

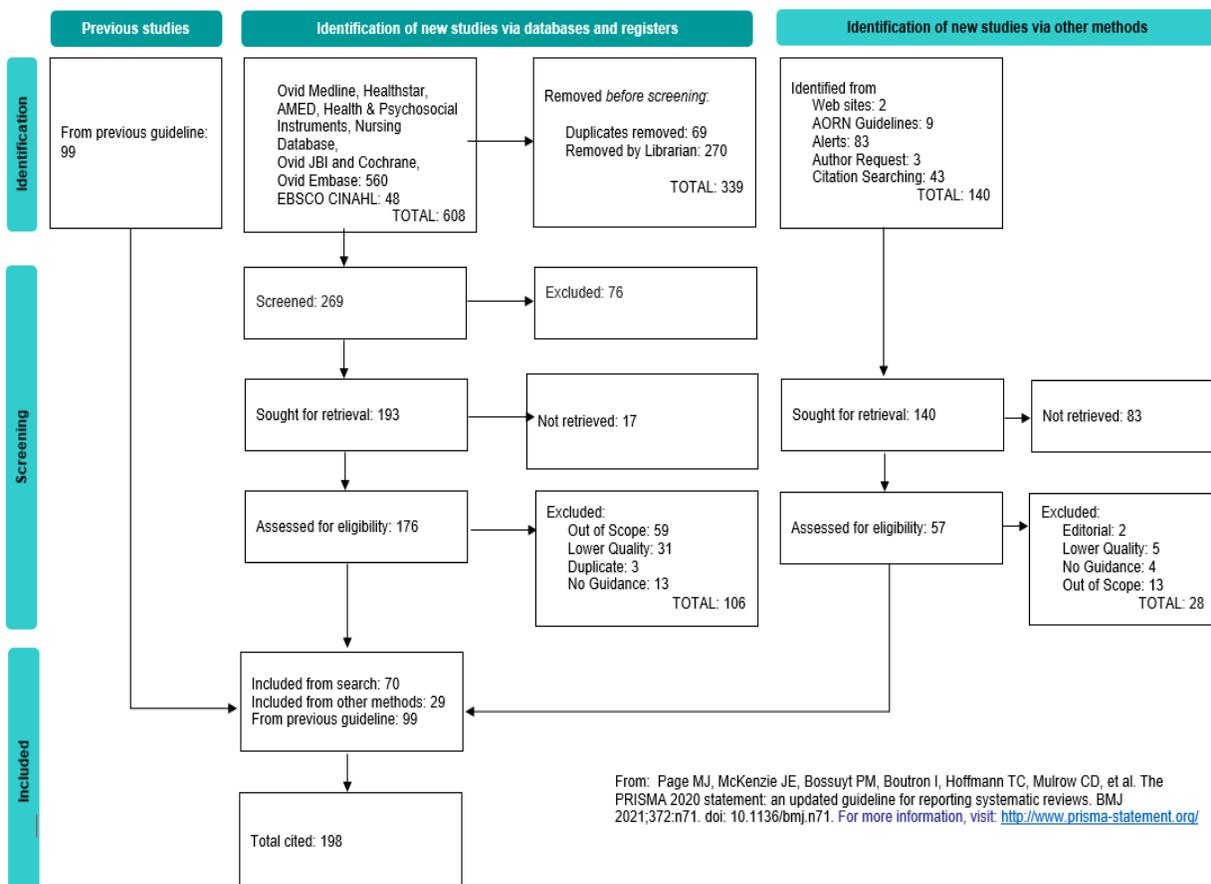
EVIDENCE REVIEW

The Guideline for Pneumatic Tourniquet Safety was approved by the AORN Guidelines Advisory Board and became effective April 17, 2024.

A medical librarian with a perioperative background conducted a systematic search of the databases Ovid MEDLINE®, Ovid Embase®, EBSCO CINAHL®, and the Cochrane Database of Systematic Reviews. The search was limited to literature published in English from January 2019 through February 2024. At the time of the initial search, weekly alerts were created on the topics included in that search. Results from these alerts were provided to the lead author until September 2024. The lead author requested additional articles that either did not fit the original search criteria or were discovered during the evidence appraisal process. The lead author and the medical librarian also identified relevant guidelines from government agencies, professional organizations, and standards-setting bodies.

