Diagnosis and Management of Acute Compartment Syndrome

Appropriate Use Criteria

Adapted by:
The American Academy of Orthopaedic Surgeons Board of Directors
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Endorsed by:

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Disclaimer
Volunteer physicians from multiple medical specialties created and categorized these Appropriate Use Criteria. These Appropriate Use Criteria are not intended to be comprehensive or a fixed protocol, as some patients may require more or less treatment or different means of diagnosis. These Appropriate Use Criteria represent patients and situations that clinicians treating or diagnosing musculoskeletal conditions are most likely to encounter. The clinician's independent medical judgment, given the individual patient's clinical circumstances, should always determine patient care and treatment.

Disclosure Requirement
In accordance with American Academy of Orthopaedic Surgeons (AAOS) policy, all individuals whose names appear as authors or contributors to this document filed a disclosure statement as part of the submission process. All authors provided full disclosure of potential conflicts of interest prior to participation in the development of these Appropriate Use Criteria. Disclosure information for all panel members can be found in Appendix B.

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FDA Clearance
Some drugs or medical devices referenced or described in this document may not have been cleared by the Food and Drug Administration (FDA) or may have been cleared for a specific use only. The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or device he or she wishes to use in clinical practice.

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For a more user-friendly version of this AUC, or to view additional AUCs, please visit the AAOS AUC web-based app at:

www.OrthoGuidelines.org/auc

To view the clinical practice guideline for this topic, please visit
https://www.aaos.org/metrcdod/

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I. INTRODUCTION

OVERVIEW

METRC and AAOS have developed this Appropriate Use Criteria (AUC) to determine appropriateness of various treatments for the diagnosis and management of acute compartment syndrome (ACS).

An "appropriate" healthcare service is one for which the expected health benefits exceed the expected negative consequences by a sufficiently wide margin.[2] Evidence-based information, in conjunction with the clinical expertise of physicians from multiple medical specialties, was used to develop the criteria in order to improve patient care and obtain the best outcomes while considering the subtleties and distinctions necessary in making clinical decisions. To provide the evidence foundation for this AUC, the AAOS Department of Clinical Quality and Value provided the writing panel and voting panel with the AAOS/METRC Clinical Practice Guideline on ACS, which can be accessed via the following link:
http://www.orthoguidelines.org/topic?id=1026

The purpose of this AUC is to help determine the appropriateness of clinical practice guideline recommendations for the heterogeneous patient population routinely seen in practice. The best available scientific evidence is synthesized with collective expert opinion on topics where gold standard randomized clinical trials are not available or are inadequately detailed for identifying distinct patient types. When there is evidence corroborated by consensus that expected benefits substantially outweigh potential risks, exclusive of cost, a procedure is determined to be appropriate. The AAOS uses the RAND/UCLA Appropriateness Method (RAM)[2] to assess the appropriateness of a particular treatment. This process includes reviewing the results of the evidence analysis, compiling a list of clinical vignettes, and having an expert panel comprised of representatives from multiple medical specialties to determine the appropriateness of each of the clinical indications for treatment as "Appropriate," "May be Appropriate," or "Rarely Appropriate." To access a more user-friendly version of the appropriate use criteria for this topic online, please visit our AUC web-based application at www.orthoguidelines.org/auc or download the OrthoGuidelines app from Google Play or Apple Store.

These criteria should not be construed as including all indications or excluding indications reasonably directed to obtaining the same results. The criteria intend to address the most common clinical scenarios facing qualified physicians managing patients suspected of ACS. The ultimate judgment regarding any specific criteria should address all circumstances presented by the patient and the needs and resources particular to the locality or institution. It is also important to state that these criteria and are not meant to supersede clinician expertise and experience or patient preference.

INTERETTING THE APPROPRIATENESS RATING

To prevent misuse of these criteria, it is extremely important that the user of this document understands how to interpret the appropriateness ratings. The appropriateness rating scale ranges from one to nine and there are three main range categories that determine how the median rating is defined (i.e. 1-3 = "Rarely Appropriate", 4-6 = "May Be Appropriate", and 7-9 = "Appropriate"). Before these AUCs are consulted, the user should read through and understand all contents of this document.

INCIDENCE AND PREVALENCE

The incidence of acute compartment syndrome is difficult to ascertain because concrete diagnostic criteria are elusive, and most reports use the incidence of fasciotomy as a surrogate for compartment syndrome. Among patients presenting with acute compartment syndrome in one report, the most common diagnoses were tibial diaphyseal fracture (36% of cases), soft tissue injury (23%), distal radius fracture (10%), crush injury and diaphyseal radius / ulna fracture (8% each) (McQueen 2000). For specific injuries, the highest rates seem to be in medial knee fracture-dislocations (53%) and bicondylar tibial plateau fractures (18%) as reported by Stark (2009).

ETIOLOGY

Acute compartment syndrome is typically associated with high-energy trauma but can be encountered with low-energy mechanisms of injury, electrocution, vascular injury and following ischemia / reperfusion events, such as after prolonged limb compression in patients with altered mental status (such as a drug overdose or intoxication). Regardless of the etiology, an increase in compartment contents from edema or bleeding raises the intra-compartment pressure. If the pathophysiologic process continues and the intramuscular pressure becomes high enough, myoneural capillary blood flow ceases and the compartment contents become ischemic. Depending on the duration of ischemia and the metabolic demands of the affected tissue, permanent tissue injury can occur, which is manifested by ischemic contracture of affected muscles and neural deficits. In some cases, systemic consequences of rhabdomyolysis can occur.

