embolization and arterial occlusion from the Heimlich maneuver. Am J Emerg Med. 2021 May;43:290.e1-290.e3. doi: 10.1016/j.ajem.2020.09.079. Epub 2020 Sep 30. PMID: 33036850. https://www.sciencedirect.com/science/article/abs/pii/S0735675720308755

Wang C, Wang ZZ, Wang TB. Blunt myocardial injury and gastrointestinal hemorrhage following Heimlich maneuver: A case report and literature review. World J Emerg Med. 2022;13(3):248-250. doi: 10.5847/wjem.j.1920-8642.2022.038. PMID: 35646206; PMCID: PMC9108913. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9108913/

Wolthers SA, Holgersen MG, Jensen JT, Andersen MP, Blomberg SNF, Mikkelsen S, Christensen HC, Jensen TW. Foreign body airway obstruction resulting in out-of-hospital cardiac arrest in Denmark - Incidence, survival and interventions. Resuscitation. 2024 May;198:110171. doi: 10.1016/j.resuscitation.2024.110171. Epub 2024 Mar 9. PMID: 38461889. https://www.resuscitationjournal.com/article/S0300-9572(24)00064-9/fulltext

2025 Evidence Update
FA 7140 – Aspirin or Chest Pain

Worksheet Author(s): Wei-Tien Chang, Tse-Ying Lee, Therese Djärv
Task Force: First Aid Task
Date Approved by SAC Representative: 1 November 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Among adults who experience non-traumatic chest pain
Intervention: does early or first aid administration of aspirin
Comparators: compared to later or in-hospital administration of aspirin
Outcomes: change any outcome
Study Designs: Included - randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, uninterrupted time series, controlled before-and-after studies, cohort studies).
Excluded - studies not reporting on our selected outcomes and those without an English language abstract

Year of last full review: 2019

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
For adults with nontraumatic chest pain, we suggest the early administration of aspirin in the first aid setting as compared with the late, in-hospital administration of aspirin (weak recommendation, very low-certainty evidence).

Current Search Strategy
(((((("Chest Pain"[Mesh] OR "Chest Pain"[All Fields]OR "Angina Pectoris"[Mesh] OR angina[TIAB] OR "Myocardial infarction"[Mesh]))) AND (("Aspirin"[Mesh] OR "acetylsalicylic acid"[TIAB] OR "aspirin"[All Fields]))) AND (("Emergency Medical Services"[Mesh] OR "Emergency Service, Hospital"[Mesh] OR "Emergency Treatment"[Mesh] OR "Emergencies"[Mesh] OR prehospital [TIAB] OR pre-hospital [TIAB] OR ems[All Fields] OR out-of-hospital[All Fields] OR early[All Fields] OR earlier[All Fields]))) AND ((((((((("randomized controlled trial"[PT] OR "controlled clinical trial"[PT] OR "clinical trial"[PT] OR "comparative study"[PT] OR random*[TIAB] OR controll*[TIAB] OR "intervention study"[TIAB] OR "experimental study"[TIAB] OR "comparative study"[TIAB] OR trial[TIAB] OR evaluat*[TIAB] OR "Before and after"[TIAB] OR "interrupted time series"[TIAB]))) OR (("Epidemiologic Studies"[Mesh] OR "case control"[TIAB] OR "case-control"[TIAB] OR ((case[TIAB] OR cases[TIAB]) AND (control[TIAB] OR controls[TIAB])) OR "cohort study"[TIAB] OR "cohort analysis"[TIAB] OR "follow up study"[TIAB] OR "follow-up study"[TIAB] OR "observational study"[TIAB] OR "longitudinal"[TIAB] OR "retrospective"[TIAB] OR "cross sectional"[TIAB] OR "cross-sectional"[TIAB] OR questionnaire[TIAB] OR questionnaires[TIAB] OR survey[TIAB])))) NOT (("animals"[MH] NOT (animals[MH] AND "humans"[MH])))) NOT (("letter"[pt] OR "comment"[pt] OR "editorial"[pt])))) AND English[lang])))

Database searched:
Pubmed, Cochrane

Time Frame: 2019.10.01-2024.09.30

Date Search Completed: 2024.10.28.

Search Results:
Number of articles identified: 98
Number of articles finally evaluated: 11
Number of relevant articles: 0

Summary of Evidence Update: No new articles was found.

Reviewer Comments:
No new studies relevant to this PICO were identified, so an updated SysRev is not indicated. With the employment of P2Y12 inhibitors in the antithrombotic treatment of acute coronary syndrome in the last two decades, it is hard to identify studies comparing early versus late administration of aspirin only. Though one observational study comparing the effect of early dual antiplatelet therapy ($\leq$ 2 hours vs. > 2 hours) in primary percutaneous coronary intervention for ST-elevation myocardial infarction

shows that early DAPT may improve left ventricular function at 6 months (Firman 2020, 99), the scope of this study does not match the PICO question since it is confounded by the concomitant use of P2Y12 inhibitors.
Another issue worthy of concern is the hazards of bleeding in patients eventually diagnosed as etiologies other than occlusive coronary artery disease. Unlike previous reviews in which no studies were found reporting such hazards, there is one study in the current search describing increased risk of bleeding in chest pain patients administered aspirin or clopidogrel (or both) and finally diagnosed as type A aortic dissection necessitating surgical intervention (Jiang 2022, 37). While the population of this PICO question is adults who experience non-traumatic chest pain, a caution should be introduced if aortic dissection is to be ruled out.

Reference list:

Firman D, et al. (2020) The effect of early dual antiplatelet timing on the microvascular resistance and ventricular function in primary percutaneous coronary intervention. Medicine 99(29):e21177 doi: 10.1097/MD.0000000000021177.

Jiang X, et al. Outcomes of preoperative antiplatelet therapy in patients with acute type A aortic dissection. J Card Surg 2022;37(1):53 doi: 10.1111/jocs.16080.

2025 Evidence Update
FA 7162 – Dietary Sugar Treatment for Hypoglycemia

Worksheet Author(s): Therese Djarv
Task Force: First Aid
Date Approved by SAC Representative: 8 December 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults and children with symptomatic hypoglycemia
Intervention: Administration of dietary forms of sugar
Comparators: Standard dose (15–20 g) of glucose tablets
Outcomes: Time to resolution of symptoms, complications, blood glucose level after treatment, hypoglycemia (defined as the persistence of symptoms [yes/no] or recurrence of symptomatic hypoglycemia for more than15 minutes after treatment), hospital length of stay
Study Designs: RCTs and nonrandomized studies (non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion; unpublished studies (eg, conference abstracts, trial protocols) were excluded.
Timeframe: All years and all languages were included as long as there was an English abstract. We reran the existing search strategy between 1 January 2020 to December 8, 2024.

Year of last full review: 2019

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We recommend that first aid providers administer glucose tablets for treatment of symptomatic hypoglycemia in conscious adults and children (strong recommendation, low-quality evidence).
We suggest that if glucose tablets are not available, various forms of dietary sugars such as Skittles, Mentos©, sugar cubes, jelly beans, or orange juice can be used to treat symptomatic hypoglycemia in conscious adults and children (weak recommendation, very low-quality evidence).
There is insufficient evidence to make a recommendation on the use of whole milk, cornstarch hydrolysate, and glucose solution, or glucose gels as compared with glucose tablets for the treatment of symptomatic hypoglycemia

Current Search Strategy
Search: ("Hypoglycemia"[Mesh:NoExp] OR Hypoglycem*[TIAB] OR Hypoglycaem*[TIAB] OR "low blood sugar"[TIAB] OR "insulin reaction"[TIAB] OR "insulin reactions"[TIAB] OR "plasma glucose"[TIAB]) AND (("Glucose"[Mesh:NoExp] OR "glucose tablets"[TIAB] OR "glucose tablet"[TIAB] OR Dextrose[TIAB] OR "Fructose"[Mesh] OR Fructose[TIAB] OR "Sucrose"[Mesh] OR sucrose[TIAB] OR "Dietary Carbohydrates"[Mesh] OR "Carbohydrates"[Mesh:NoExp] OR Carbohydrate*[TIAB] OR Sugar*[TIAB] OR "Candy"[Mesh:NoExp] OR Candy[TIAB] OR Lolly[TIAB] OR lollie[TIAB] OR sweets[TIAB] OR "Tablets"[Mesh:NoExp] OR Juice[TIAB] OR "Beverages"[Mesh] OR "oral glucose"[TIAB] OR "Gels"[Mesh:NoExp] OR gel[TIAB] OR gels[TIAB] OR paste*[TIAB] OR honey[Mesh] OR honey[TIAB] OR icing[TIAB]) AND ("Dosage Forms"[Mesh] OR "Emergency Treatment"[Mesh:NoExp] OR "First Aid"[Mesh] OR "first aid"[TIAB] OR "first-aid"[TIAB] OR "Treatment Outcome"[Mesh] OR efficacy[TIAB] OR Treatment*[TI] OR Treat[TI]) AND ("Diabetes Mellitus"[Mesh]OR diabet*[TIAB]) NOT ("Hemodialysis Solutions"[Mesh] OR Hemodialysis[TIAB] OR dialysis[TIAB] OR "Administration, Intravenous"[Mesh] OR intravenous*[TIAB] OR venous[TIAB]) NOT (animals[mesh] NOT humans[mesh]) NOT ("letter"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] or Case Reports[Publication Type])

Database searched:
Pubmed
Time Frame: Last Review – 3 January 2021 1; updated search dates – 1 January 2020 to 8 December 2024

Date Search Completed:
8 December 2024

Search Results (Number of articles identified and number identified as relevant):
Results – 521; Relevant – 2

Summary of Evidence Update:
Relevant Guidelines or Systematic Reviews

Organization (if relevant); Author; Year Published	Guideline or systematic review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
Urbanova 2022	**Narrative review**	What isthe optimal dose of glucose in hypoglycemia in diabetic patients?	11	For most nonsevere episodes of hypoglycemia, the optimal treatment is 15 to 20 g of oral glucose. However, this dose may not be appropriate with many current insulins and insulin pump therapy, where doses of glucose may have to be individualized, based on body weight or type of insulin delivery system.	Current guidelines on hypoglycemia treatment for newer glucose-lowering therapies may require re-evaluation

RCT: N/A

Study Acronym; Author; Year Published	Aim of Study; Study Type; Study Size (N)	Patient Population	Study Intervention (# patients) / Study Comparator (# patients)	Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)	Relevant 2° Endpoint (if any); Study Limitations; Adverse Events
Fumanelli et al. 2020.	**Study Aim:** compare the response to three types of frequently used rapid acting CHO to correct hypoglycemia during prolonged aerobic exercise **Study Type:** RCT	**Inclusion Criteria:** 21 subjects with T1DM, aged 12-16 years, agreed to be recruited in the study. All participants took part in a trekking camp for 5 days, with 70 Km itinerary.	**Intervention:** 0.3g/Kg of a glucose preparation **Comparison 1:** sugar fondant candies **Comparison 2:** fruit juice	**1° endpoint:** No significant differences were highlighted among the three treatments in terms of time spent in hypoglycemia, rise in blood glucose levels and number of hypoglycemic events after correction of hypoglycemia	**Study Limitations:** Number of participants. Lack of clear description of volume of both comparisons

Reviewer Comments:
Two relevant studies were identified. One RCT (Fumanelli, 2020, 91) with three arms in children with diabetes type 1 aged 12-16 years trekking for 5 days found no difference between any of the three arms; 0.3g glucose preparation/kg, sugar fondant candies and fruit juice.
A narrative review (Urbanova, 2022, 743) explored the optimal dose of carbohydrates in nonsevere hypoglycemia. Their conclusion was that most recover after 15-20g but individual strategies based on body weight or type of insulin delivery system might be relevant in future guidelines.
One trial that was not directly relevant to this PICO but was related was the REVERSIBLE trial (Cheng, 2024, 476), which showed that oral intake of carbohydrates in patients with type 1 diabetes could be beneficial earlier, i.e. at higher blood glucose levels than traditional cutoffs to avoid hypoglycemia. This might be relevant from a first aid perspective but is out of the scope for the current PICO. The evidence did not warrant a new ScopRev or SysRev.

Reference list:

Fumanelli J, Franceschi R, Bonani M, Orrasch M and Cauvin V. Treatment of hypoglycemia during prolonged physical activity in adolescents with type 1 diabetes mellitus. Acta Biomed. 2020;91:e2020103.

Cheng R, Taleb N, Wu Z, Bouchard D, Parent V, Lalanne-Mistrih ML, Boudreau V, Messier V, Lacombe MJ, Grou C, Brazeau AS and Rabasa-Lhoret R. Managing Impending Nonsevere Hypoglycemia With Oral Carbohydrates in Type 1 Diabetes: The REVERSIBLE Trial. Diabetes Care. 2024;47:476-482.

Urbanova J, Frier BM, Taniwall A, Brozova K, Malinovska J, Chandel A and Broz J. Optimal Carbohydrate Dose for Treatment of Nonsevere Hypoglycemia in Insulin-Treated Patients With Diabetes: A Narrative Review. Can J D

2025 Evidence Update
FA 7170 – Recognition of Stroke

Worksheet Author(s): Pascal Cassan, Daniel Meyran
Task Force: First Aid
Date Approved by SAC Representative: November 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Among adults with suspected acute stroke
Intervention: use of a rapid stroke scoring system or scale
Comparators: Basic first aid assessment without the use of a scale
Outcomes: Change time to treatment (e.g. symptom onset to hospital/emergency department arrival or hospital admission (Critical). Recognition of stroke (Important), high number considered beneficial for observational study high sensitivity and high specificity considered beneficial for diagnosis study. Discharge with favorable neurologic status (increase considered beneficial) (Important). Survival with favorable neurologic outcome (increase considered beneficial) (Important). Increased public/layperson recognition of stroke signs (Important)
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) are eligible for inclusion. Case series and case reports will also be considered for inclusion. As it is anticipated that there will be insufficient studies from which to draw a conclusion, the minimum number of cases for a case series to be included has been reduced for the default of 5 to 1 by the TFSR team. All years and all languages are included as long as there is an English

Year of last full review: June 2024

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST (2020 CoSTR) [6, 7]**:**
We recommend that first aid providers use stroke assessment scales/tools for adults with suspected acute stroke (strong recommendation, low-certainty evidence).

For first aid, we suggest the use of FAST, MASS, CPSS or LAPSS scales/tools for stroke assessment (weak recommendation, low-certainty evidence).

For first aid, we suggest the use of stroke assessment scales/tools that include blood glucose measurement when available, such as MASS or LAPSS, to increase specificity of stroke recognition (weak recommendation, low-certainty evidence).

For first aid, we suggest the use of FAST or CPSS stroke assessment scales/tools when blood glucose measurement is unavailable (weak recommendation, low-certainty evidence).

Current Search Strategy
1 Pubmed: (Rerun Search strategy from December 2, 2023 to June 31, 2024)
Results: 85
((((((Stroke[MeSH Terms]) AND (acute[Title/Abstract])) OR (acute stroke*[Title/Abstract]) OR (acute cerebrovascular accident*[Title/Abstract])) AND ((scale*[Title/Abstract]) OR (score*[Title/Abstract]) OR (scoring[Title/Abstract])) AND ((Time-to-Treatment[MeSH Terms]) OR ("Time Factors" [MeSH Terms]) OR (time-to-treatment[Title/Abstract]) OR (recogn*[Title/Abstract]) OR (cognitive knowledge[Title/Abstract]) OR (neurologic outcome*[Title/Abstract]) OR (neurologic status[Title/Abstract]))) NOT (animals[mh] NOT humans[mh]) NOT ("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp])) AND (2023/9/30:2024/06/30[pdat]))

2 Cochrane: (Rerun Search strategy from December 2, 2023 to June 31, 2024)
Results: 17

No.	Query	Results
#1	[mh Stroke]	17732
#2	acute:ab,ti	169963
#3	#1 AND #2	5306

#4	(acute near/3 stroke*):ab,ti	12039
#5	"acute cerebrovascular accident":ab,ti	22
#6	#3 OR #4 OR #5	13349
#7	scale*:ab,ti	264353
#8	score*:ab,ti	369690
#9	scoring:ab,ti	16512
#10	#7 OR #8 OR #9	503702
#11	[mh Time-to-Treatment]	704
#12	[mh "Time Factors"]	81907
#13	"time-to-treatment":ab,ti	2463
#14	recogn*:ab,ti	24982
#15	"cognitive knowledge":ab,ti	42
#16	"neurologic outcome":ab,ti	397
#17	"neurologic status":ab,ti	164
#18	#11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17	109326
#19	#6 AND #10 AND #18	595
#20	**#6 AND #10 AND #18 with Cochrane Library publication date Between Oct 2023 and June 2024**	**17**

3 Embase: (Rerun Search strategy from May 26, 2020 to December 2, 2023)
Results: 162

No.	Query	Results
#27	**#25 NOT #26**	**162**
#26	([editorial]/lim OR [letter]/lim OR 'case report'/de) AND [embase]/lim	3822445
#25	#23 NOT #24	550
#24	'animal'/exp NOT 'human'/exp AND [embase]/lim	4308285
#23	#7 AND #13 AND #22	555
#22	#14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21	197261
#21	'neurologic status':ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	89
#20	'neurologic outcomes':ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	176
#19	'neurologic outcome':ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	154
#18	'cognitive knowledge':ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	11
#17	recogn*:ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	46763
#16	'time to treatment':ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	790
#15	'time factors'/de AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	691
#14	'time to treatment'/de AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	2329
#13	#8 OR #9 OR #10 OR #11 OR #12	726630

#12	scoring:ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	9854
#11	score*:ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	129175
#10	scale*:ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	77580
#9	'rating scale'/de AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	2158
#8	'scoring system'/de AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	14359
#7	#3 OR #4 OR #5 OR #6	3159
#6	'acute cerebrovascular accidents':ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	9
#5	'acute cerebrovascular accident':ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	44
#4	((acute NEAR/3 stroke*):ab,ti) AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	5361
#3	#1 AND #2	19730
#2	acute:ab,ti AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	92765
#1	'cerebrovascular accident'/de AND [embase]/lim AND [25-05-2020]/sd NOT [30-09-2023]/sd	24682

Database searched: PubMed, Embase, Cochrane library
Time Frame: December 2, 2023 – June 30, 2024

Date Search Completed: July 2, 2024

Search Results:
PubMed: n=85
EMBASE: n= 162
COCHRANE LIBRARY: n=17
OTHER SOURCES: n=0
Total result before de-duping: 265
Total results after de-duping: 232
Number of relevant articles identified: 0

Inclusion/Exclusion Criteria:

	Inclusion	**Exclusion**
Population	Adults with suspected acute stroke.	Trauma unless the trauma was secondary to the occurrence of a stroke-induced fall Large vessel occlusion Child and children
Intervention	Use of a rapid stroke scoring system or scale (or test) (as FAST, LAPDS, CPSS, OPSS, KPSS, LAMS, MPDS, MASS, RACE or other).	stroke scale usable by dispatch centers providers stroke scale usable by physicians, stroke physician, neurologist, general practitioner in any setting. Stroke scale usable in an emergency department or in-hospital

		Stroke scale retrospectively calculated by a neurologist or a physician with pre-hospital EMS data. Scoring systems designed to detect Large Vessel Occlusion. These scales are intended for use by more advanced prehospital care providers to help triage of these patients to stroke centers capable of performing thrombectomy or thrombolysis. This scoring systems are beyond the capability of most first aid or lay providers.
Comparison	Standard first aid assessment (without the use of a scale).	scale with an app use, Stroke scale made by phone by the dispatcher or physician.
Outcome	change time to treatment (eg door to balloon), recognition of stroke, discharge with favorable neurologic status, cognitive knowledge, survival with favorable neurologic outcome.	Change time to treatment: measure by on-scene EMS time. Recognition of acute stroke: non-medical diagnosis of stroke or diagnosis of stroke without precision or without documented hospital.

