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Validating a new grading scale for emergency general surgery diseases

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ABSTRACT

Background: The American Association for the Surgery of Trauma (AAST) recently developed a grading scale for measuring anatomic severity of emergency general surgery (EGS) diseases. Grades were developed by expert consensus and have not been validated. The study purpose was to measure inter-rater reliability of the grading scale using colonic diverticulitis and to measure the association between disease grade and patient outcomes. **Methods:** All charts were reviewed and independently assigned AAST grades based on specific disease criteria. Inter-rater reliability was measured using a kappa coefficient. Multivariate regression models were used to determine the relationship between AAST disease grade and patient outcomes adjusted for age, comorbidities, and patient physiology.

Results: Over 70% of patients demonstrated mild disease (grades I and II). No deaths were encountered. Inter-rater reliability for grade assignment was moderate (kappa coefficient, 0.43; 95% confidence interval, 0.31–0.56), with 67% concordance in grades. Compared to grade I, complications were similar in grade II but increased significantly with higher grades (grade III odds ratio [OR], 3.13 [1.32–7.41]; grade IV OR, 8.18 [2.09–32.0]; and grade V OR, 10.2 [2.68–38.90]). Compared to grade I, length of stay increased with higher grades (grade II incidence rate ratio [IRR], 1.30 [1.07–1.60]; grade III IRR, 2.4 [1.93–2.98]; grade IV IRR, 3.2 [2.27–4.60]; and grade V IRR, 2.6 [1.82–3.60]).

Conclusions: The EGS grading scale for diverticulitis demonstrated moderate inter-rater reliability. Higher grades were independently associated with complications and length of stay. The findings provide a positive validation that the EGS scale is easily used and effective.

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1. Introduction

In 1986, the American Association for the Surgery of Trauma (AAST) developed the organ injury scale (OIS) for uniform

reporting of anatomic severity of traumatic injuries. The first OISs described injuries to the spleen, liver, and kidney, and were published in 1989 [1,2]. Similar OIS grades were then developed for a wide array of injuries from the heart to

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Table 1 – AAST grading scale for acute colon diverticulitis.

Grade	AAST grade	Clinical criteria	Imaging criteria	Operative criteria	Pathologic criteria
I	Colonic inflammation	Pain Elevated WBC count Minimal/no tenderness	Mesenteric stranding Colon wall thickening	N/A	N/A
II	Colon microperforation or pericolic phlegmon without abscess	Local tenderness (single or multiple areas) No peritonitis	Pericolic phlegmon Foci of air (single or multiple locations) No abscess	Pericolic phlegmon No abscess	Inflamed colon with microscopic perforation
III	Localized pericolic abscess	Localized peritonitis	Pericolic abscess	Pericolic abscess	Perforation
IV	Distant and/or multiple abscesses	Localized peritonitis at multiple locations	Abscess/phlegmon away from the colon	Abscess/phlegmon away from the colon	N/A
V	Free colonic perforation with generalized peritonitis	Generalized peritonitis	Free air and free fluid	Perforation with generalized fecal and purulent contamination	N/A

N/A = not applicable; WBC = white blood cell.

duodenum to the abdominal vasculature [3]. Subsequent validation studies demonstrated a good association of OIS grades with treatment options and patient outcomes [1,2,4].

Recently, the AAST developed a system for grading anatomic severity for emergency general surgery (EGS) diseases, including acute appendicitis, acute cholecystitis, acute colonic diverticulitis, hernias, intestinal obstruction, acute pancreatitis, ischemic bowel, and perforated peptic ulcers [5]. The new AAST EGS grading system is similar to the OIS and provides a uniform nomenclature to enable a more accurate and consistent description of anatomic severity of these diseases. This grading system may also be used in research to measure comparative effectiveness of alternative therapies, in clinical decision making, and to aid in communication with patients and families. However, for this grading system to be useful, it is important to determine if there is a correlation with increasing grade of disease severity and patient outcomes.

We undertook a pilot study to validate the new AAST grades for acute colonic diverticulitis, as diverticulitis is one of the most common EGS diseases. In the United States, diverticulitis accounts for over 300,000 hospital admissions per year, with an associated 1.5 million hospital days and over \$2.6 billion in associated costs [6]. Furthermore, diverticulitis is well studied with multiple existing grading systems that are currently used to predict severity and assist with medical and surgical decision making [7,8].

The purpose of this pilot study was to investigate the applicability and validity of the new AAST grading scale for acute colonic diverticulitis. Specifically, this study measured the association of the AAST grading system with patient outcomes. We also determined the ease of its use and inter-rater reliability between different surgeons.

2. Methods

This protocol was approved by the Institutional Review Boards at the University of Tennessee Health Science Center and at Baylor Scott and White Health System in Dallas. There were two phases to this pilot study: phase I measured the inter-

rater reliability of the new AAST scale for acute colonic diverticulitis in EGS patients; and phase II explored the relationship between AAST grade and patient outcomes.

2.1. AAST grade for acute colonic diverticulitis

Patient charts were graded for severity according to the AAST grading scale. This scale ranges from a severity scale of grade I (least severe) to grade V (most severe), similar to the OIS in trauma (Table 1). Four sets of criteria were used to assign grades—clinical (based on history and physical examination), imaging, operative, and pathologic. A grade was assigned for each of the four sets of criteria. The highest of the four grades was then assigned as the final AAST grade of the patient.

2.2. Inter-rater reliability of AAST grading system

Data for this analysis were obtained from the University of Tennessee Health Science Center. Patients were included if they had an International Classification of Diseases (ICD), Ninth Revision (ICD-9), code of 562.11 (diverticulitis of the colon without hemorrhage) and were of age 18 y or older. The most recent 138 patients from 2010–2013 who met these criteria were screened for inclusion in this study. Two general surgeons reviewed their charts and assigned an AAST grade for diverticulitis to each patient. Each surgeon was blinded to the grade assigned by the other surgeon. The two grades assigned to each patient were subsequently analyzed for inter-rater reliability. Of the 138 patients, eight were removed from analysis because of incomplete grading and another 11 patients were excluded as both reviewers determined absence of diverticulitis. Final study population for this analysis consisted of 119 patients with acute diverticulitis.

2.3. Association between AAST grade and patient outcomes

Data for this analysis were obtained from Baylor Scott and White Health System (December 2008–June 2013). Inclusion criteria consisted of an ICD-9 code of 562.11 (diverticulitis

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