POTENTIAL BENEFITS, HARMS, AND CONTRAINDICATIONS

All surgical interventions carry the risk of complication and unforeseen consequences. In the case of ACS, it is possible that failure to perform surgery may lead to far greater disability and morbidity. The accurate diagnosis of ACS is the most confounding aspect in treatment and can be affected by patient factors and the experience of the provider. Failure to diagnose ACS can lead to serious systemic illness, limb loss and significant loss of function. With the resultant high index of suspicion maintained by clinicians in the face of ACS, unnecessary surgery may be performed which may result in prolonged treatment, increased risks of infection and soft tissue damage and resultant disability. Even with an accurate diagnosis, improperly performed fasciotomy increases the risk of increased intra-compartmental injury and can complicate the reconstruction of traumatic injuries. Patient factors, including the inciting injury and timing of presentation, always must be considered in the face of clinical signs and symptoms and the clinician's experience. Synthesis of all available information will facilitate an informed discussion with the patient/surrogate regarding the presence or absence of ACS and the suggested treatment if ACS is suspected or presumed.

II. METHODS

This AUC for ACS is based on a review of the available literature and a list of clinical scenarios (i.e. criteria) constructed and voted on by experts in orthopaedic surgery and other relevant medical fields. This section describes the methods adapted from RAM[2]. This section also includes the activities and compositions of the various panels that developed, defined, reviewed, and voted on the criteria.

Two panels participated in the development of the ACS AUC, a writing panel and a voting panel. Members of the writing panel developed a list of patient scenarios and relevant treatment options. Additional detail on how the writing panel developed the patient scenarios and treatments is below. The voting panel participated in two rounds of voting. During the first round, the voting panel was given approximately one month to independently rate the appropriateness of each the provided treatments for each of the relevant patient scenarios as 'Appropriate', 'May Be Appropriate', or 'Rarely Appropriate' via an electronic ballot. How the voting panel rates for appropriateness is described in more detailed below. After the first round of voting/appropriateness ratings were submitted, AAOS staff calculated the median ratings for each patient scenario and specific treatment. An in-person voting panel meeting was held in Rosemont, IL on Saturday, July 13, 2019. During this meeting voting panel members addressed the scenarios/treatments which resulted in disagreement from round one voting. The voting panel members discussed the list of assumptions, patient indications, and treatments to identify areas that needed to be clarified/edited. After the discussion and subsequent changes, the group was asked to rerate their first-round ratings during the voting panel meeting, only if they were persuaded to do so by the discussion and available evidence. There was no attempt to obtain consensus about appropriateness.

The AAOS Committee on Evidence Based Quality and Value, the AAOS Council on Research and Quality, and the AAOS Board of Directors sequentially approve all AAOS AUC.

DEVELOPING CRITERIA

Panel members of the ACS AUC developed patient scenarios using the following guiding principles:

1) **Comprehensive** – Covers a wide range of patients.
2) **Mutually Exclusive** - There should be no overlap between patient scenarios/indications.
3) **Homogenous** –The final ratings should result in equal application within each of the patient scenarios.
4) **Manageable** – Number of total voting items (i.e. # of patient scenarios x # of treatments) should be practical for the voting panel. Target number of total voting items = 2000-6000. This means that not all patient indications and treatments can be assessed within one AUC.

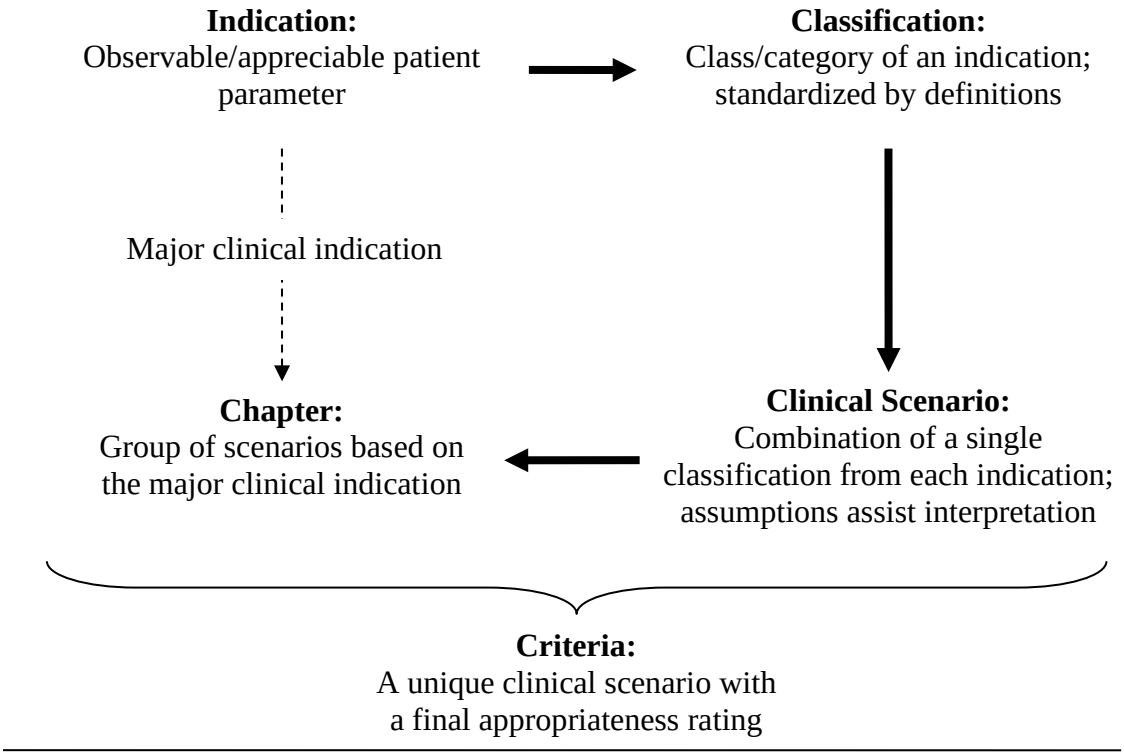
The writing panel developed the scenarios by categorizing patients in terms of indications evident during the clinical decision-making process. These scenarios relied upon definitions and general assumptions, mutually agreed upon by the writing panel during the development of the scenarios. These definitions and assumptions were necessary to provide consistency in the

interpretation of the clinical scenarios among experts voting on the scenarios, and readers using the final criteria.