Characteristics of prehospital stroke recognition scales from 2020 systematic review [8]

Assessment	**FAST**	**CPSS**	**OPSS**	**KPSS**	**ROSIER**	**MASS**	**Med PACS**	**LAPSS**	**PreHAST**	**FASTER**	**BEFAST**
Number of physical examination items	3	3	4	5	5	4	5	3	8	5	5
Facial droop	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Arm weakness/ drift	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Leg weakness/ drift			Yes	Yes	Yes		Yes		Yes		
Hand grip strength						Yes		Yes			
Stability										Yes	
Speech difficulty	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Eye position, gaze preference							Yes		Yes		
Visual field					Yes				Yes	Yes	
Eye diplopia											Yes

Sensory (pain)									Yes		
Balance coordination											Yes
Command, verbal instruction									Yes[1]		
Denial/Neglect											
Consciousness disturbance				Yes							
Level of consciousness				Yes							
Score range	0-3	0-3	0-4	0-13	-2 to 5	0-4	0-5	0-3	0-19	0-5	0-5
Eligibility criteria	Yes[2]		Yes[3]		Yes[4]	Yes[5]	Yes[6]	Yes[7]	Yes[8]	Yes[9]	Yes
Blood glucose measurement			Yes		Yes	Yes	Yes	Yes		Yes	

Abbreviations : BEFAST Balance Eyes Face Arm Speech Time on call; CPSS Cincinnati Prehospital Stroke Scale; FAST Face Arm Speech Time; FASTER Face, Arm, Speech, Time, Emergency Response; KPSS Kurashiki Prehospital Stroke Scale; LAPSS Los Angeles Prehospital Stroke Scale; MASS Melbourne Ambulance Stroke Screen; MedPACS Medic Prehospital Assessment for Code Stroke; OPSS Ontario PreHospital Stroke Scale; PreHAST PreHospital Ambulance Stroke Test; ROSIER Recognition of Stroke in the Emergency Room.
1. Verbal instruction and sensory, Close your eyes! Grip your hand! (n-paretic side); 2. GCS<7 or suspected head injury exclusion original paper; 3. seizure at onset, can be transported to arrive within two hours of onset, time since symptom onset < two hours, GCS < 10, blood glucose > 4 mmol/L, symptoms of the stroke have resolved; 4. Blood glucose > 3.5 mmol/L, history of seizure; 5. history of seizure, time since symptom onset < 24 hours, at baseline, patient is not wheelchair bound or bedridden, age > 45 years, blood glucose 2.8 to 22.2 mmol/L; 6. history of seizure, time since symptom onset < 24 hours, at baseline, patient is t wheelchair bound or bedridden, blood glucose 3.3 to 22.2 mmol/L; 7. history of seizure, at baseline, patient is t wheelchair bound or bedridden, blood glucose 2.8 to 22.2 mmol/L, age limit = 40 years; 8. Age > 18 years, intended for use, only in conscious people, i.e. alert or aroused by stimulation; 9. Time of onset less than two hours, blood glucose measurement inside the range of 4-17mmol/L.

Summary of Evidence Update:
For this evidence update about use of a stroke scale to improve recognition of stroke by lay persons and first aid providers in a prehospital setting, we did not identify any relevant article.

Reviewer Comments:
Results from this evidence update do not modify the conclusions of our last systematic review, treatment recommendations from the 2020 CoSTR.[6, 7] and the 2023 EvUp.
All the studies included in the scoping review [9], the 2020 CoSTR [6, 7] as well as those selected for the 2023 EvUp were carried out in high-income countries. The working group wonders how effective it might be to identify the signs of stroke in low- and middle-income countries, and their importance in improving patient outcomes.

The working group reminds us that a stroke scale designed for the prehospital setting must have a lower number of diagnostic criteria, easy-to-identify clinical signs and simplicity of implementation, making them applicable for use by first aid providers and lay persons. It is also important to specify that for lay provider use, a stroke scale that has high sensitivity for identifying stroke is preferable, while for other trained prehospital care providers and those with the ability to check glucose levels, the stroke assessment scales that are more specific and include blood glucose measurement are suggested. Nevertheless, FAST is the currently preferred scale for prehospital settings and for stroke recognition by the public.

An update of systematic review is not currently indicated.

Reference list

Meyran D, Cassan P, Avau B, Singletary E, Zideman DA. Stroke Recognition for First Aid Providers: A Systematic Review and Meta-Analysis. Cureus [Internet]. 2020;12:e11386. Available from: https://www.ncbi.nlm.nih.gov/pubmed/33312787

Singletary EM, Zideman DA, Bendall JC, Berry DA, Borra V, Carlson JN, et al. 2020 International Consensus on First Aid Science With Treatment Recommendations. Resuscitation. 2020a;156:A240–82. Available from: https://pubmed.ncbi.nlm.nih.gov/33098920/

Singletary EM, Zideman DA, Bendall JC, Berry DC, Borra V, Carlson JN, et al. 2020 International Consensus on First Aid Science With Treatment Recommendations. Circulation. 2020b;142(16_suppl_1):S284–334. Available from: https://pubmed.ncbi.nlm.nih.gov/33084394/

2025 Evidence Update
FA 7442 – Use of Naloxone During Resuscitation for Suspected Opioid-associated Emergencies

Worksheet author(s): Aaron Orkin
Task Force: First Aid
Date Approved by SAC Representative: 9 January 2023
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults and children with suspected opioid-associated cardio / respiratory arrest in the pre-hospital setting
Intervention: Bystander naloxone administration (intramuscular or intranasal), in addition to standard CPR
Comparators: Standard CPR only
Outcomes:Any clinical outcome
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) are eligible for inclusion. Unpublished studies (e.g., conference abstracts, trial protocols) are excluded.
Timeframe: All years and all languages were included as long as there was an English abstract. Unpublished studies (e.g., conference abstracts, trial protocols), animal studies, manikin studies, cadaver studies were excluded. Literature searched to 12 December 2023.

Year of last full review: 2022

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest that CPR be started without delay in any unconscious person not breathing normally and that naloxone be used by lay rescuers in suspected opioid related respiratory or circulatory arrest (weak recommendation based on expert consensus).

Current Search Strategy
Pubmed:
(((((("Narcotics"[Mesh] OR "Narcotics" [Pharmacological Action] OR Oxycodone[TIAB] or hydrocodone[TIAB] or heroin[TIAB] or morphine[TIAB] or methadone[TIAB] or codeine[TIAB] or fentanyl[TIAB] or opiate[TIAB] or opiates[TIAB] or opioid[TIAB] or opioids[TIAB] OR Hydromorphone[TIAB] or vicodin[TIAB] or Demerol[TIAB] or oxycontin[TIAB] or Tramadol[TIAB] or Meperidine[TIAB] or opium[TIAB] or narcotic[TIAB] OR narcotics[TIAB] OR "Opioid-Related Disorders"[Mesh]) AND ("Drug Overdose"[Mesh] or "poisoning" [Subheading] or "Poisoning"[Mesh:NoExp] or "toxicity" [Subheading] or overdose[TIAB] OR overdosed[TIAB] or overdosing[TIAB] or toxicity[TIAB] or poisoning[TIAB]))))) AND (("Resuscitation"[Mesh] OR "cardiopulmonary resuscitation"[TIAB] or "cardio-pulmonary resuscitation"[TIAB] or CPR[TIAB] or "chest compression"[TIAB] or "chest compressions"[TIAB] OR "basic life support"[TIAB] or BLS[TIAB] or "cardiac massage"[TIAB] or "heart massage"[TIAB] OR "Naloxone"[Mesh] OR "Narcotic Antagonists"[Mesh] or naloxone[TIAB] or naloxon[TIAB] or narcan[TIAB] or "narcotic antagonist"[TIAB] or "narcotic antagonists"[TIAB] OR "opioid antagonist"[TIAB] OR "opioid antagonists"[TIAB])))) NOT ((animals[mh] NOT humans[mh]) NOT ("letter"[pt] OR "comment"[pt] OR "editorial"[pt] or Case Reports[ptyp]))

Database searched: eg Medline Embase Cochrane
PubMed

Time Frame: 1 December 2022 to 12 December 2023
Date Search Completed: 12 December 2023
Search Results: 356 titles screened. None relevant.

Reviewer Comments:
No new evidence was identified. An update to the systematic review is not indicated. New guidelines and focused updates published since the last review do not reflect new evidence.

2025 Evidence Update
FA 7550 – Prevention of Syncope with Counter Pressure Maneuvers

Worksheet Author(s): Singletary, E. M. (Nici)
Task Force: First Aid
Date Approved by SAC Representative: 6 December 2023
Conflict of Interest: none

PICOST / Research Question:
Population*:* Adults and children with signs and symptoms of faintness or pre-syncope of suspected vasovagal or orthostatic origin
Intervention: interventions such as PCM, body positioning, hydration or other
Comparison*:* no intervention or each other
Outcomes*:* avoid/prevent syncope or transient loss of consciousness (T-LOC), resolution of symptoms or symptoms response, hemodynamic status, including: systolic and diastolic blood pressure, change in heart rate, or other indicators of same (cardiac output, stroke volume, blood flow velocity), recurrences of presyncope and/or syncope, time to resolution of symptoms, adverse events, admission to hospital, quality of life
Study Designs*:* Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) are eligible for inclusion. If there are insufficient studies from which to draw a conclusion, case series of 4 or more cases may be included. Unpublished studies (e.g., conference abstracts, trial protocols) are excluded. All years and all languages are included as long as there is an English abstract
Year of last full review: 2019; Last Evidence Update: 2021

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We recommend the use of any type of physical counter-pressure maneuver by individuals with acute symptoms of presyncope due to vasovagal or orthostatic causes in the first aid setting (strong recommendation, low and very low-certainty evidence).

We suggest that lower body physical counter-pressure maneuvers are preferable to upper body and abdominal physical counter-pressure maneuvers (weak recommendation, very low-certainty evidence).

Current Search Strategy
See Separate attachment -Existing Search Strategy by St. Michael's Hospital 2018 (10 pages)
New Search strategy: Not applicable
Database searched: Medline, Cochrane
Time Frame: December 2021 – December 1, 2023
Date Search Completed: December 2, 2023
Search Results: 749 articles identified in PubMed

Summary of Evidence Update:
Since the 2021 Evidence Update, 2 systematic reviews identified on the use of physical counterpressure maneuvers for the prevention of syncope and one trial RCT assessing counterpressure maneuvers during dental extraction in patients with a history of dental anxiety and previous syncope. The systematic reviews and single RCT support the findings/conclusions of the 2019 ILCOR Systematic Review and CoSTR.
Other studies evaluating the use of hydration and other interventions were applied prior to the onset of symptoms of presyncope and for the purpose of preventing syncope during blood donation. Some blood donation studies {Thijsen 2020 918; Goldman 2021 1764} included physical tensioning maneuvers with onset of symptoms but this was in conjunction with pre-treatment with oral fluids. These studies were excluded.

Relevant Guidelines or Systematic Reviews

Organization (if relevant); Author; Year Published	Guideline or systematic review	Topic addressed or PICO(S)T	Number of articles identified	Key findings	Treatment recommendations
Dockx 2019	Systematic review	Physical manoeuvers	11 trials; 688 participants	The total body of evidence (GRADE)	PCM may reduce syncope and increase

		as a preventive intervention to manage vasovagal syncope	with vasovagal syncope	was considered to be low or very low. PCM were found to improve syncope as compared to control (OR: 0.52, 95% CI [0.33;0.81], p = 0.004). Similarly, before-and-after studies without a control group showed a significant reduction in syncope following PCM (OR: 0.01, 95%CI [0.00;0.01], p<0.001). No studies investigated PCMOL. PCMHC increased SBP, DBP, MAP, SV, and CO, and decreased HR. PCMMC increased SBP, DBP, and MAP.	SBP, DBP, and MAP. The effects on other outcomes are less clear. Additional high-quality studies are needed.
Williams 2022	Quasi systematic review and meta analysis	Counter pressure maneuvers for syncope prevention	45 studies included; Articles considered various syncopal conditions (vasovagal = 12, orthostatic hypotension = 8, postural orthostatic tachycardia syndrome = 1, familial dysautonomia = 2, spinal	CPM improved standing systolic blood pressure (+ 14.8 ± 0.6 mmHg, $p < 0.001$) and heart rate (+ 1.4 ± 0.5 bpm, $p = 0.006$), however, responses of total peripheral resistance, stroke volume, or cerebral blood flow were not widely documented. Most patients experienced	Physical CPM were successful in improving syncopal symptoms and producing cardiovascular responses that may bolster against syncope; however, practical limitations may restrict applicability for use in daily living.

			cord injury = 1, blood donation = 10, healthy controls = 11). Maneuvers assessed included hand gripping, leg fidgeting, stepping, tiptoeing, marching, calf raises, postural sway, tensing (upper, lower, whole body), leg crossing, squatting, "crash" position, and bending foreword. CPM were assessed in laboratory-based studies (*N* = 28), the community setting (*N* = 4), both laboratory and community settings (*N* = 3), and during blood donation (*N* = 10)	symptom improvement following CPM use (laboratory: 60 ± 4%, community: 72 ± 9%). Patterns of postural sway may also recruit the skeletal muscle pump to enhance cardiovascular control, and its potential as a discrete, proactive CPM needs further evaluation.	

RCT:

Study Acronym; Author; Year Published	**Aim of Study; Study Type; Study Size (N)**	**Patient Population**	**Study Intervention (# patients) / Study Comparator (# patients)**	**Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)**	**Relevant 2° Endpoint (if any); Study Limitations; Adverse Events**

Bhagat M, Sr 2023	**Study Aim:** Effectiveness of Leg Raise and Leg Fold Maneuver to Prevent Syncope During Extraction of Teeth: A Pilot Study RCT, 15 patients per group **Study Type:** RCT, unblinded.	**Inclusion Criteria:** Patients undergoing dental extraction with a previous history of syncope and dental anxiety; Group I patients educated about physical maneuvers (leg raise, leg fold) and instructions given preoperatively about when to perform them. Group II, control, underwent extraction conventionally	**Intervention:** Syncope; 0/15 in test group, **Comparison:** 5/15 (33.3%) developed syncope in control group	**1° endpoint:**	**Study Limitations:** Unblinded, small sample size. Physical counterpressure maneuvers are a risk-free, effective, and low-cost treatment method in patients with vasovagal syncope. Leg raise and leg fold maneuvers improved the hemodynamics of the patients.

Reviewer Comments:

The 2 systematic reviews and one new RCT support the use of physical counterpressure maneuvers for prevention of syncope. An updated systematic review is not indicated at this time.

Reference list:

M JAB Sr, S S Jr, B N Sr, D D Sr, A R T Jr. Effectiveness of Leg Raise and Leg Fold Maneuver to Prevent Syncope During Extraction of Teeth: A Pilot Study. *Cureus*. 2023;15(2):e34488. Published 2023 Feb 1. doi:10.7759/cureus.34488

Williams EL, Khan FM, Claydon VE. Counter pressure maneuvers for syncope prevention: A semi-systematic review and meta-analysis. Front Cardiovasc Med. 2022 Oct 13;9:1016420. doi: 10.3389/fcvm.2022.1016420. PMID: 36312294; PMCID: PMC9606335.

Dockx K, Avau B, De Buck E, Vranckx P, Vandekerckhove P. Physical manoeuvers as a preventive intervention to manage vasovagal syncope: a systematic review. PLoS One. (2019) 14:e0212012. 10.1371/journal.pone.0212012 - DOI - PMC - PubMed

Thijsen A, Masser B, Davison TE. Reduced risk of vasovagal reactions in Australian whole blood donors after national implementation of applied muscle tension and water loading. Transfusion. (2020) 60:918–21. 10.1111/trf.15701 - DOI - PubMed

Goldman M, Uzicanin S, Marquis-Boyle L, O'Brien SF. Implementation of measures to reduce vasovagal reactions: donor participation and results. Transfusion. (2021) 61:1764–71. 10.1111/trf.16375 - DOI - PubMed

2025 Evidence Update
FA 7333 – Types of Adult & Pediatric Tourniquets

Worksheet Author(s): Goolsby, Charlton
Task Force: First Aid
Date Approved by SAC Representative: November 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults and children with severe, life-threatening external bleeding from an extremity
Intervention: Improvised tourniquets, direct manual pressure or direct pressure to the wound with a compression dressing, compression bandage, or compression device, hemostatic dressings
Comparators: Manufactured tourniquets
Outcomes: Mortality due to bleeding (Critical), Cessation of bleeding / achieving hemostasis (Critical), Time to achieving hemostasis (Critical), Mortality from any cause (Important), Decrease in bleeding (Important), Complications/adverse effects (e.g. wound infection, limb loss, re-bleeding, pain related to an intervention) (Important)
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion.
All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded.

