



Practice and clinical factors associated with appropriateness of CT use in extremity soft tissue infection

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Introduction

Soft tissue infections are common concerns. Although typically clinical diagnoses, imaging such as computed tomography (CT) may be used to help increase diagnostic certainty or to evaluate the extent of infection. However, use of CT in superficial soft tissue infection like cellulitis is rising with uncertain benefit¹. As extremities provide optimal opportunity for examination and diagnosis of superficial soft tissue infections, CT appropriateness in this cohort is an area of interest for quality and safety. This study aims to describe adherence to ACR Appropriateness Criteria[®] among patients with extremity cellulitis undergoing CT, and explore practice and clinical factors associated with Criteria nonadherence.

Methods

A retrospective review at a single academic medical center was conducted. Eligibility criteria included encounters between 2012-2021 involving adult patients with a clinical diagnosis of extremity cellulitis that were examined using CT. Exclusion criteria included postoperative patients, extremity implants excepting arthroplasty, trauma, and known deep infection or local malignancy. Data collected included demographics, medical history, physical exam findings, lab findings, and practice factors such as location of CT order and ordering clinician department. Logistic regression was used to analyze factors influencing Appropriateness Criteria adherence on initial imaging.

Results

529 CT scans among 462 patients were eligible. Average age was 56.4 ± 18.9 , average BMI was $37.1 \pm 15.9 \text{ kg/m}^2$. 56.7% of patients were male.

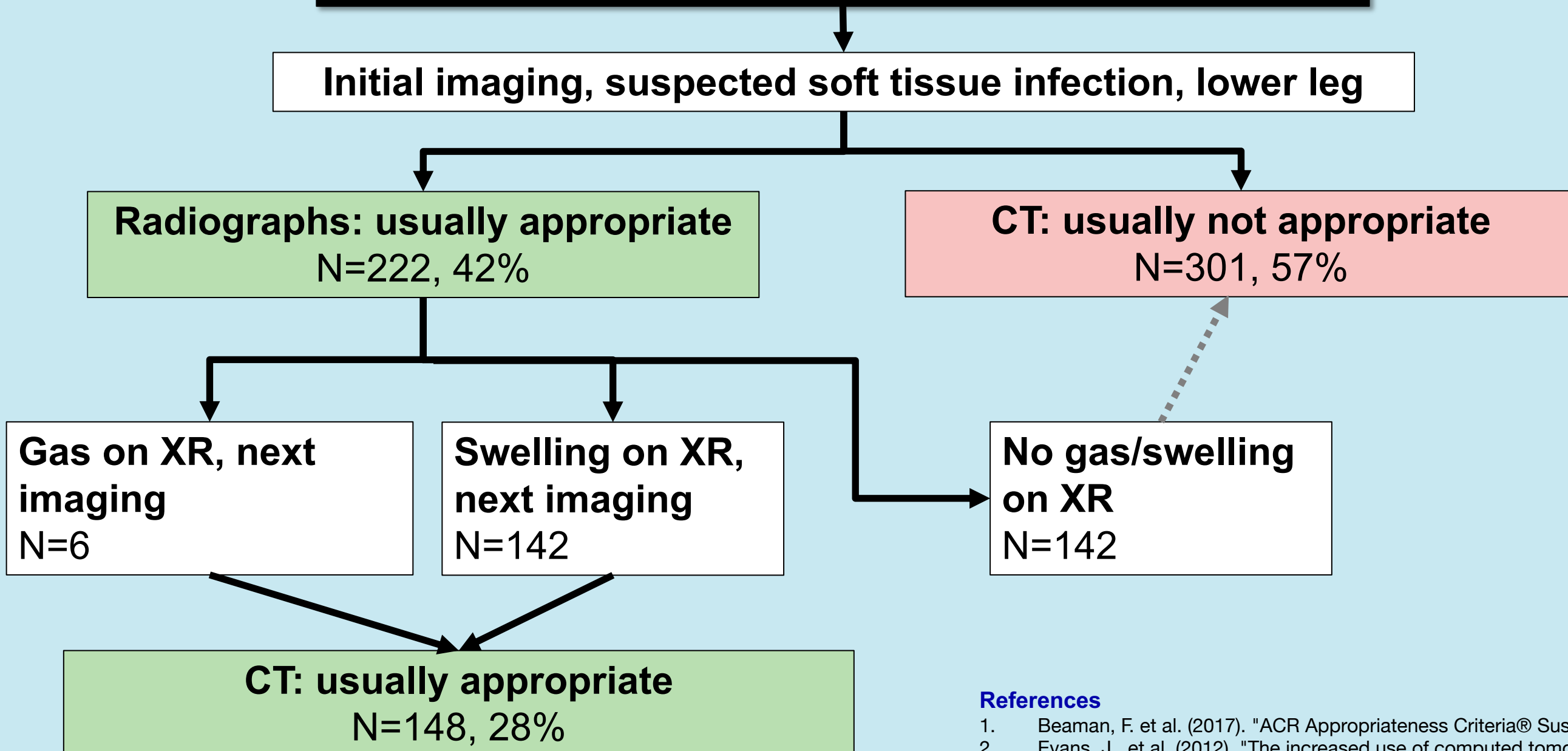
The odds of meeting criteria for “Usually Not Appropriate” on initial imaging were 11% lower in the inpatient setting compared to the ED (95% CI 0.82-0.96 $p = .00333$) and 21% higher given the presence of an infection (95% CI 1.04-1.42 $p = .01661$). Patient medical history, body mass index, fever, hypotension, tachycardia, limb exam findings, and leukocytosis were not associated with significantly different odds of appropriateness, nor was clinician department. Overall, 42.0% (222/529) of encounters met criteria for “Usually Appropriate” for initial imaging, and 56.90% (301/529) of encounters met criteria for “Usually Not Appropriate.”