FORMULATING INDICATIONS AND SCENARIOS

The AUC writing panel began the development of the scenarios by identifying clinical indications typical of patients suspected of ACS in clinical practice. Indications are most often parameters observable by the clinician, including symptoms or results of diagnostic tests. Additionally, "human factor" (e.g. activity level) or demographic variables can be considered.

FIGURE 1. DEVELOPING CRITERIA



Indications identified in clinical trials, derived from patient selection criteria, included in AAOS Clinical Practice Guidelines (http://www.orthoguidelines.org/topic?id=1022) served as a starting point for the writing panel, as well as ensured that these AUCs referenced the evidence base for this topic. The writing panel considered this initial list and other indications based on their clinical expertise and selected the most clinically relevant indications (Table 4). The writing panel then defined distinct classes for each indication to stratify/categorize the indication (Table 4).

The writing panel organized these indications into a matrix of clinical scenarios that addressed all combinations of the classifications. The writing panel was given the opportunity to remove any scenarios that rarely occur in clinical practice but agreed that all scenarios were clinically relevant. The major clinical decision-making indications chosen by the writing panel divided the

matrix of clinical scenarios into chapters, as follows: clinical symptoms, difference in perfusion pressure, and biomarkers/labs.

CREATING DEFINITIONS AND ASSUMPTIONS

The ACS AUC writing panel constructed concise and explicit definitions for the indications and classifications. This standardization helps ensure that the way the writing panel defined the patient indications is consistent among those reading the clinical scenario matrix or the final criteria. Definitions create explicit boundaries when possible and are based on standard medical practice or existing literature.

Additionally, the writing panel formulated a list of general assumptions in order to provide more consistent interpretations of a scenario. These assumptions differed from definitions in that they identified circumstances that exist outside of the control of the clinical decision-making process. Assumptions also address the use of existing published literature regarding the effectiveness of treatment and/or the procedural skill level of physicians. Assumptions also highlight intrinsic methods described in this document such as the role of cost considerations in rating appropriateness, or the validity of the definition of appropriateness. The main goal of assumptions is to focus scenarios so that they apply to the average patient presenting to an average physician at an average facility.[1]

The definitions and assumptions should provide all readers with a common starting point in interpreting the clinical scenarios. The list of definitions and assumptions accompanied the matrix of clinical scenarios in all stages of AUC development and appears in the Writing Panel section of this document.

LITERATURE REVIEW

The Clinical Practice Guideline on Diagnosis and Management of Acute Compartment Syndrome, was used as the evidence base for this AUC (see here: http://www.orthoguidelines.org/topic?id=1026). This guideline helped to inform the decisions of the writing panel and voting panel where available and necessary.

VOTING PANEL MODIFICATIONS TO WRITING PANEL DOCUMENT

At the start of the in-person voting panel meeting, the voting panel was reminded that they can amend the original writing panel materials if the amendments resulted in more clinically relevant and practical criteria. To amend the original materials, instructed voting panel member must make a motion to amend and another member must “second” that motion, after which a vote is conducted. If the majority of voting panel members voted “yes” to amend the original materials, the amendments were accepted.

DETERMINING APPROPRIATENESS

VOTING PANEL

As mentioned above, a multidisciplinary panel of clinicians was assembled to determine the appropriateness of treatments for the ACS AUC. A non-voting moderator, who is an orthopaedic surgeon, but is not a specialist in the diagnosis or management of ACS, moderated the voting panel. The moderator was familiar with the methods and procedures of AAOS Appropriate Use

Criteria and led the panel (as a non-voter) in discussions. Additionally, no member of the voting panel was involved in the development, i.e. writing panel, of the scenarios.

The voting panel used a modified Delphi procedure to determine appropriateness ratings. The voting panel participated in two rounds of voting while considering evidence-based information provided in the literature review.

RATING APPROPRIATENESS

When rating the appropriateness of a scenario, the voting panel considered the following definition:

> "An appropriate procedural step for a patient suspected of ACS is one for which the procedure **is** generally acceptable, **is** a reasonable approach for the indication, and **is** likely to improve the patient's health outcomes or survival."

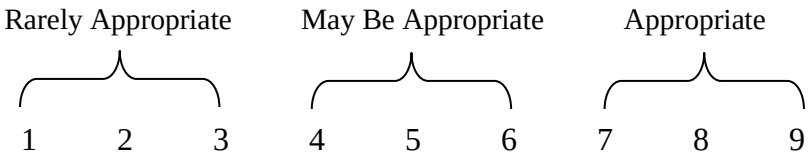
The voting panel rated each scenario using their best clinical judgment, taking into consideration the available evidence, for an average patient presenting to an average physician at an average facility as follows:

FIGURE 2. INTERPRETING THE 9-POINT APPROPRIATENESS SCALE

Rating	Explanation
7-9	**Appropriate**: Appropriate for the indication provided, meaning treatment **is** generally acceptable and **is** a reasonable approach for the indication and **is** likely to improve the patient's health outcomes or survival.
4-6	**May Be Appropriate**: Uncertain for the indication provided, meaning treatment **may** be acceptable and **may** be a reasonable approach for the indication, but with uncertainty implying that more research and/or patient information is needed to further classify the indication.
1-3	**Rarely Appropriate**: **Rarely** an appropriate option for management of patients in this population due to the lack of a clear benefit/risk advantage; **rarely** an effective option for individual care plans; exceptions should have documentation of the clinical reasons for proceeding with this care option (i.e. procedure is not generally acceptable and is not generally reasonable for the indication).