Year of last full review: 2020
Literature search updated from November 1, 2019

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest that first aid providers use a tourniquet in comparison with direct manual pressure alone for severe, life-threatening external bleeding that is amenable to the application of a tourniquet (weak recommendation, very low certainty of evidence).
We suggest that first aid providers use a tourniquet rather than a hemostatic dressing for severe, life-threatening external bleeding that is amenable to the use of a tourniquet (weak recommendation, very low certainty of evidence).
We suggest that first aid providers use a manufactured tourniquet rather than an improvised tourniquet for severe, life threatening external bleeding (weak recommendation, very low certainty of evidence).
For the treatment of severe, life-threatening external bleeding by first aid providers, we are unable to recommend any one particular design of tourniquet compared with another.

Current Search Strategy
PubMed n=184 6/29/24

Concept	**Keywords**	**MeSH**
Prehospital	“first aid"[tiab] OR paramedic*[tiab] OR “rescue personnel”[tiab] OR “emergency responder”[tiab] OR EMS[tiab] OR “emergency medical technician*”[tiab] OR “first responder*”[tiab] OR bystander*[tiab] OR “lay rescuer”[tiab] OR ”emergency care”[tiab] OR “wilderness medicine”[tiab] OR prehospital[tiab] OR pre-hospital[tiab] OR “out-of-hospital”[tiab] OR “out of hospital”[tiab]	“first aid”[mesh] OR “emergency treatment”[mesh:noexp] OR emergencies[mesh] OR “wilderness medicine”[mesh]
Tourniquet	tourniquet*[tiab]	Tourniquets[mesh]
Exclude snake bites	“snake bite*”[tiab] OR snakebite*[tiab]	Snake Bites/

Human	FinalResult NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh]))	

((tourniquet*[tiab] OR Tourniquets[mesh]) AND (("first aid"[tiab] OR paramedic*[tiab] OR "rescue personnel"[tiab] OR "emergency responder"[tiab] OR EMS[tiab] OR "emergency medical technician*"[tiab] OR "first responder*"[tiab] OR bystander*[tiab] OR "lay rescuer"[tiab] OR "emergency care"[tiab] OR "wilderness medicine"[tiab] OR prehospital[tiab] OR pre-hospital[tiab] OR "out-of-hospital"[tiab] OR "out of hospital"[tiab]) OR ("first aid"[mesh] OR "emergency treatment"[mesh:noexp] OR emergencies[mesh] OR "wilderness medicine"[mesh])) AND ((2019/11/01:3000/12/12[pdat]) AND (english[Filter])) NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh]))) NOT ("snake bite*"[tiab] OR snakebite*[tiab] OR Snake Bites/)

Embase n=204

Concept	**Keywords**	**Emtree**
Prehospital	'first aid':ti,ab,kw OR paramedic*:ti,ab,kw OR 'rescue personnel':ti,ab,kw OR 'emergency responder':ti,ab,kw OR EMS:ti,ab,kw OR 'emergency medical technician*':ti,ab,kw OR 'first responder*':ti,ab,kw OR bystander*:ti,ab,kw OR 'lay rescuer':ti,ab,kw OR 'emergency care':ti,ab,kw OR 'wilderness medicine':ti,ab,kw OR prehospital:ti,ab,kw OR pre-hospital:ti,ab,kw OR out-of-hospital:ti,ab,kw OR 'out of hospital':ti,ab,kw	'first aid'/exp OR 'emergency treatment'/de OR 'emergency'/exp OR 'first responder (person)'/exp OR 'wilderness medicine'/exp
Tourniquet	tourniquet*:ti,ab,kw	'tourniquet'/exp
Exclude snake bites	'snake bite*':ti,ab,kw OR 'snakebite*':ti,ab,kw	'snakebite'/exp
Human	Final result NOT ([animals]/lim NOT [humans]/lim)	
Exclude abstracts	NOT 'conference abstract'/it	

CINAHL n=98 6/30/24

(TI "emergency care" OR AB "emergency care") OR (TI lifesav* OR AB lifesav*) OR (TI "first respon*" OR AB "first respon*") OR (TI "life support*" OR AB "life support*") OR (TI "wilderness medicine" OR AB "wilderness medicine") OR (TI prehospital OR AB prehospital) OR (TI "pre-hospital" OR AB "pre-hospital") OR (TI "out-of-hospital" OR AB "out-of-hospital") OR (TI "out of hospital" OR AB "out of hospital") OR (TI "first aid" OR AB "first aid") OR (TI paramedic* OR AB paramedic*) OR (TI "rescue personnel" OR AB "rescue personnel") OR (TI "emergency responder" OR AB "emergency responder") OR (TI EMS OR AB EMS) OR (TI "emergency medical technician*" OR AB "emergency medical technician*") OR (TI bystander* OR AB bystander*) OR (TI "lay rescuer" OR AB "lay rescuer")

OR

(MH "Emergency Responders+") OR (MH "Prehospital Care") OR (MH "Red Cross") OR (MH "American Red Cross") OR (MH "Emergency Treatment") OR (MH "First Aid")

AND (MH "Tourniquets") OR "tourniquet*"

Web of Science n=135 6/30/24
(TI="emergency care" OR AB="emergency care") OR (TI=lifesav* OR AB=lifesav*) OR (TI="first respon*" OR AB="first respon*") OR (TI="life support*" OR AB="life support*") OR (TI="wilderness medicine" OR AB="wilderness medicine") OR (TI=prehospital OR AB=prehospital) OR (TI="pre-hospital" OR AB="pre-hospital") OR (TI="out-of-hospital" OR AB="out-of-hospital") OR (TI="out of hospital" OR AB="out of hospital") OR (TI="first aid" OR AB="first aid") OR (TI=paramedic* OR AB=paramedic*) OR (TI="rescue personnel" OR AB="rescue personnel") OR (TI="emergency responder" OR AB="emergency responder") OR (TI=EMS OR AB=EMS) OR (TI="emergency medical technician*" OR AB="emergency medical technician*") OR (TI=bystander* OR AB=bystander*) OR (TI="lay rescuer" OR AB="lay rescuer")
AND (TI=tourniquet* OR AB=tourniquet*)
NOT (TI=snakebite* OR AB=snakebite* OR TI="snake bite"* OR AB="snake bite*")

Cochrane Library n=0 reviews
("emergency care" OR "first responder" OR "first responders" OR "life saving" OR "life support" OR "wilderness medicine" OR prehospital OR "pre-hospital" OR "out-of-hospital" OR "out of hospital" OR "first aid" OR paramedic* OR "rescue personnel" OR "emergency responder" OR EMS OR "emergency medical technician" OR bystander* OR "lay rescuer"):ti,ab,kw
AND (tourniquet*):ti,ab,kw

RESULTS SEARCH 2 - tourniquets for trauma/hemorrhage in general (not specified as pre-hospital; no liver, knee, arthroplasty, WALANT, hair tourniquet syndrome)

PubMed n=505 6/30/24

Concept	**Keywords**	**MeSH**
Tourniquets	tourniquet*[tiab]	Tourniquets[mesh]
Trauma/Hemorrhage	((car OR vehicle) AND crash*) OR disaster* OR wound* OR injur* OR hemorrhag* OR haemorrhag* OR bleed* OR exsanguinat*	"Hemorrhage"[Mesh] OR "Wounds and Injuries"[Mesh] OR "Emergency Medical Services"[Mesh] OR "Emergency Medicine"[Mesh]
Exclude non-relevant	(mouse[ti] OR rat[ti] OR swine[ti] OR porcine[ti] OR liver[ti] OR ACL[ti] OR orthopedic[ti] OR knee[ti] OR arthroplast*[ti] OR WALANT[ti] OR snakebite*[ti] OR "snake bite"[ti] OR "hair tourniquet syndrome"[tiab]	
Human	Final result NOT ([animals]/lim NOT [humans]/lim)	

(((tourniquet*[tiab] OR Tourniquets[mesh]) AND (((car OR vehicle) AND crash*) OR disaster* OR wound* OR injur* OR hemorrhag* OR haemorrhag* OR bleed* OR exsanguinat* OR "Hemorrhage"[Mesh] OR "Wounds and Injuries"[Mesh] OR "Emergency Medical Services"[Mesh] OR "Emergency Treatment"[Mesh])) NOT (mouse[ti] OR rat[ti] OR swine[ti] OR porcine[ti] OR liver[ti] OR ACL[ti] OR orthopedic[ti] OR knee[ti] OR arthroplast*[ti] OR WALANT[ti] OR snakebite*[ti] OR "snake bite"[ti] OR "hair tourniquet syndrome"[tiab]) AND ((2019/11/01:3000/12/12[pdat]) AND (english[Filter]))) NOT ((("first aid"[tiab] OR paramedic*[tiab] OR "rescue personnel"[tiab] OR "emergency responder"[tiab] OR EMS[tiab] OR "emergency medical technician*"[tiab] OR "first responder*"[tiab] OR bystander*[tiab] OR "lay rescuer"[tiab] OR "emergency care"[tiab] OR "wilderness medicine"[tiab] OR prehospital[tiab] OR pre-hospital[tiab] OR "out-of-hospital"[tiab] OR "out of hospital"[tiab] AND ((2019/11/01:3000/12/12[pdat]) AND (english[Filter]))) OR ("first aid"[mesh] OR "emergency treatment"[mesh:noexp] OR emergencies[mesh] OR "wilderness medicine"[mesh])) AND (tourniquet*[tiab] OR Tourniquets[mesh]) AND ((2019/11/01:3000/12/12[pdat]) AND (english[Filter])) NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh]))) AND ((2019/11/01:3000/12/12[pdat]) AND (english[Filter])) NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh]))

Embase (exclude above prehospital citations) n=469 2/18/24

Concept	**Keywords**	**Emtree**
Tourniquets	tourniquet*:ti,ab,kw	Tourniquet/exp/mj
Trauma/Hemorrhage	(car:ti,ab,kw OR vehicle:ti,ab,kw) AND crash*:ti,ab,kw OR disaster*:ti,ab,kw OR wound*:ti,ab,kw OR injur*:ti,ab,kw OR hemorrhag*:ti,ab,kw OR haemorrhag*:ti,ab,kw OR bleed*:ti,ab,kw OR exsanguinat*:ti,ab,kw	'bleeding'/exp OR 'wounds' AND 'injury'/exp OR 'emergency health service'/exp OR 'emergency medicine'/exp
Exclude non-relevant	#19 NOT ('mouse':ti OR 'rat':ti OR 'swine':ti OR 'porcine':ti OR 'liver':ti OR 'acl':ti OR 'orthopedic':ti OR 'knee':ti OR 'arthroplast*':ti OR 'walant':ti OR 'snakebite*':ti OR 'snake bite':ti OR 'hair tourniquet syndrome':ti,ab,kw)	
Human		

CINAHL exclude non relevant (mouse OR rat OR swine OR porcine OR liver OR ACL OR orthopedic OR knee OR arthroplast* OR WALANT OR snakebite* OR "snake bite" OR "hair tourniquet syndrome") n=187 6/30/24

Web of Science (exclude above prehospital citations) n=400 6/30/24

Cochrane Library and CENTRAL n=1 review

Database searched:
PubMed, Embase, CINAHL, Web of Science, Cochrane Library
Time Frame: Nov 2019 to present
Date Search Completed: 06/29/2024
Search Results : 29 studies

Summary of Evidence Update:

In this review, 29 articles were identified pertaining to the PICO. Eleven of these articles compared a tourniquet to no use of a tourniquet, eleven compared different types of commercial tourniquets, four compared commercial tourniquets to improvised tourniquets and three studied the use of a tourniquet in the pediatric population. The data support the use of tourniquets in the prehospital setting for patients with severe life-threatening external bleeding. Regarding the use of a tourniquet to no use of a tourniquet for life threatening extremity hemorrhage, Henry et al. (2021) conducted a retrospective cohort study with 944 patients in Los Angeles County, where 97 patients received prehospital tourniquets. The study found that tourniquet use was associated with a reduction in in-hospital mortality (adjusted OR 0.32; 95% CI 0.16 to 0.85; p = 0.032). Schroll et al. (2022) conducted a large multicenter prospective study involving 1,310 patients with major extremity trauma. Prehospital tourniquet use was associated with a lower incidence of shock on arrival at the trauma center (13.0% vs. 17.4%, p = 0.04). Evidence supports the use of commercial tourniquets compared with improvised tourniquets. Salchner et al. (2023) conducted a randomized crossover trial comparing the CAT with a space blanket-improvised tourniquet in achieving radial artery occlusion in the upper extremity. The CAT achieved 100% occlusion, whereas the improvised tourniquet only achieved 52% occlusion (p < 0.001). The CAT was also faster to apply (27 seconds vs. 94 seconds, p < 0.001). Commercial tourniquets with simpler mechanisms and locking devices may be easier to use and, therefore, more successful as providing hemostasis than more complex devices. Goolsby et al. (2023) compared the novel Layperson Audiovisual Assist Tourniquet (LAVA TQ) with the CAT in a prospective, randomized controlled trial. Both tourniquets achieved 100% blood flow occlusion in all limbs tested (21 out of 21; p = 0.14). However, the LAVA TQ had a higher success rate of correct application by untrained laypersons (93% vs. 22%; RR 4.24, 95% CI 2.74-6.57; p < 0.001) and was applied faster (74.1 seconds vs. 126 seconds; p < 0.001). Wall et al. (2023) demonstrated that commercial tourniquets with self-securing tightening systems were overall easier to secure than those commercial tourniquets that were non-self-securing tightening systems (p<.0001). In the pediatric population, Harcke et al. (2019) conducted a prospective observational study on the effectiveness of the CAT in school-aged children (ages 6-16). The CAT successfully occluded arterial blood flow in 100% of upper extremities and 93% of lower extremities, with success rates influenced by limb circumference. Kelly et al. (2020) investigated the minimum patient age and limb size for effective use of the CAT in children aged 2-7 years. The study found that the CAT successfully achieved arterial occlusion in 100% of limbs tested. Bashtalay et al. (2021) compared the ability of school-aged children (ages 10-12) to apply three commercially available tourniquets (MAT, CAT, SWATT) to a manikin model. The MAT had a higher success rate (67%) compared to the CAT (44%) and SWATT (24%) (p < 0.0001). The MAT was also faster to apply, with a mean time of 57 seconds compared to 80 seconds for the CAT and 90 seconds for the SWATT (p < 0.0001).

Comparing Tourniquet with no Tourniquet

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	**Study Type/Design; Study Size (N)**	**Patient Population**	**Primary Endpoint and Results (include P value; OR or RR; & 95% CI)**	**Summary/Conclusion Comment(s)**
Henry et al. 2021	**Study Aim** To evaluate the impact of increased prehospital tourniquet use on patient survival in Los Angeles County.: **Study Type:**	**Inclusion Criteria:** Patients with extremity vascular injuries **Intervention:** Prehospital tourniquet application (97 patients)	**1° endpoint:** Tourniquet use was associated with a reduction in in-hospital mortality (adjusted OR 0.32; 95% CI 0.16 to 0.85; p = 0.032). Tourniquet use also reduced	**Study Limitations:** Retrospective design; potential for selection bias; lack of standardization in tourniquet application; inability to determine whether amputations were due to tourniquet use or unsalvageable injuries. Adverse Events: No reported increase in delayed amputation rates.

	Retrospective cohort study n=944	**Comparison:** No prehospital tourniquet (847 patients)	transfusion requirements at 4 hours (regression coefficient -547.76; 95% CI -762.73 to -283.49; p < 0.001) and 24 hours (regression coefficient -1389.82; 95% CI -1824.88 to -920.97; p < 0.001). No significant difference in delayed amputation rates was observed (adjusted OR 1.07; 95% CI 0.21 to 10.88; p = 0.097).	
Mikdad et al. 2021	**Study Aim:** To describe the incidence, therapeutic effectiveness, and morbidity associated with prehospital tourniquet placement in civilian limb trauma. **Study Type:** Retrospective cohort study n=147	**Inclusion Criteria:** Adult trauma patients requiring prehospital tourniquet application **Intervention:** Prehospital tourniquet application (147 patients) **Comparison:** None (single-group study)	**1° endpoint:** Tourniquet application increased fivefold from 2015 to 2019. 51% of tourniquets were clinically indicated (as defined by prespecified criteria for major vascular injury). Inappropriate placement occurred in 27% of cases, with 39 patients experiencing misapplication and 5 suffering significant morbidity. There was no significant difference in mortality between patients with indicated vs. non-indicated	**Study Limitations:** Both commercial and improvised tourniquet uses were records, tourniquet type per outcome is not well records. Unknown tourniquet type. Retrospective design; potential for selection bias; limited to two urban trauma centers. Adverse Events: Significant morbidity in cases of misapplication.

			tourniquet use (4% vs. 0%; p = 0.084). Patients who presented to the ED with a prehospital tourniquet placed that were clinically indicated more likely to require blood transfusion at any point during their hospitalization (58% vs. 29%; p = 0.001). Relevant 2° Endpoint: 39 patients had an improper tourniquets placed. Two patients with improper tourniquet placement developed a compartment symptom requiring fasciotomy and 2 patients developed a nerve palsy. However the rate of total complications in the clinically indicated compared with not clinically indicated was not significant (p=0.52).	
Wellme et al. 2021	**Study Aim:** To evaluate the prehospital use of tourniquets (TQ) for hemorrhage control in civilian extremity trauma in Sweden, and to assess potential	**Inclusion Criteria:** Civilian trauma patients with extremity injuries admitted to Karolinska University Hospital **Intervention:**	**1° endpoint:** TQs effectively stopped bleeding in 98.2% of cases. Complications potentially related to TQ use were observed in 3.6% of cases. However,	**Study Limitations:** Retrospective design; missing data; lack of official guidelines for TQ use in Swedish prehospital care, a minority of tourniquets were placed by lay providers.

	complications associated with TQ use. **Study Type:** Retrospective descriptive observational study n=56	Prehospital tourniquet application (56 patients) **Comparison:** None	28.6% of TQs were applied for non-life-threatening hemorrhage, suggesting potential overuse. Relevant 2° Endpoint: 30.1% of patients experienced complications, including amputations, fasciotomy, and nerve damage, though most were thought to be related to the initial trauma rather than TQ use. Thirteen patients were reported to have nerve damage, however in only 2 of these do the authors report that the damage was possibly due to tourniquet use. The authors report that no amputations were directly related to tourniquet use. No severe complications were associated with TQ use when the TQ time was kept less than 100 minutes.	
Bedri et al. 2022	**Study Aim:** To examine the safety, effectiveness, and appropriateness of tourniquet application for hemorrhage control in a rural	**Inclusion Criteria:** Adult trauma patients requiring tourniquet application **Intervention:**	**1° endpoint:** 92.5% of tourniquets were applied prehospital. 21.3% of tourniquets were not indicated per pre specified	**Study Limitations:** Relevant 2° Endpoint: Hemoglobin levels and blood transfusion requirements were lower in the non-indicated tourniquet group. Study Limitations: Retrospective design; single-center study; lack

	trauma system, and to compare the outcomes with those of urban settings. **Study Type:** Retrospective cohort study n=92	Tourniquet application in rural trauma setting (92 patients) **Comparison:** Urban trauma tourniquet application from literature	criteria regarding major vascular injury. 9.5% of tourniquets were ineffective (due to persistent distal pulses or persistent bleeding). The average tourniquet time was 123 minutes in rural settings versus 48 minutes in urban settings ($p < 0.001$). No significant difference in mortality, amputation rates, or nerve palsy between rural and urban settings (p=NS).	of detailed information on the context of tourniquet application, primarily outcome goals unclear.
Covey et al. 2022	**Study Aim:** To assess the effectiveness and safety of field tourniquets applied in an austere military environment for extremity injuries. **Study Type:** Prospective observational study n=25 patients (30 extremities)	**Inclusion Criteria:** Military personnel with extremity trauma in a forward surgical environment **Intervention:** Field tourniquet application (22 patients; 26 injured extremities) **Comparison:** No field tourniquet placement (3 patients; 4 injured extremities)	**1° endpoint:** Field tourniquets significantly reduced transfusion requirements (12 units in effective tourniquet cases vs. 19 units in ineffective/no tourniquet cases; $p = 0.0006$). Patients with effective tourniquets had higher systolic ($p = 0.003$) and diastolic ($p = 0.023$) blood pressures. No amputations were determined to be directly caused by tourniquets. One peroneal nerve palsy was reported that resolved after tourniquet release.	**Study Limitations:** Small sample size; single-center study; conducted in a military environment. Adverse Events: One case of peroneal nerve palsy which resolved after tourniquet release.

