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Section 2: Diagnosis

What Is the Definition of Acute and Chronic Periprosthetic Joint Infection (PJI) of Total Ankle Arthroplasty (TAA)?

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Abstract

Recommendation: There is a paucity of data for defining acute or chronic periprosthetic joint infection (PJI) following total ankle arthroplasty (TAA) in the literature. Any discussion of PJI after ankle replacement is entirely reliant on the literature surrounding knee and hip arthroplasty.
Level of Evidence: Consensus.
Delegate Vote: Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

Rationale

Periprosthetic joint infection (PJI) after total ankle arthroplasty (TAA) is an unfortunate and serious complication that bears significant consequences to the patient and impediments to the natural history of ankle replacement, often prompting revision arthroplasty, conversion to arthrodesis, or potentially below-the-knee amputation. Although the practice of TAA has gained popularity in recent years,[1] there is a paucity of data describing wound complications and acute or chronic PJI of TAA. The review of the current literature fails to identify a specific set of accepted criteria for defining an acute or chronic PJI of TAA.

Diagnostic criteria of acute or chronic PJI (nonspecific to TAA) is guided by the definition developed by the Musculoskeletal Infection Society, which was later modified in 2013 by the International Consensus Group on Periprosthetic Joint Infection (Table 1).[15] Diagnosis of PJI requires the presence of 1 major criterion or presence of at least 3 of 5 minor criteria. Acute infections were defined by presentation within 90 days of index surgery and chronic infections after 90 days. Acute and chronic infections each have a different set of threshold levels for the minor criteria (Table 1).[15]

The current literature regarding ankle replacement is significantly limited in data available on PJI. Of the studies that reference diagnosis of PJI in TAA, only 1 study, by Alrashidi et al, offers any explicit reference to a diagnostic algorithm used to classify patients with periprosthetic ankle infections.[1] Although not explicitly delineated, the authors appear to invoke laboratory threshold measurements described by the International Consensus Group on Periprosthetic Joint Infection in their proposed diagnostic diagram. Our systematic review failed to identify any clinical study or publication that had implemented or referenced the diagnostic algorithm submitted by Alrashidi et al.

Although Alrashidi et al have presented the most comprehensive and systematic pathway to date specific to diagnosing a PJI in TAA,[1] the criterion utilized in this pathway are derived from previously described literature specific to knee and hip arthroplasty.[14,15] TAA data are significantly more limited and thus difficult to establish statistically significant infectious indicators specific to the ankle joint. Alrashidi et al present clinically useful data in their diagnostic algorithm including the presence of a sinus tract, cell count, and differential from synovial aspiration, culture from synovial aspiration, nuclear imaging studies, and histologic frozen sections. However, no sensitivities or specificities of the results have been described in determining PJI specific to TAA. Ferrao et al also described similar workup in diagnosing PJI in TAA including clinical history, physical examination, radiographic evaluation, and laboratory values.[7] Pertinent history, such as sudden onset of pain, swelling, drainage, fever, and associated clinical findings, such as tenderness, increased local temperature and effusion, were components concerning for PJI as described by the authors. This study presented a similar diagnostic pathway, including inflammatory markers and joint aspiration, and also made reference to the hip and knee arthroplasty literature in setting criteria and thresholds.[11,20,23] The trend of referencing hip and knee arthroplasty data in the workup of PJI

Table 1. Diagnostic Criteria of Periprosthetic Joint Infection According to the International Consensus Group on Periprosthetic Joint Infection.[a]

Major Criteria
• Identification of 2 positive periprosthetic cultures with phenotypically identical microorganisms OR • Presence of a sinus tract communicating with the joint
Minor Criteria
• Elevated serum CRP AND elevated ESR • Elevated synovial fluid WBC count OR ++ change on leukocyte esterase test strip • Elevated synovial fluid PMN% • Positive histologic analysis of periprosthetic tissue • A single positive culture

Threshold Levels for Minor Criteria for PJI		
Criterion	Acute PJI	Chronic PJI
ESR (mm/h)	Not helpful with no defined threshold	30
CRP (mg/L)	100	10
Synovial WBC count (cells/ μl)	10 000	3000
Synovial PMN %	90	80
Leukocyte esterase	+ OR ++	+ OR ++
Histologic analysis of tissue	>5 neutrophils per HPF (×400) in 5 HPF	

Abbreviations: CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; HPF, high-powered field; PJI, periprosthetic joint infection; PMN%, polymorphonuclear neutrophil percentage; WBC, white blood cell count.
[a]Adapted with permission.[15]

in TAA in our systematic review was common in the literature.[3,5,9,10,12,19,22]

Patton et al define PJI by positive preoperative or intraoperative cultures or the presence of chronic draining sinus tract but do not provide reference for this definition.[17] Myerson et al similarly defined PJI by draining sinus tract, positive preoperative aspiration (purulent aspirate, positive Gram stain and/or elevated leukocyte count >1000 per mm^3), or positive intraoperative culture.[13] The authors subdivided infections into acute and chronic but did not specify criteria for differentiating between the two. Kessler et al defined PJI as clinical signs of infection plus at least 1 of the following: (1) same bacteria grown on 2 separate preoperative or intraoperative cultures, (2) visible pus surrounding the joint, (3) acute inflammation on histopathologic examination (>10 neutrophils/high-powered field) or the ability to probe the base of the wound to the implant.[9,10]

Other mentions of PJI in TAA in our literature search did not specifically describe the criteria used to reach that diagnosis.[2,5,18,21] Case reports of PJI in TAA were also described without defining parameters for diagnosis of acute or chronic infection.[4,6] Further review did demonstrate several manuscripts that identified risk factors for PJI, including proximity to dental procedures or medical comorbidities, but failed to provide a definition for diagnosis of acute or chronic PJI.[8,24] Our systematic review yielded definitions of acute and chronic PJI defined in total hip and knee literature, case reports, as well as suspected risk factors, signs, symptoms, and history related to PJI.

In summary, there remains no definitive criterion in the literature for defining acute or chronic PJI after ankle arthroplasty. In the absence of specific diagnostic criteria for PJI of TAA, we may need to rely on the literature related to total hip arthroplasty and total knee arthroplasty to investigate this area further. A recent study published offers an evidence-based and validated definition for PJI of the hip and knee.[16] The criteria based on pretest probability offer each diagnostic criteria a score that is commensurate with the performance of the test in the pretest probability and diagnostic odds ratio.[16]

Declaration of Conflicting Interests

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What Is the Diagnostic "Algorithm" for Infected Total Ankle Arthroplasty (TAA)?

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Abstract

Recommendation: Patients who present with clinical symptoms and signs of periprosthetic ankle infection (pain, erythema, warmth, sinus tract, abscess around the wound) and sinus tracts communicating with the ankle/subtalar joint are likely to have total ankle arthroplasty (TAA) infection.

In the absence of a sinus tract, elevated inflammatory markers (erythrocyte sedimentation rate [ESR] and C-reactive protein [CRP]) should prompt ankle joint aspiration for cell count, differential, and culture. The joint aspiration is to be repeated.

If the same organism is identified in at least 2 cultures of synovial fluid, the patient is diagnosed to have an infection. If the repeat aspiration is negative, further investigation is warranted.

In patients not requiring operative intervention for other reasons, nuclear imaging should be considered for diagnosis. If an operation is indicated, histologic examination (>5 neutrophils/high-power field) or synovial fluid analysis is conducted to confirm infection.

Level of Evidence: Limited.

Delegate Vote: Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)