Each panelist uses the scale below to record their response for each scenario:

Appropriateness of [Topic]



ROUND ONE VOTING

The first round of voting occurred after approval of the final indications, scenarios, and assumptions by the writing panel. The voting panel rated the scenarios electronically using the AAOS AUC Electronic Ballot Tool, a personalized ballot created by AAOS staff. There was no interaction between voting panel members while completing the first round of voting. Panelists considered the following materials:

- The instructions for rating appropriateness
- The completed literature review, that is appropriately referenced when evidence is available for a scenario
- The list of indications, definitions, and assumptions, to ensure consistency in the interpretation of the clinical scenarios

ROUND TWO VOTING

The second round of voting occurred during the in-person voting panel meeting on July 13, 2019. Prior to the in-person meeting, each voting panelist received a personalized document that included his/her first-round ratings along with summarized results of the first-round ratings that resulted in disagreement. These results indicated the frequency of ratings for a scenario for all panelists. The document contained no identifying information for other panelists' ratings. The moderator also used a document that summarized the results of the panelists' first round voting. These personalized documents served as the basis for discussions of scenarios which resulted in disagreement.

During the discussion, the voting panel members were allowed to add or edit the assumptions list, patient indications, and/or treatments if clarification was needed. Voting panel members were also able to record a new rating for any scenarios/treatments, if they were persuaded to do so by the discussion and/or the evidence. There was no attempt to obtain consensus among the panel members. After the final ratings were submitted, AAOS staff used the AAOS AUC Electronic Ballot Tool to export the median values and level of agreement for all voting items.

FINAL RATINGS

Using the median value of the second-round ratings, AAOS staff determined the final levels of appropriateness. Disagreement among raters can affect the final rating. Agreement and disagreement were determined using the BIOMED definitions of Agreement and Disagreement, as reported in the RAND/UCLA Appropriate Method User's Manual [2], for a panel of 11-13 voting members (see Figure 3 below). The 11-13 panel member disagreement cutoff was used for this voting panel. For this panel size, disagreement is defined as when ≥ 4 members' appropriateness ratings fell within the appropriate (7-9) and rarely appropriate (1-3) ranges for

any scenario (i.e. ≥ 4 members' ratings fell between 1-3 and ≥ 4 members' ratings fell between 7-9 on any given scenario and its treatment). If there is still disagreement in the voting panel ratings after the last round of voting, that voting item is labeled as "5" regardless of median score. Agreement is defined as ≤ 3 panelists rated outside of the 3-point range containing the median.

FIGURE 3. DEFINING AGREEMENT AND DISAGREEMENT FOR APPROPRIATENESS RATINGS

	Disagreement	**Agreement**
Panel Size	Number of panelists rating in each extreme (1-3 and 7-9)	Number of panelists rating outside the 3-point region containing the median (1-3, 4-6, 7-9)
8,9,10	**≥ 3**	**≤ 2**
11,12,13	≥ 4	≤ 3
14,15,16	≥ 5	≤ 4

Adapted from RAM [1]

The classifications in the table below determined final levels of appropriateness.

FIGURE 4. INTERPRETING FINAL RATINGS OF CRITERIA

Level of Appropriateness	**Description**
Appropriate	• Median panel rating between 7-9 and no disagreement
May Be Appropriate	• Median panel rating between 4-6 or • Median panel rating 1-9 with disagreement
Rarely Appropriate	• Median panel rating between 1-3 and no disagreement

REVISION PLANS

These criteria represent a cross-sectional view of current methods for diagnosis and management of ACS and may become outdated as new evidence becomes available or clinical decision-making indicators are improved. In accordance with the standards of the National Guideline Clearinghouse, AAOS will update or withdraw these criteria in five years. AAOS will issue updates in accordance with new evidence, changing practice, rapidly emerging treatment options, and new technology.

DISSEMINATING APPROPRIATE USE CRITERIA

All AAOS AUCs can be accessed via a user-friendly app that is available via the OrthoGuidelines website (www.orthoguidelines.org/auc) or as a native app via the Apple and Google Play stores.

Publication of the AUC document is on the AAOS website at [http://www.aaos.org/auc]. This document provides interested readers with full documentation about the development of Appropriate Use Criteria and further details of the criteria ratings.

AUCs are first announced by an Academy press release and then published on the AAOS website. AUC summaries are published in the *AAOS Now* and the Journal of the American Academy of Orthopaedic Surgeons (JAAOS). In addition, the Academy's Annual Meeting showcases the AUCs on Academy Row and at Scientific Exhibits.

The dissemination efforts of AUC include web-based mobile applications, webinars, and online modules for the Orthopaedic Knowledge Online website, radio media tours, and media briefings. In addition, AUCs are also promoted in relevant Continuing Medical Education (CME) courses and distributed at the AAOS Resource Center.

Other dissemination efforts outside of the AAOS include submitting AUCs to the National Guideline Clearinghouse and to other medical specialty societies' meetings.

PATIENT INDICATIONS AND TREATMENTS

ASSUMPTIONS

1. Adults (skeletally mature) suspected of extremity ACS without evidence of irreversible damage [Known acute injury with fracture, crush injury, etc.].

2. Patients present with concerning physical exam (worsening limb pain and/or limb swelling).

3. Patient not requiring revascularization

**If the patient signs/symptoms change over time, re-enter the AUC tool to assess*

Definitions:

1. Examples of clinical symptoms: pain out of proportion, paresthesia, pain with passive stretch, and paresis (motor symptoms)
2. "Consider alternate diagnosis" does not exclude an ACS diagnosis
3. "Symptoms unreliable" includes: unknown, unreliable, obtunded, intubated, or other reason for unknown history

Exclusions:

1. Pediatric population (skeletally immature)
2. ACS of the foot

INDICATIONS

PATIENT INDICATIONS AND CLASSIFICATIONS

Clinical Symptoms [e.g. pain, paresthesia, pain with passive stretch, and paresis (motor symptoms)]

1. No applicable symptoms
2. Symptoms compatible with ACS
3. Symptoms unreliable (unknown/unreliable/obtunded)

Perfusion Pressure (Delta P = DBP-ICP)