Legare et al. 2022	**Study Aim:** To evaluate the outcomes of prehospital tourniquet placement on limbs without definitive vascular injury and assess the appropriateness of their use. **Study Type:** Retrospective cohort study n=622	**Inclusion Criteria:** Trauma patients without significant vascular injury **Intervention:** Prehospital tourniquet application (585 patients) **Comparison:** No prehospital tourniquet (37 patients)	**1° endpoint:** Tourniquet were deemed effective in 69.7% (n = 408/585), ineffective in 10.4% (n = 61/585) and 19.8% (n = 116/585) were not recorded. Amputation rates were higher in the PHTQ group (8.3% vs. 0%, p = 0.11), but the difference was not statistically significant. No significant differences in nerve palsy or compartment syndrome between groups (p > 0.05). In-hospital mortality was 6.4% (38/585) in the PTHQ cohort and 8.1% (3/37) in the No-PHTQ cohort but was also not statistically different (p=0.73)	The authors suggest potential overuse of tourniquets without clear indications, raising concerns about the appropriateness of their application in cases without major vascular injury. **Study Limitations:** Retrospective design; small control group compared with intervention group; potential selection bias, most tourniquets applied by professional rescuers.
Tatebe et al. 2022	**Study Aim:** To characterize the incidence, indication, and efficacy of tourniquet placement in acute trauma resuscitation across multiple regional Level 1 trauma centers. **Study Type:** Prospective observational study n=209 patients (216 tourniquet applications)	**Inclusion Criteria:** Adult trauma patients (age 18-89) with extremity injuries **Intervention:** Prehospital tourniquet application (198 tourniquets) **Comparison:** Hospital tourniquet placement (18 tourniquets)	**1° endpoint:** Complete hemostasis was reported at the hospital in 83% (n = 171) of cases. There was no difference in hemostasis between prehospital and hospital settings (p = 0.37), or between commercial and improvised	**Study Limitations:** Single region, potential selection bias, minority of tourniquets placed by lay persons, inability to capture long-term outcomes. Adverse Events: Amputations were reported in 5 patients and rhabdomyolysis was reported in 2 patients.

			tourniquets (p = 0.51).	
Schroll et al. 2022	**Study Aim:** To evaluate the outcomes in patients with major extremity trauma (MET) who received prehospital tourniquets, and to determine whether prehospital tourniquet use decreases the incidence of shock on arrival at the trauma center. **Study Type:** Prospective observational multicenter study n=1310	**Inclusion Criteria:** Adult trauma patients age 16 years or older with major extremity trauma (MET) at 29 Level I and II trauma centers **Intervention:** Prehospital tourniquet application (962 limbs) **Comparison:** Control (350 limbs without a commercial prehospital tourniquet or with an improvised tourniquet)	**1° endpoint:** Prehospital tourniquet use was associated with a lower incidence of shock on arrival (13.0% vs. 17.4%, p = 0.04). There was no significant difference in in-hospital mortality between groups (p = 0.010).	**Study Limitations:** Observational study. Missing data on distal pulse presence/absence; Adverse Events: The incidence of amputation was higher in the tourniquet group (10.7% vs. 5.7%, p < 0.01), but injuries were more severe in this group. The incidence of nerve palsy was 1.6% in the PH tourniquet group and 3.1% in the control group (p=0.07).
Hashmi et al. 2023	**Study Aim:** To describe the characteristics and outcomes following prehospital tourniquet use by EMS in the United States from the NEMSIS database **Study Type:** Retrospective cohort study N=7161	**Inclusion Criteria:** Trauma patients with extremity injuries treated by EMS **Intervention:** Prehospital tourniquet application (7,161 patients) **Comparison:** No tourniquet (4,564,218 patients)	**1° endpoint:** Tourniquet application was associated with lower prehospital mortality (0.4% vs. 1.0%, p < 0.01) and higher survival-to-hospital emergency department (83.6% vs. 75.1%, p < 0.01).	**Study Limitations:** Retrospective design; inability to assess long-term outcomes; large amount of missing data in some variables. Adverse Events: None reported.
Read et al. 2023	**Study Aim:** To describe the initial experience with prehospital tourniquet use in Australian civilian extremity trauma from safety and efficacy viewpoints. **Study Type:** Retrospective observational study	**Inclusion Criteria:** Civilian trauma patients with limb injuries **Intervention:** Prehospital tourniquet application (31 patients) **Comparison:** None	**1° endpoint:** 96.7% of patients had bleeding controlled by the tourniquet on arrival to the Emergency Department. Median tourniquet time was 124 minutes (IQR: 47–243).	**Study Limitations:** Observational. Single-center study; limited number of cases; lack of documentation regarding distal pulse presence. Adverse Events: 13.3% (4/30) of cases had complications attributable to the tourniquet, including limb ischemia and/or reperfusion injury (6.7%) and neurological impairments (6.7%).

	N=31			
Thai et al. 2023	**Study Aim:** To evaluate the impact of prehospital tourniquet use on functional outcomes and delayed amputation rates in extremity vascular trauma. **Study Type:** Retrospective observational study n=232	**Inclusion Criteria:** Adult patients with extremity vascular trauma at a Level 1 trauma center **Intervention:** Prehospital tourniquet application (98 patients) **Comparison:** No prehospital tourniquet (134 patients)	**1° endpoint:** There was no significant difference in mortality (6.1% vs 9.0%; p=NS) or initial lactate (5.0 vs 4.2; p=NS) levels between groups. Prehospital tourniquet use was associated with lower rates of delayed amputation (1% vs 6%, P = 0.037) and higher functional mobility, particularly in moving from bed to chair (P = 0.034).	Relevant 2° Endpoint: Higher blood transfusion requirements were observed in the tourniquet group (P < 0.001). Lower rates of acute kidney injury (AKI) in the tourniquet group (0% vs 4.5%, P = 0.010). **Study Limitations:** Retrospective design; single-center study; incomplete documentation for some patients.

Comparing Commercial Tourniquets

RCT:

Study Acronym; Author; Year Published	**Aim of Study; Study Type; Study Size (N)**	**Patient Population**	**Study Intervention (# patients) / Study Comparator (# patients)**	**Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)**	**Relevant 2° Endpoint (if any); Study Limitations; Adverse Events**
Katsnelson et al. 2020	**Study Aim:** To assess the effectiveness of three new tourniquet designs (CAT7, SAM-XT, SOFTT-W) in a simulated manikin. All tourniquets were windlass based designs. **Study Type:** Randomized crossover study in a manikin model	**Inclusion Criteria:** Military medicine cadets age 18 to 25 years	**Intervention:** CAT7, SAM-XT, and SOFTT-W tourniquets **Comparison:** None (each participant used all three tourniquets)	**1° endpoint:** SAM-XT and CAT7 applied significantly higher pressure (SAM-XT: 186 mmHg ±63, CAT7: 175 mmHg ±79) compared to SOFTT-W (104 mmHg ±101, P < 0.017). Hemorrhage control rates, as defined by	Relevant 2° Endpoint: Strong negative correlation between pre-tightening slack and hemorrhage control (P < 0.001) and pressure applied (P < 0.001). Study Limitations: Conducted on a simulation manikin; all

	n=60			achieving a pressure on the manikin of 200 mmHg, were also significantly higher with SAM-XT (73.3%) and CAT7 (67.7%) compared to SOFTT-W (35%, P < 0.017). Pre-tightening slack was significantly lower with SAM-XT and CAT7 compared to SOFTT-W (P < 0.017).	participants were on the military medicine track at a university; findings may not generalize to real-world scenarios. Adverse Events: None reported.
Carius et al. 2021	**Study Aim:** To compare the effectiveness of the Combat Application Tourniquet (CAT) and the Smart Tactical Application Tourniquet (STAT) when applied by laypersons to a manikin (HapMed™) after a brief video demonstration. **Study Type:** Randomized pilot study in a manikin model n=13	**Inclusion Criteria:** Laypersons without medical experience age 18-84 years	**Intervention:** CAT application (8 participants) **Comparison:** STAT application (5 participants)	**1° endpoint:** CAT achieved a higher success rate in occlusion pressure (354 mm Hg) compared to STAT (216 mm Hg, p = 0.040). CAT had a 67% application success rate (undefined), while STAT had a 20% success rate.	**Study Limitations:** Relevant 2° Endpoint: Participants felt more comfortable with CAT, with 75% believing they had successfully applied it, compared to 20% for STAT. Study Limitations: Small sample size, single-center study, conducted in a simulated environment, results may not fully generalize to real-world scenarios.

					Adverse Events: None reported.
Beaven et al. 2022	**Study Aim:** To evaluate the efficacy and tolerability of self-applied Tactical Mechanical Tourniquet (TMT) compared to the Combat Application Tourniquet (CAT) on the lower extremity in military volunteers. **Study Type:** Randomized crossover study n=24 participants (48 limbs)	**Inclusion Criteria:** Healthy British military volunteers	**Intervention:** CAT application (24 participants) **Comparison:** TMT application (24 participants)	**1° endpoint:** The CAT achieved arterial occlusion (as determined by doppler ultrasound) in 92% of cases compared to 71% for the TMT; p=0.064. The median time to occlusion was 37.5 seconds for CAT and 35 seconds for TMT (p = 0.589). Pain scores were similar between devices (CAT median: 5, TMT median: 6; p = 0.656).	**Study Limitations:** Relevant 2° Endpoint: There was no significant difference in reported pain between the two devices (p=0.656). Study Limitations: Small sample size; conducted on healthy volunteers in a controlled environment. Indirect outcome of dopplerable pulse.
Goolsby et al. 2022	**Study Aim:** To evaluate the ability of the Layperson Audiovisual Assist Tourniquet (LAVA TQ) to occlude blood flow compared to the Combat Application Tourniquet (CAT) in a controlled trial. **Study Type:** Prospective, blinded, randomized controlled trial	**Inclusion Criteria:** Healthy adult volunteers age 18-65	**Intervention:** LAVA TQ application (21 patients) **Comparison:** Combat Application Tourniquet (21 patients)	**1° endpoint:** Both LAVA TQ and CAT achieved 100% blood flow occlusion, as measured by doppler ultrasound, in all limbs (21 out of 21; p = 0.14). Relevant 2° Endpoint: The mean application pressure was 366 mm Hg for LAVA TQ and 386 mm Hg for CAT, with no	**Study Limitations:** Study Limitations: Conducted in a laboratory setting; all tourniquet applications were conducted by 2 trained study personnel; no evaluation of device durability or usability under real-world conditions. Adverse Events: None reported.

	n= 2 trained study personnel applied each tourniquet to 21 human participants			significant difference in application pressure between the two devices ,p=0.14).	
Gabbitas et al. 2023	**Study Aim:** To compare the effectiveness of the Combat Application Tourniquet (CAT) and the Smart Tactical Application Tourniquet (STAT) when applied by laypersons after brief video instruction. **Study Type:** Randomized study in a manikin model n=84	**Inclusion Criteria:** Layperson volunteers age 18 and over	**Intervention:** CAT application (42 patients) **Comparison:** STAT application (42 patients)	**1° endpoint:** The CAT was applied successfully in 50% of cases, while the STAT had a 0% success rate (p < 0.001).	Relevant 2° Endpoint: The CAT achieved significantly higher occlusion pressure (409.9 mm Hg vs. 116.5 mm Hg, p < 0.001) and resulted in significantly less blood loss (577.8 mL vs. 974.6 mL, p < 0.001). Volunteers reported greater comfort and ease of use with the CAT (p < 0.001). **Study Limitations:** Conducted in a simulated environment; indirect nature of outcome, no validation of video instruction.
Goolsby et al. 2023	**Study Aim:** To compare the untrained public's ability to apply the Layperson Audiovisual Assist Tourniquet (LAVA TQ) vs. a Combat Application Tourniquet (CAT)	**Inclusion Criteria:** Untrained laypersons age 18 to 70 years	**Intervention:** LAVA TQ application (73 participants) **Comparison:** CAT application (74 participants)	**1° endpoint:** LAVA TQ had a 93% success rate, as defined by a prespecified checklist which included the inability to force 2 fingers	**Study Limitations:** Relevant 2° Endpoint: LAVA TQ was applied faster (74.1 seconds vs. 126 seconds, p < 0.001) and was associated with

	in a simulated leg scenario. **Study Type:** Prospective, multisite, randomized controlled trial in a manikin model n=147			under the tourniquet, compared to CAT's 22% (RR 4.24 [95% CI 2.74-6.57]; p < 0.001).	greater user comfort and ease of use (p < 0.001). The study showed improved willingness to use a tourniquet in a real-life scenario post-application for both devices. Study Limitations: Conducted in a simulated environment; indirect nature of outcome. Adverse Events: None reported.
Wall et al. 2023	**Study Aim:** To investigate the effects of different tourniquet design features on the success and efficiency of application processes by trained and untrained individuals. **Study Type:** Prospective comparative study in human models n=64	**Inclusion Criteria:** Adults age 18-62 with varying levels of prior tourniquet experience	**Intervention:** Application of eight different tourniquet models with different securing and tightening systems **Comparison:** None (within-subjects comparison across models)	**1° endpoint:** Videos of applications were scored by research personnel with relation to multiple potential tourniquet issues; major headings were the strap/redirect system, tightening system problems and tightening system security, Self-securing tightening systems had no securing struggles (p<.0001 versus non-self-	**Study Limitations:** Indirect nature of outcomes. Study was conducted in a controlled environment; findings may not fully generalize to real-world scenarios. Adverse Events: None reported.

				securing tightening systems. Self-securing tightening systems had no security problems (p<.0001 versus non-self-securing tightening systems. Tourniquets that involved applier actions for strap/redirect and/or tightening-system security had higher rates of security problems than did tourniquets with both self-securing strap/redirect and self-securing tightening systems (p<.0001). Design related mechanical problems were reported in 22 applications.	
AFLAT Barcala Furelos et al. 2024	**Study Aim:** To assess the control of hemorrhage in an aquatic environment by analyzing the usability of two tourniquet models with	**Inclusion Criteria:** Trained lifeguards	**Intervention:** T-OMNA Marine Tourniquet (ratchet)(n=24) **Comparison:** T-CAT 7 Gen Tourniquet (windlass) (n=24)	**1° endpoint:** T-OMNA did not statistically differ in stopping hemorrhage compared to T-CAT (46% vs. 21%, p = 0.066).	Relevant 2° Endpoint: Perceived fatigue was high with both devices, rated at 7 out of 10. **Study Limitations:** Simulation

	different adjustment mechanisms: windlass rod versus ratchet. **Study Type:** Randomized crossover pilot study in a mankin model n=24				setting; small sample size; atypical presentation of data, indirect nature of outcome. Adverse Events: None reported.
Katzenschlager et al. 2024	**Study Aim:** To investigate the use of a novel tourniquet (PAX Tourniquet) compared to established tourniquets (SAM and CAT) in terms of time until ligation and effectiveness. **Study Type:** Randomized crossover study in a human model n=50	**Inclusion Criteria:** Medical professionals age 18 and over without prior tourniquet experience	**Intervention:** PAX Tourniquet application (n=25) **Comparison:** SAM and CAT Tourniquets (n=25)	**1° endpoint:** Median time until ligation: 49 s for PAX vs. 56 s for SAM/CAT (p = 0.572) as measured by doppler ultrasound (p=NS).	Relevant 2° Endpoint: Significant differences of time to occlusion were seen between PAX and SAM (54 s vs. 75 s; p = 0.037) and SAM and CAT (75 s vs. 47 s; p = 0.015). **Study Limitations:** Indirect outcome, controlled environment; study participants were medical professionals. Adverse Events: None reported.