Included were research and non-research literature in English, complete publications, and publications with dates within the time restriction when available. Historical studies were also included. Excluded were non-peer-reviewed publications and older evidence within the time restriction when more recent evidence was available. Editorials, news items, and other brief items were excluded. Low-quality evidence was excluded when higher-quality evidence was available, and literature outside the time restriction was excluded when literature within the time restriction was available. Articles identified in the search were provided to the project team for evaluation. The team consisted of the lead author and one evidence appraiser. The lead author and the evidence appraiser reviewed and critically appraised each article using the AORN Research or Non-Research Evidence Appraisal Tools as appropriate. A third appraiser was consulted if there was a disagreement between the lead author and the primary evidence appraiser. The literature was independently evaluated and appraised according to the strength and quality of the evidence. Each article was then assigned an appraisal score. The appraisal score is noted in brackets after each reference as applicable. Each recommendation rating is based on a synthesis of the collective evidence, a benefit-harm assessment, and consideration of resource use. The strength of the recommendation was determined using the AORN Evidence Rating Model and the quality and consistency of the evidence supporting a recommendation. The recommendation strength rating is noted in brackets after each recommendation. See the PRISMA 2020 flow diagram (Figure 1) below for more information about the systematic review and nature of included studies and resources.

Figure 1: PRISMA 2020 Flow Diagram



On February 19, 2024, a medical librarian with a perioperative background conducted searches for relevant publications on websites of organizations selected by the author (including government

departments). Full details of these supplementary searches is included in the Supplementary Content on the aorn.org web site. These results were also screened by two screeners: the medical librarian, and then the lead author.

On January 30, 2024, a medical librarian with a perioperative background conducted a systematic search of 18 health science databases,- the names and date coverage of which are given in Table 1. These results were screened by the medical librarian, and then the lead author.

Table 1: Databases searched and coverage

Database	Coverage
AORN Full Text Journals@Ovid	
Books@Ovid	February 12, 2024
JBIC EBP Database	Current to January 31, 2024
EBM Reviews: ACP Journal Club	1991 to January 2024
EBM Reviews: Cochrane Central Register of Controlled Trials	January 2024
EBM Reviews: Cochrane Database of Systematic Reviews	2005 to February 7, 2024
EBM Reviews: Cochrane Clinical Answers	January 2024
EBM Reviews: Cochrane Methodology Register	3rd Quarter 2012
EBM Reviews: Database of Abstracts of Reviews of Effects	1st Quarter 2016
EBM Reviews: Health Technology Assessment	4th Quarter 2016
EBM Reviews: NHS Economic Evaluation Database	1st Quarter 2016
AMED (Allied and Complementary Medicine)	1985 to October 2023
Embase	1974 to 2024 February 09
Health and Psychosocial Instruments	1985 to January 2024
Ovid Healthstar	1999 to November 2023
Ovid MEDLINE(R) ALL	1946 to February 09, 2024
Ovid Nursing Database	1946 to January Week 5 2024
CINAHL Complete via EBSCOhost	1937 to Current

Search strategy development process: The medical librarian referred to a search strategy used for the previous Guideline. A draft search strategy was developed using terms listed in the previous strategy and additional search terms identified from a meeting with the lead author. Using the MeSH Subject Headings database, additional search terms were identified and added to the search strategy. The strategy was limited following the constraints in the eligibility criteria outlined by the lead author.

Editor's note: MEDLINE is a registered trademark of the US National Library of Medicine's Medical Literature Analysis and Retrieval System, Bethesda, MD. Embase is a registered trademark of Elsevier B.V., Amsterdam, The Netherlands. CINAHL, Cumulative Index to Nursing and Allied Health Literature, is a registered trademark of EBSCO Industries, Birmingham, AL.

Search Strategies

Ovid (Medline, Cochrane, and Embase)