1. Delta P <30 mm Hg (Compromised Perfusion)
2. Delta P >30 mm Hg (Adequate Perfusion)
3. Pressure not obtained

Biomarkers/Labs (Myoglobinuria, elevated serum creatinine or CPK)

1. Abnormal Biomarkers
2. Normal Biomarkers
3. Unknown Biomarkers

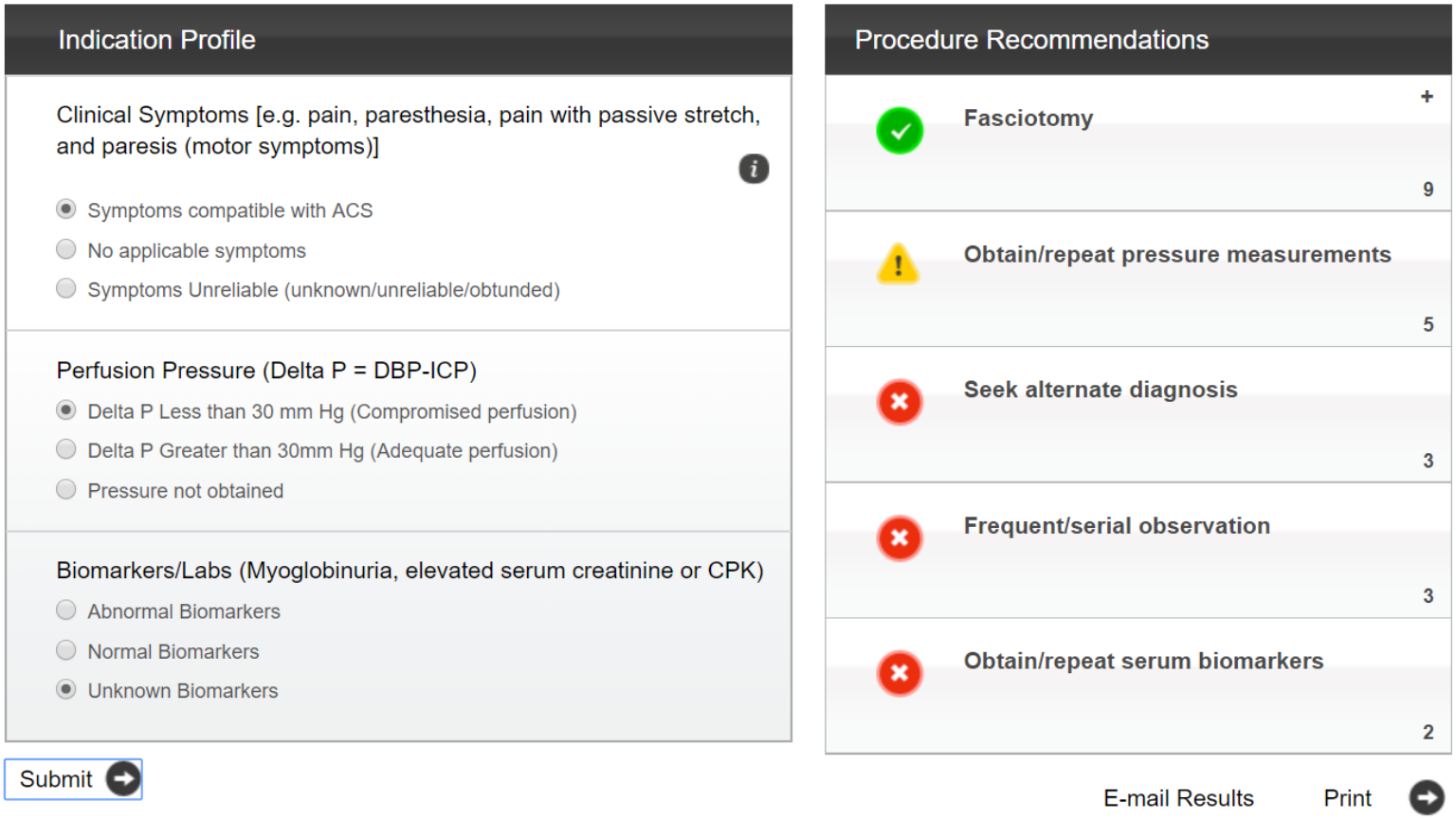
TREATMENTS

1. Fasciotomy
2. Consider alternate diagnosis
3. Frequent/serial observation
4. Obtain/repeat serum biomarker
5. Obtain/repeat pressure measurements

III. RESULTS OF APPROPRIATENESS RATINGS

For a user-friendly version of these appropriate use criteria, please access our AUC web-based application at www.orthoguidelines.org/auc. The OrthoGuidelines native app can also be downloaded via the Apple or Google Play stores.

Web-Based AUC Application Screenshot



RESULTS

The following Appropriate Use Criteria tables contain the final appropriateness ratings assigned by the members of the voting panel. Patient characteristics are found under the column titled “Scenario”. The Appropriate Use Criteria for each patient scenario can be found within each of the treatment rows. These criteria are formatted by appropriateness, median rating, and + or - indicating agreement or disagreement amongst the voting panel, respectively.

Out of 135 total voting items, 50 (37%) voting items were rated as “Appropriate”, 48 (36%) voting items were rated as “May Be Appropriate”, and 37 (27%) voting items were rated as “Rarely Appropriate” (Figure 1). Additionally, the voting panel members were in statistical agreement on 57 (42%) voting items with no statistical disagreement on any voting items (Figure 2).