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Ellis et al. 2020	**Study Aim:** To compare the efficacy of three novel commercial	**Inclusion Criteria:** Healthy adult volunteers (emergency	**1° endpoint:** All novel tourniquets were non-inferior to the CAT7 in	**Study Limitations:**: Limited number or participants; unblinded methodology; conducted on trained medical professionals,

	tourniquet designs to a military-approved Combat Application Tourniquet (CAT7) in controlling extremity hemorrhage. **Study Type:** Prospective comparative study N= 9 Emergency Medicine residents (36 trials)	medicine residents) **Intervention:** Novel tourniquet designs: SWAT-T, RATS, Tourni-Key (TK) **Comparison:** CAT7 Combat Application Tourniquet	terms of arterial occlusion (SWAT-T 67%, RATS 89%, TK 78%, CAT7 89%; p =0.83), as measures by occlusion of popliteal artery blood flow measured by ultrasound. Mean application times were fastest for CAT7 (10.4s) and RATS (11.1s; p = 0.65 as compared with CAT7), while SWAT-T (23.1s) and TK (20.0s) were slower (P < .01). TK generated the highest steady-state force (41.9N).	limiting generalizability to laypersons. Adverse Events: None reported.
Holinga et al. 2022	**Study Aim:** To evaluate the performance of the Solo-T (ST) adhesive wrap-based tourniquet compared to the Combat Application Tourniquet Generation 7 (CAT) in controlling femoral arterial hemorrhage. **Study Type:** Prospective comparative study using a cadaver model n= 3 participants completed 48 trials (on cadavers)	**Inclusion Criteria:** Human cadaver model simulating femoral arterial hemorrhage **Intervention:** Solo-T adhesive wrap-based tourniquet **Comparison:** Combat Application Tourniquet (CAT) Generation 7	**1° endpoint:** Both tourniquets achieved 100% occlusion success rates as determined by doppler ultrasound. Occlusion and application times were similar for both devices (p = 0.94 and p=0.91, respectively). ST delivered equivalent hemorrhage control at significantly lower completion pressures than CAT (p = 0.009 for normal pressure, p	**Study Limitations:** Relevant 2° Endpoint: Ease of use was similar between the two devices. Study Limitations: Conducted on cadaver models, only three persons applied the tourniquets. Adverse Events: None reported.

			= 0.03 for elevated pressure).	

Comparing Improvised to Commercial Tourniquets

RCT:

Study Acronym; Author; Year Published	**Aim of Study; Study Type; Study Size (N)**	**Patient Population**	**Study Intervention (# patients) / Study Comparator (# patients)**	**Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)**	**Relevant 2° Endpoint (if any); Study Limitations; Adverse Events**
Cremonini et al. 2021	**Study Aim:** To evaluate the efficacy and usability of five different types of tourniquet, both commercial and improvised, in controlling hemorrhage in a perfused cadaver model. **Study Type:** Randomized unblinded study in a perfused cadaver model n=48 participants (medical students)	**Inclusion Criteria:** Medical students in a perfused cadaver model simulating femoral artery hemorrhage	**Intervention:** Combat Application Tourniquet (CAT), Rapid Application Tourniquet System (RATS), Stretch, Wrap, And Tuck Tourniquet (SWAT-T), Improvised windlass using a triangle bandage and wooden dowel, Leather belt **Comparison:** None (each participant used all tourniquets)	**1° endpoint:** All but one tourniquet (RATS) effectively stopped bleeding in all attempts. Mean time to hemostasis and mean blood loss were not statistically significant among the tourniquets, p =0.24 and p= 0.07, respectively. The SWAT-T took the longest to apply (47.8 ± 17.0 seconds), while the leather belt was the fastest (15.2 ± 6.5 seconds, p < 0.001).	**Study Limitations:** Relevant 2° Endpoint: The improvised windlass was rated as the easiest to apply, while the SWAT-T was rated as the most difficult. Study Limitations: Conducted in a controlled cadaver model; medical students applied the tourniquets. Adverse Events: None reported.
Salchner et al. 2023	**Study Aim:** To investigate whether rescuers can apply a space blanket as an improvised tourniquet (I-TQ) to provide adequate vascular occlusion of the	**Inclusion Criteria:** Healthy volunteers from Mountain Rescue Tyrol	**Intervention:** Space blanket–improvised tourniquet application (n=23) **Comparison:** Combat Application Tourniquet (CAT) (n=23)	**1° endpoint:** The CAT achieved 100% radial occlusion, as measured by doppler ultrasound, while the space blanket–improvised tourniquet only	Relevant 2° Endpoint: Application time was significantly faster for CAT (27 seconds) compared to the improvised tourniquet (94 seconds), (p<0.001).

	upper extremity, comparing its effectiveness to a Combat Application Tourniquet (CAT) in a controlled environment. **Study Type:** Randomized crossover trial n= 1 study personnel applied the tourniquets to 23 participants			achieved complete occlusion in 52% of cases ($p < 0.001$).	**Study Limitations:** Conducted in a controlled setting on healthy volunteers; single operator applied all the tourniquets, indirect nature of outcome. Adverse Events: None reported.

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Hay-David et al. 2020	**Study Aim:** To compare the effectiveness and application times of improvised and commercially available tourniquets in controlling hemorrhage in a simulated traumatic amputation scenario. **Study Type:** Prospective observational study using a manikin model n=5 tourniquets, each tested 3 times by the same investigator	**Inclusion Criteria:** Simulated hemorrhage in a manikin model **Intervention:** SOFTT-W, C-A-T, SWAT-T, Tourni-key, Improvised (tie & wooden spoon) **Comparison:** None (comparison among tested devices)	**1° endpoint:** All devices successfully controlled bleeding within 1 minute. SOFTT-W was fastest to occlude bleeding (25 seconds) but had rebleeding in 2 out of 3 applications. C-A-T had no rebleeding and was joint fastest to apply (32 seconds). The improvised tourniquet was second fastest to stop bleeding (26 seconds). No p values given.	**Study Limitations:** Small sample size; use of a single operator to apply all devices may limit generalizability; conducted in a controlled simulation environment, not in real-world conditions. Adverse Events: The improvised tourniquet was reported to have a noticeable ligature effect.

Herron et al. 2021	**Study Aim:** To compare the application times of the Tourni-key and Combat Application Tourniquet (CAT) in trained and untrained populations **Study Type:** Prospective crossover study in a manikin model n=100	**Inclusion Criteria:** 50 team medic trained UK infantry troops and 50 untrained Jamaican Defense Force personnel **Intervention:** Tourni-key application (50 trained, 50 untrained) **Comparison:** CAT application (50 trained, 50 untrained)	**1° endpoint:** Mean application time post training for the CAT was 42.13 s vs. 37.61s for the Tourni-key (MD 4.47s : p<0.001). Training significantly improved application times for the untrained group (p < 0.0001).	Relevant 2° Endpoint: Comfort level in controlling hemorrhage improved post-training. **Study Limitations:** Small sample size Adverse Events: None reported.

Comparing Tourniquets in Pediatric Patients

RCT:

Study Acronym; Author; Year Published	**Aim of Study; Study Type; Study Size (N)**	**Patient Population**	**Study Intervention (# patients) / Study Comparator (# patients)**	**Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)**	**Relevant 2° Endpoint (if any); Study Limitations; Adverse Events**
El Bashtalay et al. 2021	**Study Aim:** To determine which of three commercially available tourniquets is most effective when used by school-aged children (ages 10-12). **Study Type:** Randomized crossover study in a manikin model n=96	**Inclusion Criteria:** School-aged children (10-12 years)	**Intervention:** Student were given a 7-minute training video and 2-minute practice period for Mechanical Advantage Tourniquet (MAT), Combat Application Tourniquet (CAT) and Stretch Wrap and Tuck Tourniquet (SWATT) **Comparison:** None (each participant used all three tourniquets)	**1° endpoint:** MAT had a higher success rate (67%) compared to CAT (44%) and SWATT (24%) (p < 0.0001), as defined by inability to pass a finger between the tourniquet and manikin. MAT was also faster to apply (mean time 57	Relevant 2° Endpoint: The MAT was the most preferred by students (64%), followed by CAT (30%) and SWATT (6%) (p < 0.0001). **Study Limitations:** Conducted in a controlled environment with a simulated scenario; no validation of training video, limited generalizability to other pediatric populations. Adverse

				seconds) compared to CAT (80 seconds) and SWATT (90 seconds) ($p < 0.0001$).	Events: None reported.

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Harcke et al. 2019	**Study Aim:** To determine if the Combat Application Tourniquet (CAT) is effective in occluding arterial blood flow in school-aged children. **Study Type:** Prospective observational study in a human model n=60, tourniquets applied by study personnel	**Inclusion Criteria:** School-aged children (ages 6-16 years) **Intervention:** CAT application on upper and lower extremities (60 participants) **Comparison:** None (single-group study)	**1° endpoint:** The CAT successfully occluded arterial blood flow, by doppler ultrasound, in 100% of upper extremities and 93% of lower extremities. Success was influenced by limb circumference, with older, obese children requiring more windlass turns.	Upper extremity circumferences ranged from 16-37 cm, while lower extremity circumferences ranged from 26-55.5 cm. In this study the CAT Gen 7 windlass tourniquet was successful in occluding distal pulses in both upper and lower extremities of those children age 6 and over with a limb circumference ≥ 16cm. **Study Limitations:** Relevant 2° Endpoint: None specified. Study Limitations: Conducted in a non-emergency, controlled setting; the maximum number of windlass turns limited to 3, which may not reflect real-world application. Adverse Events: Significant pain requiring discontinuation of the procedure in 1 participant.
Kelly et al. 2020	**Study Aim:** To determine the minimum patient age and limb size on which the Combat Application Tourniquet (CAT) can effectively control extremity hemorrhage in young children.	**Inclusion Criteria:** Pediatric patients aged 2-7 years scheduled for elective orthopedic surgery **Intervention:** Application of Combat Application Tourniquet (CAT) on upper and lower limbs	**1° endpoint:** 100% of limbs tested achieved arterial occlusion (95% CI: 85.8-100%). Both upper and lower extremities were successfully occluded. No significant differences in occlusion success	Weights ranged from 12.8-23.9 kg, leg circumference 24.5-34.5 cm and arm circumference 13-24 cm. **Study Limitations:** Small sample size; controlled, non-traumatic setting; limited generalizability to real-world trauma scenarios. Adverse Events: None reported.

	Study Type: Prospective observational study in a human model n=13 participants with 24 extremities tested, tourniquets applied by study personnel	**Comparison:** None (single-group study)	between the preschool (1-4 years) and school-age (5-8 years) groups ($p > 0.05$).	

Reviewer Comments:
In this review, continued evidence supports the use of commercial tourniquets in the prehospital setting for controlling life-threatening external bleeding. Commercial tourniquets are superior to improvised options in achieving hemostasis. Two studies demonstrate the overall effectiveness of a single brand of windlass when applied by adults to limbs in school aged children. However, additional evidence suggests that a windlass model may not be the most easy to apply by school aged children. Overall these studies support prior ILCOR recommendations for the use of tourniquets as first line therapy for life-threatening hemorrhage and a further systematic or scoping review is not warranted on the general topic. However, a scoping review may be indicated specifically on the topic of tourniquet use in the pediatric population.

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2025 Evidence Update
FA 7331 – Manual Pressure and Pressure Devices for Bleeding

Worksheet Author(s): Goolsby, Charlton
Task Force: First Aid
Date Approved by SAC Representative: October 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults and children with severe, life-threatening external bleeding
Intervention: Direct pressure of the wound with a compression dressing, compression bandage, or compression device, wound clamp, application of a junctional pressure device, proximal manual pressure
Comparators: Direct manual pressure
Outcomes: Mortality due to bleeding (Critical), Cessation of bleeding / achieving hemostasis (Critical), Time to achieving hemostasis (Critical), Mortality from any cause (Important), Decrease in bleeding (Important), Complications/adverse effects (e.g. wound infection, limb loss, re-bleeding, pain related to an intervention) (Important)
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion.
All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded.

Year of last full review: 2020

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We recommend that first aid providers use direct manual compression compared with the use of external compression devises or pressure dressings/bandages for severe life-threatening external bleeding (strong recommendation, very low certainty of evidence).
We recommend against the use of pressure points compared with the use of direct pressure by first aid providers for severe, life-threatening external bleeding (strong recommendation, very low certainty of evidence).

Current Search Strategy
Total Results n=662 on 7/2/24

Ovid Medline

Concept	Keywords	MeSH
Bleeding	(hemorrhag$ or haemorrhag$).ti,ab,kf. or hemorrhage/ (blood adj3 loss).ti,ab,kf. bleed$.ti,ab,kf. Combine above with below (major or massive or acute or lethal or uncontrolled or sever$ or life-threatening or serious or shock or death$ or surviv$ or mortal$ or arter$ or trauma* or posttraumatic or prehospital).ti,ab,kf. or (military or army or corps or special operations or disaster or trauma or first aid or emergency or acute care).jw. Also add Exp exsanguination/	Exsanguination/ exp "Wounds and Injuries"/ hemorrhage/ or shock, hemorrhagic/

	exsanguination.ti,ab,kf. (((arter$ or vascular or vessel) adj3 (injur$ or ruptur$ or damage)) or MVI).ti,ab,kf. amputat$.ti,ab,kf. avulsion.ti,ab,kf.	
Pressure Interventions	sandbag.ti,ab,kf. ((direct$ or manual$ or point or device or digital or wound or proximal$) adj3 (compress$ or press$)).ti,ab,kf. (bandag$ or pressure dressing$ or compression dressing$ or Israeli dressing$ or wound pack$ or field dressing$).ti,ab,kf. NOT ("Negative pressure wound therapy" or "mechanical chest compression" or "sinus compression" or "nerve compression" or "pressure sore" or "pressure ulcer$" or "chronic wound$" or "venous ulcer$" or "diabetic ulcer$" or "varicose veins" or "varicose ulcer" or "varicosis wound" or "venous leg ulcer" or "ulcer healing").ti,ab,kf.	Compression Bandages/
Human	not (exp "Animals"/ not "Humans"/) (mouse OR mice OR murine OR rat OR rats OR porcine OR swine OR horse* OR dog*)	
Exclude Pub Types	not (review.pt. or guideline.pt. or scoping.ti. or systematic.ti. or umbrella.ti. or meta-analysis.ti. OR “narrative review”.ti.)	
Dates, English	limit # to dt=20191101-20240630	

n=363 7-2-24

Embase n=482

NOT review articles, conference abstracts

not (scoping or systematic or umbrella or meta-analysis OR ‘narrative review’)

NOT (mouse:ti,ab,kw OR mice:ti,ab,kw OR murine:ti,ab,kw OR rat:ti,ab,kw OR rats:ti,ab,kw OR porcine:ti,ab,kw OR swine:ti,ab,kw OR horse*:ti,ab,kw OR dog*)

NOT ("Negative pressure wound therapy" or "mechanical chest compression" or "sinus compression" or "nerve compression" or "pressure sore" or "pressure ulcer$" or "chronic wound$" or "venous ulcer$" or "diabetic ulcer$" or "varicose veins" or "varicose ulcer" or "varicosis wound" or "venous leg ulcer" or "ulcer healing").ti,ab,kf.

sandbag:ti,ab,kw

((direct* or manual* or point or device or digital or wound or proximal*) NEAR/3 (compress* or press*)):ti,ab,kw

:ti,ab,kw

'compression bandage'/exp/mj OR 'pressure dressing'/exp/mj

'exsanguination'/mj OR 'exsanguination':ti,ab,kw OR (((arter* OR vascular OR vessel) NEAR/3 (injur* OR ruptur* OR damage)):ti,ab,kw) OR amputat*:ti,ab,kw OR avulsion:ti,ab,kw OR 'hemorrhagic shock'/mj OR 'bleeding severity'/mj OR 'major bleeding'/mj OR 'wound hemorrhage'/mj OR 'blast injury'/exp/mj OR 'battle injury'/exp/mj OR 'penetrating trauma'/exp/mj OR 'multiple trauma'/exp/mj
major:ti,ab,kw OR massive:ti,ab,kw OR acute:ti,ab,kw OR lethal:ti,ab,kw OR uncontrolled:ti,ab,kw OR sever*:ti,ab,kw OR 'life threatening':ti,ab,kw OR serious:ti,ab,kw OR shock:ti,ab,kw OR death*:ti,ab,kw OR surviv*:ti,ab,kw OR morta*:ti,ab,kw OR arter*:ti,ab,kw OR trauma*:ti,ab,kw OR posttraumatic:ti,ab,kw OR prehospital:ti,ab,kw OR military:jt OR army:jt OR corps:jt OR 'special operations':jt OR disaster:jt OR trauma:jt OR 'first aid':jt OR emergency:jt OR 'acute care':jt
hemorrhag*:ti,ab,kw OR haemorrhag*:ti,ab,kw OR 'hemorrhage'/mj OR ((blood NEAR/3 loss):ti,ab,kw) OR bleed*:ti,ab,kw OR 'bleeding'/mj

CINAHL n=126
WOS n=149
Database searched: Medline Embase Cochrane
Time Frame: November 2019 to present
Date Search Completed: 07/02/2024
Search Results:

Summary of Evidence Update:

Seven studies were identified in this evidence update. Four studies were identified pertaining to the use of pressure points. In two studies, pressure point techniques demonstrated some benefit over an improvised and commercial tourniquet, respectively. Taylor et al (2021) found that inguinal compression reduced popliteal artery peak systolic velocity by 89.7% (95% CI: 83.9%-95.5%), significantly outperforming the surfboard leg rope tourniquet, which achieved a 43.8% reduction (95% CI: 34.5%-53.1%), ($p \leq 0.001$). In addition, Furness et al (2023) demonstrated a mean reduction in blood flow of 89.7% (SD 29.1) with the use of pressure point application as opposed to a commercial tourniquet (unknown brand) that only reduce blood flow by 50.8% (SD 58.5) when applied (RR: 1.7500, 95%CI 0.8343 to 3.6708). However, both of these studies have significant limitations including the limited time of pressure point application and the unknown efficacy of the applied tourniquets. In an observational study, Gavriely et al. demonstrated high success rates with manual pressure points, achieving complete blood flow cessation in 97.1% of cases at the supraclavicular point and 100% at the femoral point within a mean time of 12.5 seconds and 5.5 seconds, respectively ($p < 0.001$). In a similar observational study by Thompson et al 2023, all participants achieved distal pulse cessation at supraclavicular and femoral pressure points with a median time of 3.0 and 4.5 seconds, respectively. Again, in both studies the time of pressure application was limited and both studies were in a controlled setting.

Three studies were identified regarding the use of pressure devices. In a study by McKee et al. (2019) in a human cadaver model of a neck wound, the use of an iTClamp and Foley catheter balloon tamponade resulted in significantly less fluid loss than direct manual pressure ($p = 0.000$), with the iTClamp being quicker to apply ($p < 0.0001$). Similarly, in a manakin model, Stuart et al. (2023) found that the iTClamp was more than twice as fast to apply as a pressure dressing (mean 17.6 seconds vs. 42.5 seconds; $p < 0.0001$), with no significant skill atrophy observed over 30 days. There were also limitations to both of these studies, with both being conducted in models, with low number of participants and having some medical training. A case series by McKee et al (2019) evaluated 80 patients with a prehospital iTClamp applied to bleeding scalp and facial lacerations. Adequate hemorrhage control was achieved in 87.5% of cases (n=70) in which the iTClamp placed. Inadequate control reported in 3.75% of cases (n=3). In seven cases hemorrhage control was not reported. No specific p-values or confidence intervals provided. 27.5% (n=22) of cases switched from direct pressure and packing to iTClamp.