1	((limb or phalange or digit or hand or foot or wrist or ankle) and surgery).ti,ab,kw. or "surgical procedures, operative"/mt or extremities/su or "elective surgical procedures"/st, mt, is or orthopedics/mt, su, is or arthroplasty\$.de,sh,hw.	332070
2	tourniquets/st or "hemostasis, surgical"/mt or ((arterial or pneumatic) adj1 tourniquet\$.ti,ab,kw. or ((bloodless adj1 (field or surgery)) or (exsanguinat\$ or "occlusion of vasculature")).ti,ab,kw. or tourniquet.ti,ab,kw. or "surgical hemostasis".ti,ab,kw.	21581
3	1 and 2	4734
4	("intravenous regional anesthesia" or "intravenous regional anaesthesia" or ((bier or digital or ankle or peripheral or "adductor canal") and block) or "two tourniquet sequential block" or ("tumescent local anesthesia infiltration" or "tumescent local anaesthesia infiltration") or (conduction and an\$thesia)).ti,ab,kw. or "conscious sedation"/is, mt, nu, st, tu	53512
5	3 and 4	529
6	(esmark adj2 bandage).ti,ab,kw,mv. or ("hand over hand" or "elastic band" or "gauze bandage").ti,ab,kw. or "rhys davis".mv,ti,ab,kw. or ((distal or proximal or paired or double) adj3 tourniquet).ti,ab,kw. or ((nylon or "elastic tourniquet") and cuff).ti,ab,kw. or (silicon\$ adj2 ring).mv,ti,ab,kw. or ((wide or contour\$ or cylind\$) adj3 tourniquet).ti,ab,kw.	5833
7	3 and 6	193
8	(((("compartment syndromes" or rhabdomyolysis or "postoperative complications" or "disease transmission, infectious" or (arm or leg or hand or foot or reperfusion)) and injur\$) or ((radial or ulnar or "brachial plexus") and neuropath\$) or ("postoperative complications" adj5 neuralgia)).de,sh,hw.	352373
9	("compartment syndrome" or "peripheral nervous system diseases" or "nerve palsy" or acido\$ or hyperemia or "venous congestion" or "systemic inflammatory response" or ischemi\$ or "pulmonary embolism" or "dvt" or "skin lesions" or "fat embolism syndrome" or "damaged muscle tissue" or "postoperative knee swelling" or "iatrogenic fracture" or "tourniquet hypertension" or "thromboembolic events" or "patient reported outcomes" or "tourniquet failure" or calcifications or "rumple leede phenomenon" or "acute capillary rupture syndrome" or "sickle cell" or chemoprophylaxis or hypox\$ or "venous reflux" or "muscle atrophy" or "postoperative anemia" or "metabolism changes" or "oxidative stress" or "postocclusive reactive hyperemia" or "microbial colonization of tourniquet" or "avascular necrosis" or "latex allergy" or "natural rubber latex neuropathic pain" or vasculopathy or "nerve pain" or "neuropathic pain").ti,ab,kw.	3540409
10	(((arm or leg or hand or foot or reperfusion or neuromuscular or vascular or "soft tissue" or nerve or compression) adj1 injur\$) or (musculoskeletal and injur\$) or ((local or systemic) adj1 inflammation) or ((tourniquet or cuff) adj2 pain) or ((hidden or paradoxical or total or postoperative or intraoperative or calculate\$) adj3 "blood loss") or ((Limb or extremity) adj3 paralysis) or (Delay\$ adj4 "wound healing")).ti,ab,kw.	496918
11	8 or 9 or 10	4073232
12	3 and 11	2100
13	("patient positioning" or "nursing assessment").de,sh,hw. or "surgical procedures, operative"/ae or tourniquets/ae or "hemostasis, surgical"/ae or paresthesia/et	177456
14	(((nursing or perioperative) adj1 (care or injury)) or (metabolic adj1 (phenomena or changes or effects)) or ("pain measurement" or "vital signs" or respiration or "carbon dioxide" or "intracranial pressure" or "oxygen consumption" or "cardiac output" or "limb elevation" or pulse or "routine practice" or "fomite free" or competencies or "squeeze method" or "performance metrics" or "skin integrity" or "skin injury" or petechiae or "reperfusion time" or reinflation or "venous occlusion technique" or "functional outcomes" or "pulse oximetry monitoring" or "occlusion protocols" or "minimizing cuff pressure" or "hemodynamic effects" or "microvascular function" or "postoperative recovery" or "intertourniquet distances" or "osteogenesis imperfecta" or "tissue oxygen saturation" or "extremity girth" or "limb circumference" or "limb size" or "perioperative assessment") or (assessment adj4 (integrity or injur\$) adj "skin color")).ti,ab,kw.	1907413
15	(((maintain or regulate or blood or interface or inflation or adjustment) adj2 pressure) or ((limb or arterial) adj1 "occlusion pressure" adj1 (determination or estimation)) or (patient adj1 ("pain perception" or preference or satisfaction or comfort or experience)) or (simulated adj1 ("use of tourniquets" or training)) or (tourniquet adj1 (width or time or tolerance or inflation or "release timing")) or (tourniquet adj3 (placement or reposition\$) adj3 wound)).ti,ab,kw.	1511382
16	13 or 14 or 15	3392383
17	3 and 16	2045