FIGURE 5. BREAKDOWN OF APPROPRIATENESS RATINGS

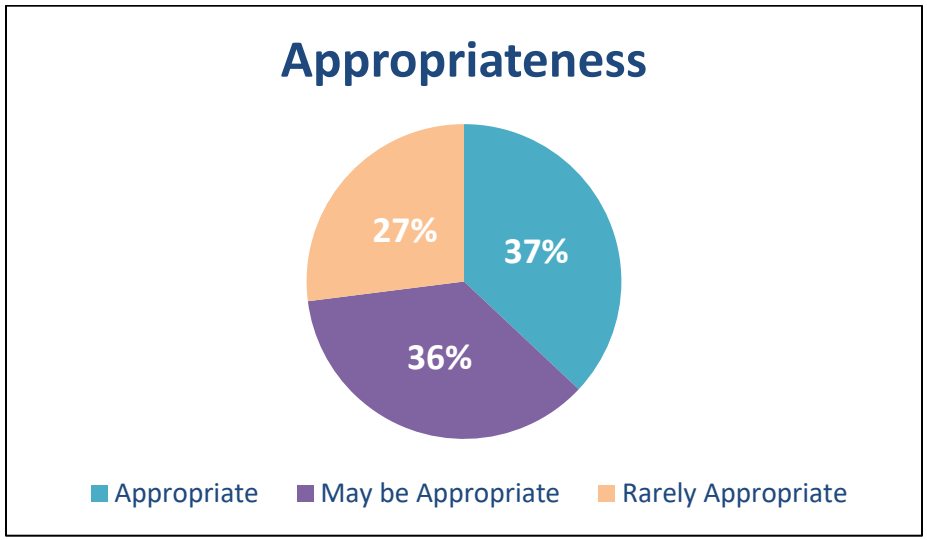


FIGURE 6. BREAKDOWN OF AGREEMENT AMONGST VOTING PANEL

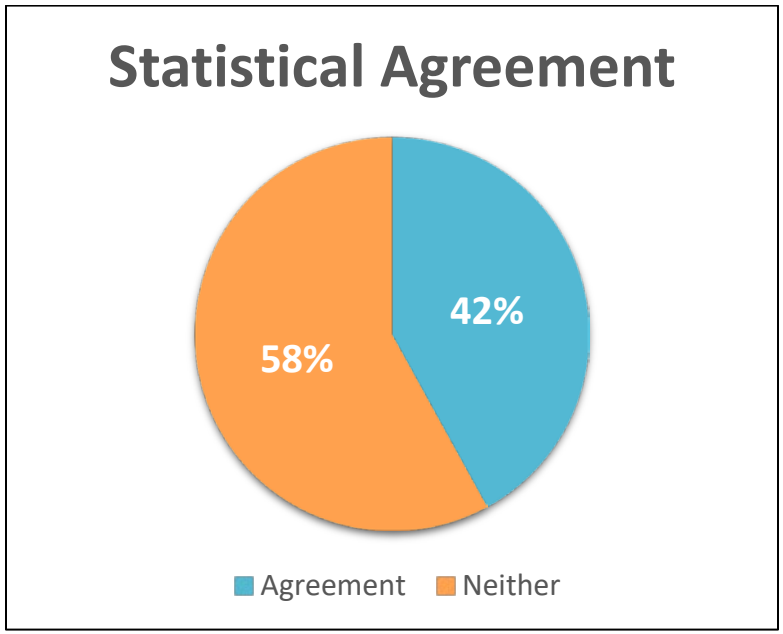
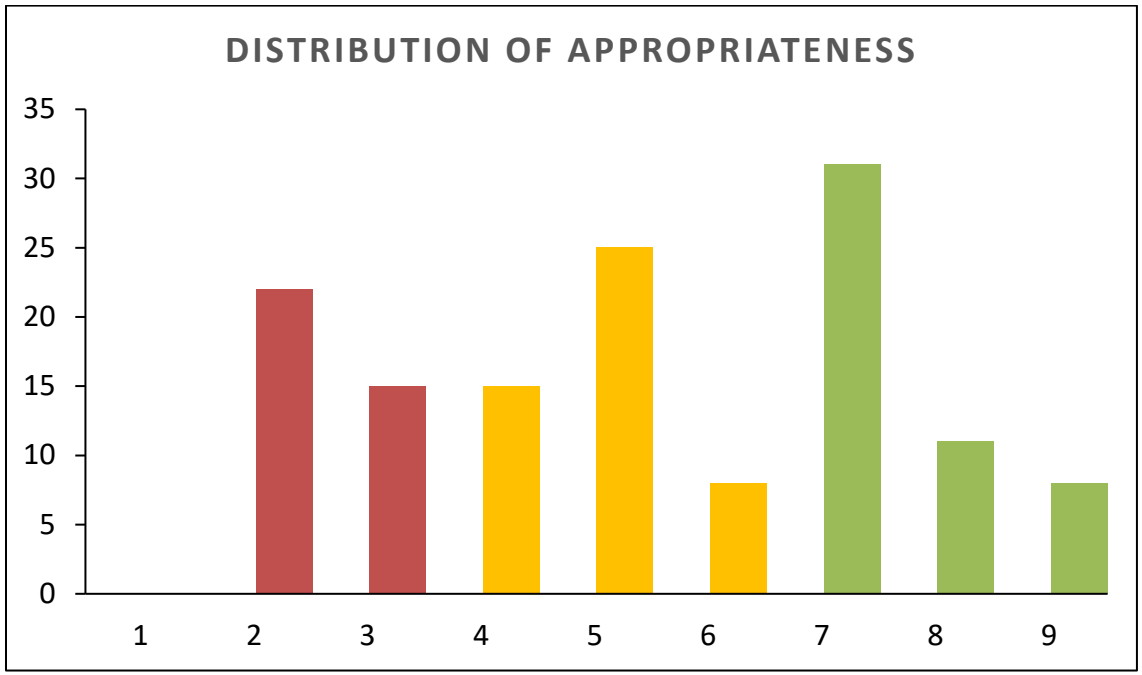


FIGURE 7. DISTRIBUTION OF APPROPRIATENESS ON 9-POINT RATING SCALE



APPROPRIATENESS RATINGS BY PATIENT SCENARIO

Interpreting the AUC tables:

- Each procedure contains the appropriateness (i.e. appropriate, may be appropriate, or rarely appropriate) for each patient scenario, followed by the median panel rating, and the panel's agreement in parentheses.