Pressure Points					
Furness et al. 2023	**Study Aim:**	**Inclusion Criteria:** Non-	**Intervention:**	**1° endpoint:** PP resulted in a	**Study Limitations:**. Small sample size,

	To compare the effectiveness of pressure point (PP) control and a commercial arterial tourniquet (AT) (unclear what device) in reducing femoral artery blood flow among non-medically trained surf lifesavers. **Study Type:** Randomized crossover trial n=8	medically trained surf lifesavers (lifeguards)	PP technique (8 participants) **Comparison:** Arterial tourniquet (AT) (8 participants)	mean reduction in blood flow of 89.7% (SD 29.1), as measured by doppler ultrasound, while AT resulted in a reduction of 50.8% (SD 58.5). Full blood flow occlusion was achieved in 87.5% (7 out of 8) of participants using PP and 50% (4 out of 8) using AT (RR: 1.7500, 95%CI 0.8343 to 3.6708). PP was faster to apply (mean 50.63s vs. 113.5s for AT). Perceived difficulty was lower for PP (mean 2.8 out of 10) compared to AT (mean 3.5).	limited generalizability, short duration of application, unknown type of commercial tourniquet used.
Pressure Devices					
McKee et al. 2019	**Study Aim:** To determine whether the iTClamp is equivalent to direct manual pressure (DMP) and Foley catheter balloon tamponade (BCT) in controlling neck hemorrhage. **Study Type:** Randomized trial using perfused human cadaver model, block randomization	**Inclusion Criteria:** Human cadaver model with a wound created in the left sided of the neck	**Intervention:** iTClamp application **Comparison:** Direct manual pressure (DMP) and Foley catheter balloon tamponade (BCT)	**1° endpoint:** iTClamp and BCT were associated with significantly less fluid loss compared to DMP during both no movement ($p = 0.000$) and movement ($p = 0.000$ for iTClamp, $p = 0.006$ for BCT). iTClamp was significantly faster to apply than BCT ($p < 0.0001$).	**Study Limitations:** Conducted on a cadaver model; limited observation period; saline used as perfusate lacking clotting capability; limited to three cadavers; only two research personnel applied the interventions, not blinded.

	n = 3 cadavers (45 interventions; 5 of each method on each model); only 2 research personnel applied the interventions				
Stuart et al 2023	**Study Aim:** To evaluate the speed, skill retention, and user perceptions of iTClamp application by Navy corpsmen compared to standard pressure dressing. **Study Type:** Randomized crossover study using manikin model n=26	**Inclusion Criteria:** Volunteer, Navy corpsmen with Tactical Combat Casualty Care training	**Intervention:** iTClamp application **Comparison:** Pressure dressing (Emergency Trauma Dressing)	**1° endpoint:** iTClamp application was more than twice as fast as pressure dressing application (mean 17.6s vs. 42.5s; P < 0.0001). No significant skill atrophy was observed after 30 days. No significant differences in preference for iTClamp over pressure dressing.	**Study Limitations:** Conducted on a manikin model, small sample size, conducted in military personnel. Adverse Events: None reported.

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Pressure Points				
Gavriely et al.2023	**Study Aim:** To assess the efficacy and feasibility of the manual pressure points (MPP) technique for hemorrhage control.	**Inclusion Criteria:** Healthy male combat medics aged 21.1 ± 1.3 years MPP at femoral and supraclavicular	**1° endpoint:** The primary outcome was the ability to induce complete distal blood flow cessation within 120 seconds by doppler. Success rates: Supraclavicular point:	Study Limitations: Controlled environment; young, healthy male combat medics, no real-world testing, short duration of application. Adverse Events: None reported.

	Study Type: Prospective, non-randomized, controlled study n=38, (35 evaluations completed)	pressure points (35 patients)	97.1% (95% CI: 90.1%-99.2%); Femoral point: 100% (95% CI: 92.1%-100%). Mean time to success: Supraclavicular: 12.5 ± 20.9 seconds; Femoral: 5.5 ± 4.3 seconds ($p < 0.001$). Flow cessation duration: Supraclavicular: 76.2% ± 23.7%; Femoral: 98.7% ± 3.8% ($p < 0.001$). Pain scores: Supraclavicular: Median VAS 4 (out of 10) (responders), 3 (models); Femoral: Median VAS 3 (responders), 2 (models) ($p < 0.001$ for both).	
SHARC Taylor & Lamond 2021	**Study Aim:** To determine the most effective first aid method for controlling lower limb hemorrhage, particularly in the context of shark attacks. **Study Type:** Non-randomized trial using healthy volunteers n = 34 with 136 interventions	**Inclusion Criteria:** Healthy volunteers **Intervention:** Inguinal pressure point compression technique with a fist pressing at the midpoint of the inguinal canal **Comparison:** Surfboard leg rope tourniquet	1° endpoint: Inguinal pressure point compression resulted in a mean reduction of popliteal artery peak systolic velocity (PSV) by 89.7% (95% CI: 83.9%-95.5%) compared to 43.8% (95% CI: 34.5%-53.1%) for the leg rope ($P \leq 0.001$). No significant effect of wetsuit use.	Study Limitations: Conducted on volunteers with healthcare background, controlled environment, short duration of application, design of improvised rope tourniquet. Adverse Events: None reported.
Thompson 2023	**Study Aim:** To assess the effectiveness of the manual pressure points (MPP) technique for hemorrhage control among healthcare providers with varying levels of experience.	**Inclusion Criteria:** Healthy military healthcare provider with varying levels of experience **Intervention:** MPP technique application (38 participants)	1° endpoint: All participants achieved distal pulse cessation at supraclavicular (median 3.0 seconds, IQR 2.0-5.0) and femoral (median 4.5 seconds, IQR 3.0-6.0) pressure points. Participants who attended an instructional class prior	Study Limitations: Small sample size; controlled environment; subjective measures of effectiveness (pulse palpation); short duration of occlusion (1 minute); potential selection bias as participants were familiar with emergency care. Adverse Events: None reported.

	Study Type: Prospective, non-randomized, controlled environment study n=38	**Control:** None	to the exercise had significantly faster success rates (p = .004). Pain scores were low, with 68.4% reporting pain scores between 0 and 3 for the supraclavicular point and 84.2% for the femoral point	
Pressure Devices				
McKee et al. 2019	**Study Aim:** To evaluate the effectiveness of the iTClamp for controlling bleeding from craniomaxillofacial (CMF) injuries in a prehospital environment. **Study Type:** Case series n = 80	**Inclusion Criteria:** Patients with craniomaxillofacial injuries (scalp and face lacerations) from various causes.	**1° endpoint:** Adequate hemorrhage control was achieved in 87.5% of cases (n=70) in which the iTClamp was applied. . Inadequate control reported in 3.75% of cases (n=3). In seven cases hemorrhage control was not reported. No specific p-values or confidence intervals provided. 27.5% (n=22) of cases switched from direct pressure and packing to iTClamp.	Study Limitations: Retrospective review, voluntary data submission, potential for bias, no control group, limited generalizability. Adverse Events: Inadequate hemorrhage control in patients with frail skin.

Reviewer Comments:

While findings in these studies do suggest some potential benefits for the use of pressure points or pressure devices in some settings, the results are confounded by significant limitations, indirect nature of the evidence and potential bias. These limitations are similar to the limitations in the prior ILCOR review that led to the recommendation that direct manual pressure be used for treatment of life-threatening bleeding compared with external pressure devices or pressure points. There continues to be little to no direct evidence that lay persons can effectively use pressure points or pressure devices to control hemorrhage in a real world setting. Due to this limited evidence, it is not felt that this updated evidence would change current treatment recommendations, and it is not felt that an additional scoping or systematic review is warranted at this time. As additional literature is published, these recommendations should continue to be re-evaluated. Particularly regarding whether pressure point application could be used as adjunctive therapy or as a temporizing measure while other hemostatic methods are applied.

Reference list:

Furness J, Abery P, Kemp-Smith K, Bruce K, Lamond D, Taylor N, Jones P, Snelling PJ. Comparison of surf lifesaver pressure point control and a commercial arterial tourniquet for major lower limb haemorrhage: A randomised controlled crossover pilot trial. Emerg Med Australas. 2023 Dec;35(6):1038-1040. doi: 10.1111/1742-6723.14307. Epub 2023 Sep 13. PMID: 37704229.

Mckee JL, Mckee IA, Ball CG, Tan E, Moloff A, McBeth P, LaPorta A, Bennett B, Filips D, Teicher C, Kirkpatrick AW. The iTClamp in the treatment of prehospital craniomaxillofacial injury: a case series study. J Inj Violence Res. 2019 Jan;11(1):29-34. doi: 10.5249/jivr.v11i1.917. Epub 2019 Jan 12. PMID: 30635996; PMCID: PMC6420914.

Mckee JL, Mckee IA, Bouclin MD, Filips DF, Atkinson IJ, Ball CG, McBeth PB, Kirkpatrick MAW. A Randomized Controlled Trial using iTClamp, Direct Pressure, and Balloon Catheter Tamponade to Control Neck Hemorrhage in a Perfused Human Cadaver Model. J Emerg Med. 2019 Apr;56(4):363-370. doi: 10.1016/j.jemermed.2018.12.008. Epub 2019 Jan 30. PMID: 30709605.

Gavriely R, Lior Y, Gelikas S, Levy S, Ahimor A, Glassberg E, Shapira S, Benov A, Avital G. Manual Pressure Points Technique for Massive Hemorrhage Control-A Prospective Human Volunteer Study. Prehosp Emerg Care. 2023;27(5):586-591. doi: 10.1080/10903127.2022.2122644. Epub 2022 Sep 28. PMID: 36074122.

Stuart SM, Bohan ML, Friedrich EE. Speed, Skill Retention, and End User Perceptions of iTClamp Application by Navy Corpsmen on a Manikin Model of Femoral Hemorrhage. Mil Med. 2023 Jul 22;188(7-8):e2496-e2501. doi: 10.1093/milmed/usac355. PMID: 36424914.

Taylor NB, Lamond DW. Stopping Haemorrhage by Application of Rope tourniquet or inguinal Compression (SHARC study). Emerg Med Australas. 2021 Oct;33(5):803-807. doi: 10.1111/1742-6723.13736. Epub 2021 Feb 7. PMID: 33554450.

Thompson P, Glassberg E, Alon Y, Bjerkvig CK, Eliassen HS, Radomislensky I, Strandenes G, Talmy T, Almog O. The effectiveness of the manual pressure points technique for hemorrhage control-The 2022 THOR pre-conference meeting experience. Transfusion. 2023 May;63 Suppl 3:S222-S229. doi: 10.1111/trf.17350. Epub 2023 Apr 12. PMID: 37042672.

2025 Evidence Update
FA 7334 – Hemostatic Dressing

Worksheet Author(s): Goolsby, Charlton
Task Force: First Aid
Date Approved by SAC Representative: October 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults and children with severe, life-threatening external bleeding
Intervention: Hemostatic dressings with or without direct pressure (manual or pressure to the wound with a compression dressing, compression bandage, or compression device)
Comparators: Direct manual pressure or direct pressure to the wound with a compression dressing, compression bandage, or compression device
Outcomes: Mortality due to bleeding (Critical), Cessation of bleeding / achieving hemostasis (Critical), Time to achieving hemostasis (Critical), Mortality from any cause (Important), Decrease in bleeding (Important), Complications/adverse effects (e.g. wound infection, limb loss, re-bleeding, pain related to an intervention) (Important)
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion.
All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded.

Year of last full review: ***2020***
Literature search updated from November 1, 2019.

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest that first aid providers use a hemostatic dressing with direct pressure as opposed to direct pressure alone for severe, life-threatening external bleeding (weak recommendation, very low certainty of evidence).

For the treatment of severe, life-threatening external bleeding by first aid providers, due to very limited data and very low confidence in effect estimates, we are unable to recommend the use of any one specific type of hemostatic dressing compared with another.

Current Search Strategy
Total Results n=1845 on 7-1-24

Ovid Medline

Concept	**Keywords**	**MeSH**
Bleeding	(hemorrhag$ or haemorrhag$).ti,ab,kf. or hemorrhage/ (blood adj3 loss).ti,ab,kf. bleed$.ti,ab,kf. Combine above with below (major or massive or acute or lethal or uncontrolled or sever$ or life-threatening or serious or shock or death$ or surviv$ or mortal$ or arter$ or trauma* or posttraumatic or prehospital).ti,ab,kf. or (military or army or corps or special operations or disaster or trauma or first aid or emergency or acute care).jw. Also add	Exsanguination/ or exp "Wounds and Injuries"/ or hemorrhage/ or shock, hemorrhagic/

	Exp exsanguination/ exsanguination.ti,ab,kf. (((arter$ or vascular or vessel) adj3 (injur$ or ruptur$ or damage)) or MVI).ti,ab,kf. amputat$.ti,ab,kf. avulsion.ti,ab,kf.	
Exclude	Gastrointestinal Hemorrhage/ or "gastrointestinal hemorrhage".ti,ab,kf. or "gastrointestinal haemorrhage".ti,ab,kf. or Peptic Ulcer Hemorrhage/ or "Peptic ulcer".ti,ab,kf. or Hematuria/ or Hemoptysis/ or Hemothorax/ or Intracranial Hemorrhages/ or Uterine Hemorrhage/ or "Postpartum hemorrhage".ti,ab,kf. or "Postpartum haemorrhage".ti,ab,kf. or "subarachnoid hemorrhage".ti,ab,kf. or "subarachnoid haemorrhage".ti,ab,kf. or Cerebral Hemorrhage/ or "intracranial hemorrhage".ti,ab,kf. or "Cerebral infarction".ti,ab,kf. or Vitreous Hemorrhage/ or Retinal Hemorrhage/ or "Rectal bleeding".ti,ab,kf. Also exclude GI bleed, endoscope, nasal, intracerebral, coronary, REBOA, endovascular and/or catheterization	
Hemostatic Dressings	((hemostatic or haemostatic) adj3 (agent or dressing or gauze or sponge or foam or bandag* or technique or topical or powder or granul$)).ti,ab,kf. (Hemostatic Techniques/ or Hemostatics/ or hemostatic*.ti. or haemostatic*.ti.) and (wound* or injur* or amputat* or avulsion* or bleed* or haemorrhag* or hemorrhag*).ti,ab,kf. (ActCel or axiostat or BleedArrest or BloodStop or BioHemostat or celox or chitoflex or ChitoGauze or "combat gauze" or hemcon or InstaClot or PolyMem or quickclot or QuikClot or TraumaDex or TraumaStat or XSTAT or XSTAT-30 or X-Sponge or WoundStat or "self-expanding hemostatic polymer" or "mrdh bandage" or "modified rapid deployment hemostat").ti,ab,kf.	Hemostatic Techniques/ or Hemostatics/
Exclude	exp Aprotinin/ or exp Aminocaproates/ or exp Tranexamic Acid/ or “tranexamic acid”.ti,ab,kf.	
Human	not (exp "Animals"/ not "Humans"/)	

	not (mouse or mice or murine or rat or rats or swine or porcine or horse* OR dog*).ti.	
Dates, English	limit # to dt=20191101-20240630 Limit to English language	
Exclude	review articles, guidelines not ((review or guideline).pt. or scoping.ti. or systematic.ti. or umbrella.ti. or meta-analysis.ti.)	

n=659 on 7/1/24

Embase

Concept	**Keywords**	**Emtree**
Bleeding	(hemorrhag* or haemorrhag*):ti,ab,kw 'hemorrhage'/mj (blood NEAR/3 loss):ti,ab,kw bleed*:ti,ab,kw 'bleeding'/mj Combine above with below major:ti,ab,kw OR massive:ti,ab,kw OR acute:ti,ab,kw OR lethal:ti,ab,kw OR uncontrolled:ti,ab,kw OR sever*:ti,ab,kw OR 'life threatening':ti,ab,kw OR serious:ti,ab,kw OR shock:ti,ab,kw OR death*:ti,ab,kw OR surviv*:ti,ab,kw OR morta*:ti,ab,kw OR arter*:ti,ab,kw OR trauma*:ti,ab,kw OR posttraumatic:ti,ab,kw OR prehospital:ti,ab,kw OR military:jt OR army:jt OR corps:jt OR 'special operations':jt OR disaster:jt OR trauma:jt OR 'first aid':jt OR emergency:jt OR 'acute care':jt Also add 'exsanguination'/mj 'exsanguination':ti,ab,kw ((arter* or vascular or vessel) NEAR/3 (injur* OR ruptur* or damage)):ti,ab,kw amputat*:ti,ab,kw avulsion:ti,ab,kw 'hemorrhagic shock'/mj 'bleeding severity'/mj 'major bleeding'/mj 'wound hemorrhage'/mj 'blast injury"/exp.mj	'bleeding'/mj 'hemorrhagic shock'/mj 'bleeding severity'/mj 'exsanguination'/mj 'major bleeding'/mj 'wound hemorrhage'/mj

	'battle injury'/exp/mj 'penetrating trauma'/exp/mj 'multiple trauma'/exp/mj	
Exclude	'gastrointestinal hemorrhage'/exp or 'gastrointestinal hemorrhage':ti,ab,kw or 'gastrointestinal haemorrhage':ti,ab,kw or 'peptic ulcer bleeding'/exp or 'Peptic ulcer':ti,ab,kw OR 'urinary tract hemorrhage'/exp or 'hemoptysis'/exp or 'hematothorax'/exp or 'brain hemorrhage'/exp OR 'uterus bleeding'/exp OR 'obstetric hemorrhage'/exp OR 'postpartum hemorrhage':ti,ab,kw or 'postpartum haemorrhage':ti,ab,kw or 'subarachnoid hemorrhage':ti,ab,kw or 'subarachnoid haemorrhage':ti,ab,kw or 'intracranial hemorrhage':ti,ab,kw or 'cerebral infarction':ti,ab,kw OR 'intraocular hemorrhage'/exp OR 'digestive system hemorrhage'/exp OR **'blood clotting factor deficiency'/exp**	
Hemostatic Dressings	((hemostatic or haemostatic) NEAR/3 (agent or dressing or gauze or sponge or foam or bandag* or technique or topical or powder or granul*)):ti,ab,kw ('hemostatic agent'/exp or hemostatic*:ti or haemostatic*:ti) AND (wound* or injur* or amputat* or avulsion* or bleed* or haemorrhag* or hemorrhag*):ti,ab,kw (ActCel or axiostat or BleedArrest or BloodStop or BioHemostat or celox or chitoflex or ChitoGauze or "combat gauze" or hemcon or InstaClot or PolyMem or quickclot or QuikClot or TraumaDex or TraumaStat or XSTAT or XSTAT-30 or X-Sponge or WoundStat or "self-expanding hemostatic polymer" or "mrdh bandage" or "modified rapid deployment hemostat"):ti,ab,kw	'hemostatic agent'/exp

