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Validation of the American Association for the Surgery of Trauma's emergency general surgery breast infection grading system

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ARTICLE INFO

Article history:

Received 30 January 2018

Received in revised form

1 March 2018

Accepted 15 March 2018

Available online xxx

Keywords:

Breast infection

AAST

Emergency grading system

ABSTRACT

Background: The American Association for the Surgery of Trauma (AAST) developed emergency general surgery (EGS) grading systems for multiple diseases to standardize classification of disease severity. The grading system for breast infections has not been validated. We aimed to validate the AAST breast infection grading system.

Methods: Multi-institutional retrospective review of all adult patients with a breast infection diagnosis at Mayo Clinic Rochester 1/2015-10/2015 and Pietermaritzburg South African Hospital 1/2010-4/2016 was performed. AAST EGS grades were assigned by two independent reviewers. Inter-rater reliability was measured using the agreement statistic (kappa). Final AAST grade was correlated with patient and treatment factors using Pearson's correlation coefficient.

Results: Two hundred twenty-five patients were identified: grade I ($n = 152, 67.6\%$), II ($n = 44, 19.6\%$), III ($n = 25, 11.1\%$), IV ($n = 0, 0.0\%$), and V ($n = 4, 1.8\%$). At Mayo Clinic Rochester, AAST grades ranged from I-III. The kappa was 1.0, demonstrating 100% agreement between reviewers. Within the South African patients, grades included II, III, and V, with a kappa of 0.34, due to issues of the grading system application to this patient population. Treatment received correlated with AAST grade; less severe breast infections (grade I-II) received more oral antibiotics (correlation $[-0.23, P = 0.0004]$), however, higher AAST grades (III) received more intravenous antibiotics (correlation $0.29, P < 0.0001$).

Conclusions: The AAST EGS breast infection grading system demonstrates reliability and ease for disease classification, and correlates with required treatment, in patients

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<https://doi.org/10.1016/j.jss.2018.03.045>

presenting with low-to-moderate severity infections at an academic medical center; however, it needs further refinement before being applicable to patients with more severe disease presenting for treatment in low-/middle-income countries.

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Introduction

While mastitis occurs in approximately 1%-24% of lactating women, breast infections are more common in nonpuerperal women and may further progress to a breast abscess in 5%-11% of patients.¹⁻⁴ Breast abscesses have classically been categorized into puerperal (lactational) and nonpuerperal (nonlactational) abscesses, with nonpuerperal abscesses further subdivided by location: central subareolar or peripheral.^{3,5-7} While the gold standard of abscess treatment is incision and drainage (I and D), breast abscesses have been increasingly treated by ultrasound-guided aspiration since the 1990s.^{7,8} Multiple studies have made treatment recommendations based on abscess size; however, there has not been a consensus on the optimal treatment regimen based on these previous classifications.^{3-5,9-11}

Stratification of breast-related infections has lacked a standardized and generalizable grading system, as size, lactation status, and location do not correlate with severity.^{3,7,12} Furthermore, accurate models to predict the type of therapy and subsequent outcomes have not been described previously. To address the lack of standardization in diagnosis, management, and prognosis in several emergency general surgery (EGS) diseases, including breast infections, the American Association for the Surgery of Trauma (AAST) generated a clinical, imaging, operative, and pathologic finding grading system to better describe disease severity.¹³⁻¹⁵ All AAST EGS grading systems are similar and range from I to V. These correspond with grade I representing localized disease and grade V diffuse disease (Tables 1 and 2).¹⁵

Previous work has demonstrated the AAST grading systems' ability to validate and assess severity for several EGS

diseases.¹⁶⁻¹⁸ The AAST grade measure of disease severity has been associated with important clinical outcomes such as operation type, duration of hospital stay, morbidity as defined by the Clavien-Dindo classification, and mortality.¹⁶⁻¹⁸ In addition, the AAST grading system has been used in multinational populations, suggesting its generalizability and ease of use.¹⁹ Because the AAST EGS grading system for breast infection was not developed on evidence but instead based on expert opinion, there is need for its validation in a clinical setting. We therefore sought to validate the AAST EGS breast infection grading system and determine its generalizability to two different patient populations.

Materials and methods

Patient selection and data collection

Institutional Review Board approval was obtained from Mayo Clinic Rochester (MCR) and the Biomedical Research Committee of the University of Kwa Zulu Natal. At MCR, we identified and included all patients ≥ 18 y of age that were evaluated for a breast infection diagnosis between January 1, 2015 and October 1, 2015 using an institution-specific clinical search tool and the International Classification of Diseases-9 code 611.0, which includes inflammatory disease of the breast (abscess, intramammary fistula, and mastitis). For patients from Pietermaritzburg South Africa (SA), a prospectively maintained database was queried for all patients with a breast infection diagnosis between January 1, 2010 and April 1, 2016. A description of Pietermaritzburg SA and the variety of hospitals that participate in the prospectively maintained

Table 1 – Current AAST grading criteria.¹⁵

| Grade | Clinical | Imaging | Operative |
|-------|--|---|--|
| I | Erythema, induration | Inflammation without fluid collection | N/A |
| II | Single, small abscess without loculations; not involving the nipple/areolar complex | Single well-circumscribed fluid collection within breast tissue, not involving nipple/areolar complex | Single, well-circumscribed fluid collection within breast tissue, not involving nipple/areola complex |
| III | Large abscess with multiple loculations, multiple abscesses, or abscess involving nipple/areola complex; lymphadenopathy | Multiple separate fluid collections or single large collection with multiple loculations within breast tissue or involvement of nipple/areola complex | Multiple separate fluid collections or single large collection with multiple loculations within breast tissue, or involvement of nipple/areola complex; enlarged lymph nodes |
| IV | Breast abscess with ipsilateral lymphadenopathy, thrombophlebitis, lymphangitis | Fascial plane thickening with enhancement; evidence of lymphadenopathy on ultrasound or computed tomography | Above, plus axillary fluid collections, extension of inflammatory changes well beyond the abscesses |
| V | Above, plus erosion into chest wall muscles or ribs or pleural space, or necrotizing fasciitis | Above, plus inflammatory changes in the chest wall muscles, ribs or pleural space | Above, with erosion into chest wall muscles or ribs or pleural space, or necrotizing fasciitis |

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