Scenario	Patient Indications	Treatment	Appropriateness Rating
1	Applicable symptoms, Less than 30 mm Hg, Abnormal Biomarkers	Fasciotomy	Appropriate
		Seek alternate diagnosis	Rarely Appropriate
		Frequent/serial observation	Rarely Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	Rarely Appropriate
2	Applicable symptoms, Less than 30 mm Hg, Normal Biomarkers	Fasciotomy	Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Rarely Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate
3	Applicable symptoms, Less than 30 mm Hg, Unknown Biomarkers	Fasciotomy	Appropriate
		Seek alternate diagnosis	Rarely Appropriate
		Frequent/serial observation	Rarely Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate
4	Applicable symptoms, Greater than 30mm Hg, Abnormal Biomarkers	Fasciotomy	May Be Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate
5	Applicable symptoms, Greater than 30mm Hg, Normal Biomarkers	Fasciotomy	May Be Appropriate
		Seek alternate diagnosis	Rarely Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	Appropriate

Scenario	Patient Indications	Treatment	Appropriateness Rating
6	Applicable symptoms, Greater than 30mm Hg, Unknown Biomarkers	Fasciotomy	May Be Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	Appropriate
7	Applicable symptoms, Pressure not obtained, Abnormal Biomarkers	Fasciotomy	Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	May Be Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	Appropriate
8	Applicable symptoms, Pressure not obtained, Normal Biomarkers	Fasciotomy	May Be Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	Appropriate
9	Applicable symptoms, Pressure not obtained, Unknown Biomarkers	Fasciotomy	May Be Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	Appropriate
10	No applicable symptoms, Less than 30 mm Hg, Abnormal Biomarkers	Fasciotomy	May Be Appropriate
		Seek alternate diagnosis	Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	May Be Appropriate
		Obtain/repeat pressure measurements	Appropriate
11	No applicable symptoms, Less than 30 mm Hg, Normal Biomarkers	Fasciotomy	May Be Appropriate
		Seek alternate diagnosis	Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	Appropriate

Scenario	Patient Indications	Treatment	Appropriateness Rating
12	No applicable symptoms, Less than 30 mm Hg, Unknown Biomarkers	Fasciotomy	May Be Appropriate
		Seek alternate diagnosis	Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	Appropriate
13	No applicable symptoms, Greater than 30mm Hg, Abnormal Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	May Be Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate
14	No applicable symptoms, Greater than 30mm Hg, Normal Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate
15	No applicable symptoms, Greater than 30mm Hg, Unknown Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate
16	No applicable symptoms, Pressure not obtained, Abnormal Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	May Be Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate
17	No applicable symptoms, Pressure not obtained, Normal Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate

Scenario	Patient Indications	Treatment	Appropriateness Rating
18	No applicable symptoms, Pressure not obtained, Unknown Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate
19	Symptoms unknown/unreliable/obtunded, Less than 30 mm Hg, Abnormal Biomarkers	Fasciotomy	Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	May Be Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	Appropriate
20	Symptoms unknown/unreliable/obtunded, Less than 30 mm Hg, Normal Biomarkers	Fasciotomy	Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	May Be Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate
21	Symptoms unknown/unreliable/obtunded, Less than 30 mm Hg, Unknown Biomarkers	Fasciotomy	Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	May Be Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	May Be Appropriate
22	Symptoms unknown/unreliable/obtunded, Greater than 30mm Hg, Abnormal Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	May Be Appropriate
		Obtain/repeat pressure measurements	Appropriate
23	Symptoms unknown/unreliable/obtunded, Greater than 30mm Hg, Normal Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	Rarely Appropriate
		Obtain/repeat pressure measurements	Appropriate

Scenario	Patient Indications	Treatment	Appropriateness Rating
24	Symptoms unknown/unreliable/obtunded, Greater than 30mm Hg, Unknown Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	May Be Appropriate
		Obtain/repeat pressure measurements	Appropriate
25	Symptoms unknown/unreliable/obtunded, Pressure not obtained, Abnormal Biomarkers	Fasciotomy	May Be Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	May Be Appropriate
		Obtain/repeat pressure measurements	Appropriate
26	Symptoms unknown/unreliable/obtunded, Pressure not obtained, Normal Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	May Be Appropriate
		Obtain/repeat pressure measurements	Appropriate
27	Symptoms unknown/unreliable/obtunded, Pressure not obtained, Unknown Biomarkers	Fasciotomy	Rarely Appropriate
		Seek alternate diagnosis	May Be Appropriate
		Frequent/serial observation	Appropriate
		Obtain/repeat serum biomarkers	May Be Appropriate
		Obtain/repeat pressure measurements	Appropriate

IV. APPENDICES

APPENDIX A. DOCUMENTATION OF APPROVAL

AAOS BODIES THAT APPROVED THIS APPROPRIATE USE CRITERIA

Evidence-Based Quality and Value Committee: Approved on August 20, 2019
The AAOS Committee on Evidence Based Quality and Value consists of 23 AAOS members. The overall purpose of this committee is to plan, organize, direct, and evaluate initiatives related to Clinical Practice Guidelines, Appropriate Use Criteria, and Quality Measures.

Council on Research and Quality: Approved on <DATE>
To enhance the mission of the AAOS, the Council on Research and Quality promotes the most ethically and scientifically sound basic, clinical, and translational research possible to ensure the future care for patients with musculoskeletal disorders. The Council also serves as the primary resource to educate its members, the public, and public policy makers regarding evidenced-based medical practice, orthopaedic devices and biologics regulatory pathways and standards development, patient safety, and other related areas of importance.

Board of Directors: Approved on September 20, 2019
The 16 member AAOS Board of Directors manages the affairs of the AAOS, sets policy, and determines and continually reassesses the Strategic Plan.