Exclude	'aprotinin'/exp or 'aminocaproic acid derivative'/exp OR 'tranexamic acid'/exp or "tranexamic acid':ti,ab,kw	
Human	NOT (mouse:ti,ab,kw OR mice:ti,ab,kw OR murine:ti,ab,kw OR rat:ti,ab,kw OR rats:ti,ab,kw OR porcine:ti,ab,kw OR swine:ti,ab,kw OR horse*:ti,ab,kw)	
Dates, English, pub types	NOT 'conference abstract'/it [2019-11-01 to 2024-07-01]/ld	

n=975 on 7/1/24

CINAHL n=212 on 7/1/24
Web Of Science n=486 on 7/1/24

Database searched: Medline, Embase, CINAHL, Web of Science
Time Frame: November 2019 to present
Date Search Completed: 07/01/2024
Search Results: 5 relevant atudies

Summary of Evidence Update:
Five articles were identified in this evidence update regarding the use of hemostatic dressings for the control of life-threatening bleeding. The evidence suggests that hemostatic dressings offer superior bleeding control compared to conventional gauze, achieving faster hemostasis and reducing the need for multiple applications. Three randomized trials were identified that evaluated the use of a hemostatic dressing compared with conventional gauze. Misgav et al. (2017) demonstrated that the use of chitosan pads significantly reduced the time to hemostasis compared to conventional gauze pads after decannulation of a dialysis fistula on both the arterial (3.00 min vs. 18.76 min) and venous (2.83 min vs. 13.28 min) sides, $p < 0.001$. Similarly, Kliuk-Ben Bassat et al. (2021) reported that WoundClot® hemostatic gauze reduced mean bleeding times by approximately 4-6 minutes compared to cotton gauze ($p < 0.001$ following). Ghouti-Terki et al. (2022), did not observe a statistically significant difference between hemostatic dressings and plain compresses in general, although specific subgroups, such as those receiving high doses of heparin (>35 IU/kg) showed a benefit with hemostatic dressings. Two non-randomized studies reviewed further support the use of hemostatic dressings in managing severe bleeding. Kabeer et al. (2019) found that the Axiostat® dressing significantly reduced time to hemostasis (4.68 min vs. 18.56 min) and blood loss compared to cotton gauze in patients with scalp wounds ($p < 0.0001$). Winstanley et al. (2019) demonstrated that military trauma patients the use of hemostatic dressings was associated with a 7% increase in survival, particularly with the Celox dressing in patients with high injury severity scores ($p < 0.001$).

RCT:

Study Acronym; Author; Year Published	**Aim of Study; Study Type; Study Size (N)**	**Patient Population**	**Study Intervention (# patients) / Study Comparator (# patients)**	**Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)**	**Relevant 2° Endpoint (if any); Study Limitations; Adverse Events**
Misgav et al. 2017	**Study Aim:** To evaluate the hemostatic	**Inclusion Criteria:** Hemodialysis patients >18 with	**Intervention:**	**1° endpoint:** The mean time to hemostasis was	**Study Limitations:** No apparent

	efficacy of chitosan pads compared to conventional gauze pads in hemodialysis patients with prolonged bleeding after needle extraction. **Study Type:** Single-center, open-label crossover study n=15 patients (288 applications)	significant bleeding tendency undergoing decannulation of dialysis fistula	Chitosan-acetate pad (144 applications) **Comparison:** Conventional gauze pad (144 applications)	shorter with chitosan pads compared to gauze pads for both arterial (3.00 min vs. 18.76 min, $p < 0.001$) and venous (2.83 min vs. 13.28 min, $p < 0.001$) access points. Hemostasis was achieved after the first chitosan pad application in 78.4% of cases.	blinding, indirect data, unclear protocol for pressure application; small sample size; single-center study, applications conducted by healthcare professionals.
Bassat et al. 2021	**Study Aim:** To evaluate the impact of WoundClot® hemostatic gauze on bleeding time (BT) after arteriovenous fistula (AVF) decannulation in hemodialysis patients and to assess its effect on long-term AVF preservation. **Study Type:** Randomized prospective single-center study n=49 (24 in WoundClot® group, 25 in control group)	**Inclusion Criteria:** Hemodialysis patients receiving hemodialysis by AVF for at least 6 months	**Intervention:** WoundClot® hemostatic gauze (24 patients) **Comparison:** Cotton gauze (25 patients)	**1° endpoint:** WoundClot® significantly reduced mean venous BT following decannulation of dialysis fistula by 3.99 minutes (±4.6) and mean arterial BT by 6.38 minutes (±4.8) compared to cotton gauze ($p < 0.001$). The WoundClot® group showed a higher dialysis adequacy (spKt/V 1.73 vs. 1.53, $p = 0.047$) after 12 months of follow-up. Thrombosis rates were similar between the groups.	**Study Limitations:**: Single-center study, baseline bleeding time was longer in the WoundClot® group, potentially indicating a selection bias, unclear blinding, indirect evidence. Adverse Events: Two patients reported re-bleeding after WC removal; one patient had skin lesions that resolved after cessation of WC use.
Ghouti-Terki et al. 2022	**Study Aim:** To evaluate the effectiveness of hemostatic	**Inclusion Criteria:** Hemodialysis patients using AVF	**Intervention:** Hemostatic dressings (35	**1° endpoint:** No significant difference in compression	**Study Limitations:** Study Limitations: Indirect data,

	dressings compared to simple compresses in controlling bleeding time after arteriovenous fistula (AVF) cannulation in hemodialysis patients. **Study Type:** Prospective, crossover study n = 35		patients, first 2 weeks) **Comparison:** Simple compresses (35 patients, following 2 weeks)	times was observed between hemostatic dressings and simple compresses (12.6 min vs. 12.9 min; p = 0.23). However, in patients receiving >35 IU/kg of heparin during dialysis sessions, compression time was significantly longer with compresses compared to hemostatic dressings (12.75 min vs. 11.75 min; p = 0.008).	unclear blinding, small sample size, single-center study.

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	Study Type/Design; Study Size (N)	Patient Population	Primary Endpoint and Results (include P value; OR or RR; & 95% CI)	Summary/Conclusion Comment(s)
Kabeer et al. 2019	**Study Aim:** To evaluate the effectiveness of Axiostat® dressing compared to conventional cotton gauze in controlling pre- hospital hemorrhage from scalp wounds. **Study Type:** Prospective, open-label study n =104	**Inclusion Criteria:** Patients ≥ 18 with bleeding scalp wounds **Intervention:** Axiostat® chitosan hemostatic dressing (47 patients) **Comparison:** Cotton gauze dressing (57 patients)	**1° endpoint:** Axiostat® significantly reduced time to hemostasis (4.68 ± 1.04 min vs. 18.56 ± 5.04 min; p < 0.0001) and blood loss (5.41 ± 2.53 g vs. 11.16 ± 4.96 g; p < 0.0001) compared to cotton gauze. Hemostasis was achieved in 94% of Axiostat® cases vs. 74% in	Adverse Events: No side effects reported for Axiostat®, while three patients in the cotton gauze group experienced side effects, which included adherence of the gauze to the wound, tissue loss and rebleeding.

			cotton gauze cases ($p < 0.05$). Fewer patients required a second dressing application with Axiostat® (17% vs. 35%; $p < 0.05$). Study Limitations: Small sample size; single-center study; only scalp injuries were included; no long-term follow-up.	
Winstanley et al. 2019	**Study Aim:** To analyze the use of hemostatic dressings in military trauma patients and assess their association with survival. **Study Type:** Retrospective database review N=3792	**Inclusion Criteria:** Military major trauma patients treated during the conflicts in Iraq and Afghanistan **Intervention:** Hemostatic dressings (Celox, Hemcon, Quickclot) (317 patients) **Comparison:** No hemostatic agent (3475 patients)	**1° endpoint:** Overall, hemostatic agents were associated with a 7% increase in survival ($p < 0.001$). Celox was associated with a statistically significant increase in survival, particularly in patients with New Injury Severity Scores (NISS) of 36-75 (24% increase in survival, $p < 0.001$). Hemcon and Quickclot did not show a statistically significant increase in survival.	Study Limitations: Retrospective nature; inability to identify anatomical area of application; potential confounding factors such as differing injury patterns and body regions not accounted for.

Reviewer Comments:

While much of the data continues to be indirect, data continues to suggest that hemostatic dressings decrease the time of bleeding and improve survival when compared to conventional gauze when used to stop life-threatening bleeding. In addition, there continues to be a low reported rate of side effects. As the overall data appears to be positive, it is reasonable to recommend the use of hemostatic dressings as adjunctive therapy to direct manual pressure to treat life-threatening bleeding. Based on the available data, it currently does not appear possible to recommend one type of dressing over another. Therefore, based on this evidence update, no additional scoping or systematic review is warranted.

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Winstanley M, Smith JE, Wright C. Catastrophic haemorrhage in military major trauma patients: a retrospective database analysis of haemostatic agents used on the battlefield. J R Army Med Corps. 2019 Dec;165(6):405-409. doi: 10.1136/jramc-2018-001031. Epub 2018 Oct 3. PMID: 30287682.

2025 Evidence Update
FA 7361 – Dental Avulsion

Worksheet Author(s): Amy Kule
Task Force: First Aid
Date Approved by SAC Representative: 2 November 2023
Conflict of Interest: none

PICOST / Research Question:
Population: Adults and children in any setting (in-hospital or out-of-hospital) with an avulsed permanent tooth
Intervention: Any storage media, container or technique.
Comparators: Storage in whole milk or the patient's saliva.
Outcomes: Success of replantation and tooth survival or viability (critical outcomes). Color of the tooth, infection rate, malfunction (eating, speech) and pain (important outcomes).
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) are eligible for inclusion.
Timeframe: All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded. Literature search updated to September 2, 2019.
PROSPERO Registration: CRD42020152903

Year of last full review: 2020

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest the use of Hank's Balanced Salt solution (HBSS), propolis (from 0.04 mg to 2.5 mg per ml 0.4% ethanol), Oral Rehydration Salt solutions including ricetral [Oral Rehydration Salt solutions containing sodium chloride, glucose, potassium chloride, citrate (or extruded rice)], or cling film compared with any form of cow's milk for temporary storage of an avulsed tooth that cannot be immediately replanted (weak recommendation, very low certainty evidence).

If none of the above choices are available, we suggest the use of cow's milk, any percent fat or form, compared with tap water, buttermilk, castor oil, turmeric extract or saline (sodium chloride) for temporary storage of an avulsed tooth (weak recommendation, very low certainty evidence).

There is insufficient evidence to recommend for or against temporary storage of an avulsed tooth in saliva compared with alternative solutions.

There is insufficient evidence to recommend for or against temporary storage of an avulsed tooth in probiotic media, Epigallocatechin-3-Gallate, Dentosafe® box, or egg white compared with cow's milk.

Current Search Strategy:

((((("Tooth Injuries"[Mesh] OR "Tooth Replantation"[Mesh] OR ((tooth[TIAB] OR teeth[TIAB] OR denta*[TIAB] OR dento*[TIAB] OR "Periodontal Ligament"[Mesh] OR "periodontal ligament"[TIAB]) AND (avuls*[TIAB] OR replant*[TIAB]))) AND ("Tissue Preservation"[Mesh] OR stor*[TIAB] OR preserv*[TIAB] OR transport*[TIAB] OR "Organ Preservation Solutions"[Mesh] OR "Saliva"[Mesh] OR saliva[TIAB] OR "Sodium Chloride"[Mesh] OR saline[TIAB] OR "Milk"[Mesh] OR milk[TIAB] OR "Water"[Mesh] OR water[TIAB] OR solution*[TIAB] OR propolis[TIAB] OR "Propolis"[Mesh] OR tea [TIAB] OR "Tea"[Mesh] OR (egg[TIAB] AND (white[TIAB] OR raw[TIAB] or albumen[TIAB] OR glair[TIAB] OR glaire[TIAB])) OR "Egg White"[Mesh] OR ice[TIAB] OR "Ice"[Mesh] OR "Sodium Fluoride"[Mesh] OR "sodium fluoride"[TIAB] OR ((cling[TIAB] OR plastic[TIAB] OR stretch[TIAB]) AND (wrap[TIAB] OR film[TIAB] OR foil[TIAB])) OR bag[TIAB] OR container[TIAB] OR box[TIAB])) NOT ("Letter"[Publication Type] OR "Comment"[Publication Type] OR "Editorial"[Publication Type] OR "Case Reports"[Publication Type] OR News[Publication Type])) AND (("2019/07/01"[Date - Publication] : "2023/07/01"[Date - Publication])))

New Search strategy: Not applicable

Database searched: Pubmed
Time Frame: July 1, 2019 – July 1, 2023
Date Search Completed: June 1, 2023
Search Results (Number of articles identified/number identified as relevant): 142/8

Updated Search Completed: December 2, 2023
Search Results (Number of articles identified/number identified as relevant): 36/0

Summary of Evidence Update:
For this evidence update, 4 systematic reviews or guideline documents were identified, all which were related to the 2020 CoSTR on this topic. Results from one meta-analysis were found to be in line with the 2020 CoSTR. For the 1 new RCT, it was found that in general PDFL viability was better at the cooler temperature for all storage media, except HBSS. Milk was the most effective, followed by propolis and HBSS at 5C, but at 20C, HBSS was the most effective, followed by milk. Results from each of the observational studies suggested that propolis, as well as cow and almond milk can be alternative storage mediums.

Organization (if relevant); Author; Year Published	**Guideline or systematic review**	**Topic addressed or PICO(S)T**	**Number of articles identified**	**Key findings**	**Treatment recommendations**
ILCOR Singletary 2020	2020 International consensus on First Aid Science with Treatment Recommendations (Circulation)	Storage of an Avulsed Permanent Tooth Before Replantation Population: Adults and children in any setting (in-hospital or out-of hospital) with an avulsed permanent tooth Intervention: Any storage media, container, or technique Comparators: Storage in whole milk or the patient's saliva	33	Media favored over cow's milk to store an avulsed tooth: -HBSS -Propolis -Oral rehydration salts/Ricetral -Cling film -Rice water Cow's milk favored over the following media to store an avulsed tooth: -Tap water -Buttermilk -Castor oil -Tumeric extract -Saline solution -GC tooth mousse Equal efficacy to cow's milk: -Probiotic media -Saliva -Egg white -Epigallocatechin-3-gallate	We suggest the use of HBSS; propolis (from 0.04 mg to 2.5 mg per mL of 0.4% ethanol); oral rehydration salt solutions including Ricetral (a commercial form of oral rehydration salt); solutions containing sodium chloride, glucose, potassium chloride, citrate, or extruded rice; or cling film compared with any form of cow's milk for temporary storage of an avulsed tooth that cannot be immediately replanted (weak recommendation, very low-certainty evidence). If none of these choices are available, we suggest the use of cow's milk (with any percent fat or form) compared with tap water, buttermilk, castor oil, turmeric extract, or saline (0.9% sodium chloride) for temporary storage of an avulsed tooth (weak recommendation, very low-certainty evidence). There is insufficient evidence to recommend for or

		Outcomes: Success of replantation and tooth survival or viability (critical outcomes); color of the tooth, infection rate, malfunction (eating, speech), and pain (important outcomes) Study design: RCTs and nonrandomized studies (non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion. Time frame: All years and all languages were included as long as there was an English abstract; unpublished studies (eg, conference abstracts, trial protocols) were excluded. Literature search was updated to September 2, 2019.		-Dentosafe box Equal efficacy to saliva: -Saline solution -Dentosafe box	against temporary storage of an avulsed tooth in the person's own saliva compared with alternative solutions. There is insufficient evidence to recommend for or against temporary storage of an avulsed tooth in probiotic media, epigallocatechin-3-gallate, Dentosafe box, or egg white compared with cow's milk.

ILCOR Singleta ry 2020	2020 International consensus on First Aid Science with Treatment Recommendatio ns (Resuscitation)	Storage of an Avulsed Permanent Tooth Before Replantation • Population: Adults and children in any setting (in-hospital or out-of-hospital) with an avulsed permanent tooth • Intervention: Any storage media, container, or technique • Comparator: Storage in whole milk or the patient's saliva • Outcome: Success of replantation and tooth survival or viability (critical outcomes); color of the tooth, infection rate, malfunction (eating, speech), and pain (important outcomes) • Study design: RCTs and nonrandomized studies (non-RCTs, interrupted time	33	The following media showed greater tooth cell viability compared with milk during storage: -HBSS -Saliva and thereafter HBSS -Propolis -Oral rehydration salt solution -Rice water -Cling film	We suggest the use of HBSS; propolis (from 0.04mg to 2.5mgmL of 0.4% ethanol); oral rehydration salt solutions including Ricetral (a commercial form of oral rehydration salt); solutions containing sodium chloride, glucose, potassium chloride, citrate, or extruded rice; or cling film compared with any form of cow's milk for temporary storage of an avulsed tooth that cannot be immediately replanted (weak recommendation, very low-certainty evidence). If none of these choices are available, we suggest the use of cow's milk (with any percent fat or form) compared with tap water, buttermilk, castor oil, turmeric extract, or saline (0.9% sodium chloride) for temporary storage of an avulsed tooth (weak recommendation, very low-certainty evidence). There is insufficient evidence to recommend for or against temporary storage of an avulsed tooth in the person's own saliva compared with alternative solutions. There is insufficient evidence to recommend for or against temporary storage of an avulsed tooth in probiotic media, epigallocatechin-3-gallate, Dentosafe box, or egg white compared with cow's milk.

		series, controlled before-and-after studies, cohort studies) were eligible for inclusion. • Time frame: All years and all languages were included as long as there was an English abstract; unpublished studies (eg, conference abstracts, trial protocols) were excluded. Literature search was updated to September 2, 2019.			
ERC Zideman 2021	European Resuscitation Council Guidelines 2021: First aid	Dental Avulsion			1. If the casualty is bleeding from the avulsed tooth socket: _Put on disposable gloves prior to assisting the victim _ Rinse out the casualty's mouth with cold, clean water _ Control bleeding by: *Pressing a damp compress against the open tooth socket *Tell the casualty to bite on the damp compress *Do not do this if there is a high chance that the injured person will swallow the compress (for example, a small child, an agitated person or a person with impaired consciousness). 2. If it is not possible to immediately replant the avulsed tooth at the place of accident: *Seek help from a specialist *Take the casualty and the avulsed tooth to seek expert help from a specialist.