18	5 or 7 or 12 or 17	3417
19	remove duplicates from 18	1762
20	limit 19 to English language	1624
21	limit 20 to yr="2019 -Current" [Limit not valid in DARE; records were retained]	560

EBSCOhost (CINAHL Complete)

S19 S5 OR S7 OR S12 Limiters - Publication Date: 20190101-20240231; English Language; Peer Reviewed; Exclude MEDLINE records
 Expanders - Apply equivalent subjects
 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
 Search Screen - Advanced Search
 Database - CINAHL Complete 48

S18 S5 OR S7 OR S12 Expanders - Apply equivalent subjects
 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
 Search Screen - Advanced Search
 Database - CINAHL Complete 269

S17 S3 AND S16 Expanders - Apply equivalent subjects
 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
 Search Screen - Advanced Search
 Database - CINAHL Complete 237

S16 S13 OR S14 OR S15 Expanders - Apply equivalent subjects
 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
 Search Screen - Advanced Search
 Database - CINAHL Complete 572,066

S15 (((maintain or regulate or blood or interface or inflation or adjustment) N2 pressure)) OR (((limb or arterial) N1 "occlusion pressure" N1 (determination or estimation))) OR ((patient N1 ("pain perception" or preference or satisfaction or comfort or experience))) OR ((simulated N1 ("use of tourniquets" or training))) OR ((tourniquet N1 (width or time or tolerance or inflation or "release timing"))) OR ((tourniquet N3 (placement or reposition*) N3 wound)) Expanders - Apply equivalent subjects
 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
 Search Screen - Advanced Search
 Database - CINAHL Complete 215,213

S14 (((nursing or perioperative) N1 (care or injury))) OR ((metabolic N1 (phenomena or changes or effects))) OR ((assessment N4 (integrity or injur*) N1 "skin color")) OR (("pain measurement" or "vital signs" or respiration or "carbon dioxide" or "intracranial pressure" or "oxygen consumption" or "cardiac output" or "limb elevation" or pulse or "routine practice" or "fomite free" or competencies or "squeeze method" or "performance metrics" or "skin integrity" or "skin injury" or petechiae or "reperfusion time" or reinflation or "venous occlusion technique" or "functional outcomes" or "pulse oximetry monitoring" or "occlusion protocols" or "minimizing cuff pressure" or "hemodynamic effects" or "microvascular function" or "postoperative recovery" or "intertourniquet distances" or "osteogenesis imperfecta" or "tissue oxygen saturation" or "extremity girth" or "limb circumference" or "limb size" or "perioperative assessment"))) Expanders - Apply equivalent subjects
 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
 Search Screen - Advanced Search
 Database - CINAHL Complete 364,946

S13 (MH "Patient Positioning") OR (MH "Nursing Assessment") OR (MH "Surgery, Operative/AE") OR (MH "Tourniquets/AE") OR (MH "Hemostasis, Surgical/AE") OR (MH "Paresthesia/ET") Expanders - Apply equivalent subjects
 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
 Search Screen - Advanced Search
 Database - CINAHL Complete 31,314

S12 S3 AND S11 Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Complete 222

S11 S8 OR S9 OR S10 Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Complete 364,210

S10 (((arm or leg or hand or foot or reperfusion or neuromuscular or vascular or "soft tissue" or nerve or compression) N1 injur*) OR ((musculoskeletal and injur*) OR (((local or systemic) N1 inflammation)) OR (((tourniquet or cuff) N2 pain)) OR (((hidden or paradoxical or total or postoperative or intraoperative or calculate*) N3 "blood loss")) OR (((Limb or extremity) N3 paralysis)) OR (Delay* N4 "wound healing"))) Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Complete 50,947

S9 "compartment syndrome" or "peripheral nervous system diseases" or "nerve palsy" or acido* or hyperemia or "venous congestion" or "systemic inflammatory response" or ischemi* or "pulmonary embolism" or "dvt" or "skin lesions" or "fat embolism syndrome" or "damaged muscle tissue" or "postoperative knee swelling" or "iatrogenic fracture" or "tourniquet hypertension" or "thromboembolic events" or "patient reported outcomes" or "tourniquet failure" or calcifications or "rumple leede phenomenon" or "acute capillary rupture syndrome" or "sickle cell" or chemoprophylaxis or hypox\$ or "venous reflux" or "muscle atrophy" or "postoperative anemia" or "metabolism changes" or "oxidative stress" or "postocclusive reactive hyperemia" or "microbial colonization of tourniquet" or "avascular necrosis" or "latex allergy" or "natural rubber latex neuropathic pain" or vasculopathy or "nerve pain" or "neuropathic pain" Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Complete 232,705