APPENDIX B. DISCLOSURE INFORMATION

ACS WRITING PANEL MEMBER DISCLOSURES

Andrew Schmidt, MD
AAOS: Board or committee member
ActivOrtho: Stock or stock Options
Acumed, LLC: Paid consultant
Conventus Orthopaedics: Stock or stock Options
Conventus Orthopedics: Paid consultant
Epien: Stock or stock Options
Epix VAN: Stock or stock Options
JBJS Essential Surgical Techniques: Editorial or governing board
Journal of Knee Surgery: Editorial or governing board
Journal of Orthopaedic Trauma: Editorial or governing board
Smith & Nephew: IP royalties
St. Jude Medical: Paid consultant
Thieme, Inc.: Publishing royalties, financial or material support

Colonel Patrick Osborn, MD
Perspectives in Medical Education: Editorial or governing board
SAMMC Alumni Association: Board or committee member

Colonel Anthony Johnson, MD, FAOA
AAOS: Board or committee member
AAOS Now: Editorial or governing board
American College of Surgeons: Board or committee member
American Orthopaedic Association: Board or committee member
Arthroscopy: Editorial or governing board
Association of American Medical Colleges: Board or committee member
Clinical Orthopaedics and Related Research: Editorial or governing board
Journal of Bone and Joint Surgery - British: Editorial or governing board
Pacira Pharmaceuticals, Inc.: Paid consultant
Pfizer: Stock or stock Options
Sanofi-Aventis: Paid consultant

Luke Balsamo, MD
This individual reported nothing to disclose

Marcus Philip Coe, MD
DePuy, A Johnson & Johnson Company: Paid consultant
Ferring Pharmaceuticals: Research support
footeducation.com: Editorial or governing board

I. Leah Gitajn, MD
DePuy, A Johnson & Johnson Company: Paid presenter or speaker

ACS VOTING PANEL MEMBER DISCLOSURES

Arthur Manoli, MD*
DJ Orthopaedics: IP royalties ($7,200) Royalties (Self)
Michigan Orthopaedic Society: Board or committee member ($0)

Robert Marsh, MD
This individual reported nothing to disclose

John Hagedorn, MD*
Abbott: Employee; Stock or stock Options
Current Orthopaedic Practice: Editorial or governing board
Orthopaedic Trauma Association: Board or committee member

Edward J. Harvey, MD*
Canadian J Surgery: Publishing royalties, financial or material support
Canadian Orthopaedic Association: Board or committee member
CMAJ: Editorial or governing board
Greybox: Research support
Greybox Solutions: Unpaid consultant
MY01: Stock or stock Options
NXTSens: Research support; Stock or stock Options
Orthopaedic Trauma Association: Board or committee member
OTA International: Editorial or governing board
Stathera: Stock or stock Options

Shafic Sraj, MD
AAOS: Board or committee member
WV medical Journal: Editorial or governing board
WV orthopaedic society: Board or committee member
WV State Medical Association: Board or committee member

Babar Shafiq, MD*
AAOS: Board or committee member
AOTrauma: Paid presenter or speaker
Orthopaedic Trauma Association: Board or committee member
Synthes: Paid consultant

Teresa Carman, MD
American Board of Vascular Medicine: Board or committee member
American Board of Venous and Lymphatic Medicine: Board or committee member
Portola: Research support
Society for Vascular Medicine: Board or committee member
Vascular Medicine: Editorial or governing board

Brandon Horne, MD*
GE Healthcare: Stock or stock Options
Society of Military Orthopaedic Surgeons: Board or committee member

*Financial Conflicts of Interest (FCOI) reported were not relevant to the topics addressed in this AUC.

APPENDIX C. REFERENCES

(1) American Academy of Orthopaedic Surgeons. The Burden of Musculoskeletal Diseases in the United States. American Academy of Orthopaedic Surgeons; 2008.

(2) Fitch K, Bernstein SJ, Aguilar MD et al. *The RAND/UCLA Appropriateness Method User's Manual*. Santa Monica, CA: RAND Corporation; 2001.

(3) American Academy of Orthopaedic Surgeons. Systematic Literature Review on the Management of Acute Compartment Syndrome. https://www.aaos.org/metrcdod/. Published December 07, 2018.

LETTERS OF ENDORSEMENT FROM ORGANIZATIONS

SOMOS
Society of Military Orthopaedic Surgeons

Kaitlyn S. Sevarino, MBA, CAE
Senior Manager, Quality and Value
Implementation Department of Research,
Quality, & Scientific Affairs

Dear Ms. Sevarino,

The Society of Military Orthopaedic Surgeons has voted to endorse the AAOS Diagnosis and Management of Acute Compartment Syndrome Appropriate Use Criteria. This endorsement implies permission for the AAOS to officially list our organization as an endorser of this Appropriate Use Criteria and reprint our logo in the introductory section of the Appropriate Use Criteria review document.

Sincerely,

Col Christopher LeBrun, MD
President

Col Christopher LeBrun, MD
US Air Force
SOMOS President

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Towson, MD 21204

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January 2, 2020

Kaitlyn S. Sevarino, MBA, CAE
Senior Manager, Quality and Value Implementation
Department of Research, Quality, & Scientific Affairs
AAOS
9400 W. Higgins Road
Rosemont, IL 60018

Dear Ms. Sevarino,

The American Orthopaedic Foot & Ankle Society has voted to endorse the AAOS Diagnosis and Management of Acute Compartment Syndrome Appropriate Use Criteria. This endorsement implies permission for the AAOS to officially list our organization as an endorser of this Appropriate Use Criteria and reprint our logo in the introductory section of the Appropriate Use Criteria review document. Please advise when the AOFAS name and logo will be posted. On behalf of AOFAS, thank you for the opportunity for our member to contribute to this important process.

Sincerely,

Elaine M. Leighton, MPH, CAE
Executive Director