Discussion

Adherence to Appropriateness Criteria was suboptimal in this cohort of extremity cellulitis patients, with less than half of cases meeting the Usually Appropriate designation of radiographs prior to CT. Among patients who did receive radiographs first, less than one-third had findings of gas or swelling, which would suggest that additional imaging was appropriate.

Out of patients with extremity cellulitis receiving a CT scan, those presenting to the ED were more likely to deviate from Appropriateness Criteria adherence, as were patients whose CTs were positive for findings of deep infection. Since medical history, physical exam findings, nor lab abnormalities were associated with inappropriate CT utilization, factors driving nonadherence may include physician preference in the ED setting or medicolegal concerns, rather than differences in clinical presentation. Efforts for improved quality and patient safety should focus on exploring factors influencing CT ordering in this cohort, and education of Appropriateness Criteria[®] in extremity soft tissue infection that is tailored to ED personnel. In addition, a further clustering analysis should be conducted on patients with incidental findings of a deep soft tissue infection that didn't adhere to Appropriateness Criteria[®] procedure to examine potential patient characteristics or presentations that might be associated with initial CT ordering.

Schematic: Abbreviated ACR Appropriateness Criteria[®] for Suspected Soft Tissue Infection, lower leg²



| Variable | N (%) |
|-------------------------------|------------|
| Diabetes mellitus | 162 (34.2) |
| Immunocompromised | 102 (19.2) |
| Injection drug use | 29 (5.4) |
| Lower extremity | 450 (84.6) |
| Fever prior to CT | 89 (17.9) |
| Leukocytosis prior to CT | 238 (49.0) |
| CT ordered in ED | 262 (49.5) |
| CT ordered inpatient | 253 (47.8) |
| Ordering clinician specialty | |
| Internal medicine | 180 (34.0) |
| Emergency medicine | 246 (46.5) |
| General surgery | 26 (4.9) |
| Infectious disease | 28 (5.3) |
| Orthopedic or plastic surgery | 14 (2.6) |

References

1. Beaman, F. et al. (2017). "ACR Appropriateness Criteria[®] Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot)." *J Am Coll Rad* 14(5): S326-S337.
2. Evans, J., et al. (2012). "The increased use of computed tomography scanning for diagnosing superficial soft tissue infections: a disturbing trend of increased radiation with no benefit." *Am J Surg* 204(6): 988-995.