					3. Only touch an avulsed tooth at the crown. Do not touch the root 4. Rinse a visibly contaminated avulsed tooth for a maximum of 10 seconds with saline solution or under running tap water prior to transportation. 5. To transport the tooth: *Wrap the tooth in cling film or store the tooth temporarily in a small container with Hank's Balanced Salt solution (HBSS), propolis or Oral Rehydration Salt (ORS) solution *If none of the above are available, store the tooth in cow's milk (any form or fat percentage) *Avoid the use of tap water, buttermilk or saline (sodium chloride).
ILCOR De Brier 2020	Storage of an avulsed tooth prior to replantation: A systematic review and meta-analysis	Population: Included: adults and children with an avulsed or extracted permanent tooth. There were no restrictions on causes of tooth avulsion or tooth extraction, treatments (mouthwash, medication use, or pulp extirpation), and types of replantation procedures. Excluded: studies using cultured cells of the PDL or extracted animal teeth. • Intervention: Included: all	33	Among the 23 comparisons evaluating the effect of storage on the viability of avulsed or extracted teeth, six showed positive effects on the viability of the PDL cells compared with storage in milk. In addition, six storage interventions had a less beneficial impact on the preservation of cell viability than milk and two interventions suffered from conflicting evidence. Finally, for the other nine comparisons, there was evidence neither in favor of the intervention nor in favor of the control. Several storage techniques were associated with improved preservation	If there is access to special storage media such as HBSS or diluted propolis solutions, the evidence supports their use compared with other interventions evaluated in this review. While propolis solutions might be available in African households, most (rural areas) of low- and middle-income countries will have no or limited access to commercial products such as rescue boxes or Tooth Mousse. Cling film may be a simple and readily available choice in many households and has a very limited cost. In Europe and Africa, ORS is available in first aid kits and therefore easily applicable in all settings. Also, evidence-based African first aid recommendations have already taken into account that ORS can be prepared based on local ingredients and, hence, its use might be recommended for storing an avulsed tooth in rural and remote regions. If none of the above choices are available, cow's milk, in any percentage fat or form, could be considered for temporary storage of an avulsed tooth.

		solutions, containers, and techniques which can be used to store an avulsed or extracted tooth (following dry storage) and which are available to laypeople. Excluded: solely dry storage of the avulsed or extracted tooth and all solutions or techniques unavailable to laypeople such as cell culture media (eg, Dulbecco's modified Eagle's medium and Ham's F-10). • Comparison: Included: patient's saliva and cow's milk with varying fat content. Excluded: other milk types (eg, goat milk, probiotic milk, and buttermilk). Of note, these other milk types were included as intervention solutions for storing an avulsed or extracted		of tooth or cell viability. It was reported that storing an avulsed tooth in (saliva and thereafter) HBSS, ORS, propolis solutions, cling film, and rice water resulted in a significantly higher PDL cell viability rate compared with storage in milk (Table 3). • Milk was shown to extend the periodontal ligament cell viability before replantation compared with saline or tap water. • Hank's balanced salt solution, propolis, oral rehydration salts, rice water, and cling film have also demonstrated efficacy at preserving the cell viability. • There is insufficient evidence to recommend for or against temporary storage of an avulsed tooth in saliva compared with alternative solutions.	

		tooth. • Outcome: Included: infection rate, tooth survival or viability, pain, malfunction (eating and speech), color of the tooth, and success of replantation. Excluded: financial costs. • Study design: Included: (a) the studies of a systematic review if the search strategy and selection criteria were clearly described and if at least three electronic databases were searched; (b) experimental studies: (quasi- or non-) randomized controlled trial (RCT), controlled before and after studies, or controlled interrupted time series; and (c) observational studies: cohort and case-control studies, controlled before and after			

		studies, and controlled interrupted time series. Excluded: cross-sectional studies, case series, qualitative studies, conference abstracts, and PhD theses. • Other: No language criteria were used as long as an English abstract was provided. The review did not report on data from studies reporting only means, but no SDs, effect sizes, and P-values.			
Zhang 2021	Network Meta-Analysis of 10 Storage Mediums for Preserving Avulsed Teeth	Storage mediums for preserving avulsed teeth	20	Direct meta-analysis suggested that HBSS was superior to ORS, milk, saline, and water, ORS was superior to milk but inferior to coconut water and propolis, egg white was superior to milk but inferior to AVG and propolis, propolis was superior to AVG, milk, and saline, and coconut water and water was inferior to saline and milk, respectively. Network meta-analysis suggested	Concluded that propolis may be the preferred storage media for storing avulsed teeth for the purpose of preserving the viability of PDL cells before replantation when it is available to actual settings. However, given the availability of propolis and HBSS in real settings of occurring traumatic injuries and the hypotonic properties of saline solution, ORS or milk should also be preferentially selected to store an avulsed tooth as a media.

				that AVG was inferior to the other nine mediums, and propolis was superior to HBSS (SMD, −5260.24; 95% CrI, −10447.39 to −70.37) and milk (SMD, −5461.11; 95% CrI, −10574.99 to −328.51). Moreover, ranking probabilities indicated the highest probability for propolis, followed by saline, ORS, HBSS, milk, egg white, water, green tea, and AVG successively. Propolis may be the optimal media for storing avulsed teeth before replantation. However, given the availability of propolis and HBSS and the hypotonic properties of saline, ORS or milk should also be preferentially selected.	

RCT:

Study Acronym; Author; Year Published	**Aim of Study; Study Type; Study Size (N)**	**Patient Population**	**Study Intervention (# patients) / Study Comparator (# patients)**	**Endpoint Results (Absolute Event Rates, P value; OR or RR; & 95% CI)**	**Relevant 2° Endpoint (if any); Study Limitations; Adverse Events**
Souza 2020 Effects of several storage media on viability and proliferation	**<u>Study Aim:</u>** To investigate the PDFL cells viability after 24 h of contact with skimmed milk (SMilk), whole milk (WMilk), balanced salt solution Hank (HBSS),	**<u>Inclusion Criteria:</u>** Incubated human periodontal ligament	**<u>Intervention:</u>** PDFL cell viability when stored in medium at 5 C (N=6 plates)	**<u>1° endpoint:</u>** PDFL cells viability in various storage media after incubation at 5 C and 20 C Milk and HBSS were more effective in maintaining cellular	**<u>Study Limitations:</u>** Laboratory limitations

capacity of periodontal ligament cells	Save-A-Tooth (Save), Propolis, egg white (Egg), and natural coconut water (Coconut), at 5 C and 20C. **Study Type:** experimental **Study Size:** N=12 96-well culture plates	fibroblasts (PDLF) cellS	**Comparison:** PDFL cell viability when stored in medium at 20 C (N=6 plates)	viability and proliferation capacity than any other storage media. In general, the lowest temperature favored the effectiveness of all storage media, except for HBSS. At 5C, the most viable alternative was milk, but effectiveness of propolis and HBSS were similar (p=1.000). At 20C, HBSS had better results, followed by SMilk and WMilk.	

Nonrandomized Trials, Observational Studies

Study Acronym; Author; Year Published	**Study Type/Design; Study Size (N)**	**Patient Population**	**Primary Endpoint and Results (include P value; OR or RR; & 95% CI)**	**Summary/Conclusion Comment(s)**
Bunwanna 2020 Preservation of the viability and gene expression of human periodontal ligament cells by Thai propolis extract	**Study Type:** Observational study; N=99	**Inclusion Criteria:** Human premolars from 18-24 year olds in Thailand.	-Thai propolis -HBSS -Milk Each for 3h, 6h, 12h (N=9) Thai propolis extract at 0.625 mg mL−1 was chosen for the storage medium for the second experiment Average percentage of PDL cell viability after the teeth were left to dry for 30 minutes and stored in Thai propolis extract at 0.625 mg mL−1, HBSS	Suggests propolis as an alternative tooth storage medium for up to 12 hours.

			and milk at 3, 6 and 12 hours showed no significant difference	
Sinpreechanon 2019 Comparative evaluation of periodontal ligament fibroblasts stored in different types of milk: effects on viability and biosynthesis of collagen	**Study Type:** Observational study; N=96	**Inclusion Criteria:** PDLFs isolated from healthy premolars that had been atraumatically extracted for orthodontic purposes	**1° endpoint:** Viability of PDLFs after simulated tooth avulsion followed by incubation in different types of storage media for 1 h In whole milk and low-fat milk, viability of PDLFs was 87.8% and 90.4%, respectively, which was almost as high as that of the DMEM control (100%). There were no significant differences between the three milk groups. The lowest number of viable PDLFs (63.4%) was observed in the cells stored in HBSS, which was significantly lower than the number of viable PDLFs	Results support low fat cow's milk and almond milk as alternative storage medium.

			in the DMEM control, whole milk, and low-fat milk ($P < 0.001$, $P < 0.01$, and $P < 0.01$, respectively).	

Reviewer Comments:
As the findings from the 1 RCT and 2 observational studies were found to be consistent with the previous results, an updated systematic review is not indicated and the existing 2020 treatment recommendations remain valid.

Reference list:
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Singletary EM, Zideman DA, Bendall JC, Berry DA, Borra V, Carlson JN, Cassan P, Chang WT, Charlton NP, Djärv T, Douma MJ, Epstein JL, Hood NA, Markenson DS, Meyran D, Orkin A, Sakamoto T, Swain JM, Woodin JA, De Buck E, De Brier N, O D, Picard C, Goolsby C, Oliver E, Klaassen B, Poole K, Aves T, Lin S, Handley AJ, Jensen J, Allan KS, Lee CC; First Aid Science Collaborators. 2020 International Consensus on First Aid Science With Treatment Recommendations. Resuscitation. 2020 Nov;156:A240-A282. doi: 10.1016/j.resuscitation.2020.09.016. Epub 2020 Oct 21. PMID: 33098920.

Sinpreechanon P, Boonzong U, Sricholpech M. Comparative evaluation of periodontal ligament fibroblasts stored in different types of milk: effects on viability and biosynthesis of collagen. Eur J Oral Sci. 2019 Aug;127(4):323-332. doi: 10.1111/eos.12621. Epub 2019 Jun 11. PMID: 31185144.

Souza BDM, Garcia LFR, Bortoluzzi EA, Felippe WT, Felippe MCS. Effects of several storage media on viability and proliferation capacity of periodontal ligament cells. Eur Arch Paediatr Dent. 2020 Feb;21(1):53-59. doi: 10.1007/s40368-019-00450-8. Epub 2019 May 18. PMID: 31104259.

Zhang N, Cheng Y, Li F, Kang Q. Network Meta-Analysis of 10 Storage Mediums for Preserving Avulsed Teeth. Front Med (Lausanne). 2021 Oct 11;8:749278. doi: 10.3389/fmed.2021.749278. PMID: 34708058; PMCID: PMC8542672.

Zideman DA, Singletary EM, Borra V, Cassan P, Cimpoesu CD, De Buck E, Djärv T, Handley AJ, Klaassen B, Meyran D, Oliver E, Poole K. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021 Apr;161:270-290. doi: 10.1016/j.resuscitation.2021.02.013. Epub 2021 Mar 24. PMID: 33773828.

2025 Evidence Update
FA 7381 – Compression Wrap for Joint Injuries

Worksheet Author(s): David Berry
Task Force: First Aid
Date Approved by SAC Representative: 24 November 2024
Conflicts of Interest: none

PICOST / Research Question:
Population: Adults in the prehospital setting with a closed extremity joint injury.
Intervention: Compression wrap, elastic wrap
Comparators: No compression wrap or elastic wrap
Outcomes: Critical outcomes of; Reduction of pain and Reduction of swelling/edema; Important outcomes of Recovery time; Range of motion; Adverse effects
Study Designs: Randomized controlled trials (RCTs) and nonrandomized studies (non-RCTs, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion. All years and all languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded.

Year of last full review: 2019

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We suggest either application of a compression bandage or no application of a compression bandage for adults with an acute closed ankle joint injury (weak recommendation, very low certainty evidence).

Due to a lack of identified evidence, we are unable to recommend for or against use of a compression bandage for closed joint injuries besides the ankle.

Current Search Strategy
PubMed
1 “Sprains and strains”[Mesh] OR “Soft Tissue Injuries"[Mesh] OR “athletic injuries”[Mesh] OR strain*[TIAB] OR sprain*[TIAB] OR distortion*[TIAB] OR rupture*[TIAB] OR “ankle injuries”[Mesh] OR “knee injuries”[Mesh] OR “wrist injuries”[Mesh] OR “tendon injuries”[Mesh:NoExp] OR overexertion[TIAB] OR ((ankle[TIAB] OR knee[TIAB] OR wrist[TIAB] OR elbow[TIAB]) AND (injur*[TIAB]))
2 “Compression Bandages"[Mesh] OR ((compression[TIAB] OR elastic[TIAB]) AND (bandag*[TIAB] OR wrap*[TIAB] OR dressing*[TIAB] OR stocking*[TIAB] OR sleeve*[TIAB]))
3 1 AND 2

Embase
1 ‘sprain'/exp OR ‘joint injury'/de OR ‘ankle injury'/exp OR ‘knee injury'/exp OR ‘wrist injury'/exp OR ‘elbow injury'/exp OR ‘ligament and tendon injury'/exp OR ‘muscle injury'/exp OR ‘overexertion'/exp OR ‘Soft Tissue Injury'/exp OR ‘sport injury'/exp OR strain*:ab,ti OR sprain*:ab,ti OR distortion*:ab,ti OR rupture:ab,ti OR overexertion:ab,ti OR ((ankle:ab,ti OR knee:ab,ti OR wrist:ab,ti OR elbow:ab,ti) AND (injur*:ab,ti))
2 ‘Compression Bandage'/exp OR ‘compression stocking'/exp OR ‘compression sleeve'/de OR ((compression:ab,ti OR elastic:ab,ti) AND (bandag*:ab,ti OR wrap*:ab,ti OR dressing*:ab,ti OR stocking:ab,ti OR sleeve:ab,ti))
3 1 AND 2

Cochrane library
1 [mh “Sprains and strains”] OR [mh “Soft Tissue Injuries”] OR [mh “athletic injuries”] OR strain*:ti,ab,kw OR sprain*:ti,ab,kw OR distortion*:ti,ab,kw OR rupture*:ti,ab,kw OR [mh “ankle injuries”] OR [mh “knee injuries”] OR [mh “wrist injuries”] OR [mh ^“tendon injuries”] OR overexertion:ti,ab,kw OR ((ankle:ti,ab,kw OR knee:ti,ab,kw OR wrist:ti,ab,kw OR elbow:ti,ab,kw) AND (injur*:ti,ab,kw))
2 [mh “Compression Bandages”] OR ((compression:ti,ab,kw OR elastic:ti,ab,kw) AND (bandag*:ti,ab,kw OR wrap*:ti,ab,kw OR dressing*:ti,ab,kw OR stocking*:ti,ab,kw OR sleeve*:ti,ab,kw))
3 1 AND 2

Database searched:

PubMed, Embase, Cochrane Library

Time Frame: Last Review – Nov 3 2019 to Nov 24 2024.

Date Search Completed:
Nov 24 2024

Search Results (Number of articles identified and number identified as relevant):
Results – 230; Relevant – 0

Summary of Evidence: No new studies. The EvUp did not identify evidence to justify a SysRev or a change in treatment recommendations.

Reviewer Comments:
Insufficient literature to impact previous treatment recommendations.
Additional reviews (systematic or scoping review) not recommended at this time.
Recommend retiring this PICOST.

Reference list:
Not applicable

FA 7231 – Aid for Environmental Emergencies (Tick Removal)

Worksheet Author(s): Nathan Charlton
Task Force: First Aid
Date Approved by SAC Representative: 18 November 2024
Conflict of Interest: none

PICOST / Research Question:
Population: Individuals in the first aid setting with a tick attached to the skin.
Intervention: Any tick removal method, including heat, chemical, commercial tick removal apparatus, or tweezers/forceps
Comparators: Any other method of tick removal
Outcomes: Transmission of disease (critical), removal of (parts of) the tick (critical), damaged or broken off mouth parts (important)
Study Designs: Randomized controlled trials (RCTs) and non-randomized studies (non-randomized controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion.
Timeframe: January 1, 2017 to June 23, 2020. All languages were included as long as there was an English abstract; unpublished studies (e.g., conference abstracts, trial protocols) were excluded.
Year of last full review: February 17, 2021

Current ILCOR Consensus on Science and Treatment Recommendation for this PICOST:
We recommend against the use of chemicals, heat or ice in comparison with mechanical methods for the removal of a tick. (strong recommendation, very low certainty evidence)
We suggest either pulling with tweezers or using commercial devices according to the manufacturer's instructions to remove a tick rather than removal by hand. (weak recommendation, very low certainty evidence)

Current Search Strategy included in the attached approved PICOST
The Cochrane Library (systematic reviews and controlled trials) using the following search strategy:
1. [mh "ticks"] OR tick*:ti,ab,kw OR ixodida*:ti,ab,kw

MEDLINE (via PubMed interface) for experimental and observational studies using the following search strategy:
1. "ticks"[MeSH] OR tick*[TIAB] OR ixodida*[TIAB]
2. remov*[TIAB] OR excis*[TIAB]
3. #1AND #2

Embase (via Embase.com interface) using the following search strategy:
1. 'tick'/exp OR tick*:ab,ti OR ixodida*:ab,ti
2. remov*:ab,ti OR excis*:ab,ti
3. #1AND #2

Time Frame: January 2020 until search date below
Date Search Completed: Aug 25 2023
Search Results: No relevant articles found.

Reviewer Comments: No new articles found.