S8 (MH "Compartment Syndromes") OR (MH "Postoperative Complications") or (MH "Disease Transmission") or (MH "Rhabdomyolysis") OR (MH "Radial Nerve/IN") OR ((MH "Reperfusion") OR (MH "Foot") OR (MH "Arm") OR (MH "Leg") OR (MH "Hand")) AND injur*) OR (MH "Brachial Plexus Neuropathies") OR (MH "Ulnar Neuropathies") OR ((MH "Postoperative Complications") AND (MH "Neuralgia")) Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Complete 104,901

S7 S3 AND S6 Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Complete 27

S6 esmarch N2 bandage OR ("hand over hand" or "elastic band" or "gauze bandage") OR "rhys davies" OR (((distal or proximal or paired or double) N3 tourniquet)) OR (((nylon or "elastic tourniquet") and cuff)) OR silicon* N2 ring OR (((wide or contour* or cylind*) N3 tourniquet)) Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Complete 514

S5 S3 AND S4 Expanders - Apply equivalent subjects
Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Complete 68

S4 (MH "Conscious Sedation/MT/NU/ST") OR (((bier or digital or ankle or peripheral or "adductor canal") and block)) OR ((conduction and an*thesia)) OR ("intravenous regional anesthesia" or "intravenous regional anaesthesia" or "two tourniquet sequential block" or) OR (("tumescant local

anesthesia infiltration" or "tumescent local anaesthesia infiltration")) Expanders - Apply equivalent subjects

Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases

Search Screen - Advanced Search

Database - CINAHL Complete 24,187

S3 S1 AND S2 Expanders - Apply equivalent subjects

Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases

Search Screen - Advanced Search

Database - CINAHL Complete 433

S2 (MH "Tourniquets/ST") OR (MH "Hemostasis, Surgical/MT") OR (((arterial or pneumatic) n1 tourniquet*)) OR (((bloodless N1 (field or surgery))) OR (exsanguinat* or "occlusion of vasculature") OR (tourniquet or "surgical hemostasis") Expanders - Apply equivalent subjects

Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases

Search Screen - Advanced Search

Database - CINAHL Complete 3,689

S1 (MH "Surgery, Operative/MT") OR (MH "Surgery, Elective/MT/ST") (MH "Extremities/SU") or (MH "Orthopedics/MT") or (MH "Arthroplasty") or ((limb or phalange or digit or hand or foot or wrist or ankle) and surgery) Expanders - Apply equivalent subjects

Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases

Search Screen - Advanced Search

Database - CINAHL Complete 57,147

Web Searches// All searches conducted in 2024.

2/19: Using google.com, searched for "national institute health care excellence". 2] Chose first result. 3] Typed "tourniquet" in search bar on NICE (UK) site. 4] Browsed results, saved for author screening.

2/19: Went to fda.gov. 2] Typed "Pneumatic tourniquet" in search bar. 3] Browsed results. 4] Saved for author screening

RESULTS

Studies that offer insights that can inform perioperative patient care in the area of pneumatic tourniquet safety were included in this review. Studies that appeared to meet the inclusion criteria were excluded if they were of lower quality, provided no guidance, were duplicates of already-included studies, full text was not available in English, the results were not applicable or generalizable to the perioperative practice setting, were the wrong setting, or wrong population. A synthesis of the study results informed construction of practice recommendations and this synthesis is described briefly in the corresponding rationales that follow each practice recommendation. Additional information about each included study is found in the evidence table that corresponds to the published guideline.

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- Originally published April 1984, AORN Journal. Revised November 1990.
- Published as proposed recommended practices March 1994. Revised November 1998; published December 1998.
- Reformatted July 2000.
- Revised November 2001; published February 2002, AORN Journal.
- Revised 2006; published in Standards, Recommended Practices, and Guidelines, 2007 edition.
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- Evidence ratings revised 2013 to conform to the AORN Evidence Rating Model.
- Minor editing revisions made in November 2014 for publication in Guidelines for Perioperative Practice, 2015 edition.
- Evidence ratings revised in Guidelines for Perioperative Practice, 2018 edition, to conform to the current AORN Evidence Rating Model.
- Evidence ratings revised and minor editorial changes made to conform to the current AORN Evidence Rating model, May 2019, for publication in Guidelines for Perioperative Practice online.
- Revised May 2020 for online publication in Guidelines for Perioperative Practice.
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