

The Emergent General Surgical Patient: Evaluation Patterns in the Emergency Department

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Received Nov. 3, 2021; Accepted for publication Jan. 24, 2022; Published online April 29, 2022
<https://doi.org/10.17161/kjm.voll5.16036>

ABSTRACT

Introduction. Emergency general surgery patients represent a growing segment of general surgical admissions and national health-care burden. A paucity of literature exists evaluating the work-up of these patients presenting to the Emergency Department (ED), particularly possible evaluation differentials between emergency physicians and physician assistants or advanced practice registered nurses (PA/APRNs). The purpose of this study was to evaluate differences in ED work-up of general surgical patients between emergency physicians and PA/APRNs.

Methods. A retrospective review was conducted of patients presenting to the ED with the chief complaint of abdominal pain. Demographic data, evaluating provider, laboratory and imaging tests, diagnostic data, and disposition were obtained.

Results. Patient median age was 53.5 years, with 49% male and 81.6% Caucasian. Emergency physicians saw the majority (61.2%) of patients. Emergency physicians saw older patients (62.0 vs. 45.5 years; $p = 0.017$), and more patients that were anemic (28.3% vs. 14.3%) or with elevated creatinine levels (46.7% vs. 25.7%). There was no significant difference between groups for time in the ED (6.1 ± 2.4 vs. 5.7 ± 2.6 hours; $p = 0.519$), time to surgical consult (3.4 vs. 3.3 hours; $p = 0.298$), or time to the operating room (29.5 vs. 12.0 hours; $p = 0.075$). Patients seen by emergency physicians had a longer length of hospital stay (4.5 vs. 2 days; $p = 0.002$).

Conclusions. Time in the ED and time to surgical consult did not vary between groups although patients first seen by emergency physicians had potentially higher acuity. Decreased hospital length of stay in patients seen by PA/APRNs may reflect disease-specific differences.

Kans J Med 2022;15:112-118

INTRODUCTION

Emergency general surgery (EGS) comprises a significant portion of all general surgery admissions and procedures, and represents a growing portion of national healthcare financial burden.^{1,2} Evidence suggested that these admissions comprise over 7% of all hospital admissions and that the annual rate of EGS cases is higher than the rate of new cancer diagnoses.^{2,3} Although early recognition of EGS conditions may play a role in outcomes, there was little research that described the process of patient evaluation in the emergency department (ED) prior to initiation

of surgical consult or admission with an EGS diagnosis.^{4,7}

Furthermore, physician assistants and advanced practice registered nurses (PA/APRNs) play a growing role in health care delivery, particularly in the emergency department,^{8,9} as patients presenting with EGS conditions may be first evaluated either by a PA/APRN or an emergency physician. The selection of which type of provider initially will evaluate a patient can be driven by many factors, including perceived level of visit severity assessed at time of triage.^{8,9} This may represent an important branch point in patient care. It was unknown if initial provider type had any impact upon the work-up required to diagnose an EGS condition or upon the time from initial evaluation to recognition of an EGS condition or surgical consult. Furthermore, it was unknown whether these variables have any impact on final patient outcomes such as hospital length of stay or mortality.

There were other studies evaluating ED outcomes between patients evaluated by a PA/APRN or emergency physician in some medical patient sub-groups.^{10,11} For example, Tsai et al.¹¹ demonstrated a lower guideline concordance score for PA/APRNs than for emergency physicians when evaluating asthma patients. Although there were data regarding the presentation and evaluation of the EGS patient in the ED, there was a paucity of data regarding PA/APRN-specific involvement and how that altered evaluation and outcomes in the ED within this specific population.¹² The purpose of this study was to compare the characteristics and outcomes between those patients presenting with abdominal pain who were first evaluated by a PA/APRN compared to those that were first evaluated by an emergency physician.

METHODS

This study was approved for implementation by the Institutional Review Board of Ascension Via Christi Hospitals Wichita, Inc.

Study Setting and Population. A retrospective review was conducted of all patients presenting to the ED of a Level 1 trauma center, tertiary-care hospital seeing 60,000 patients annually with the chief complaint of abdominal pain between October 1, 2018 and December 31, 2018. Patients under the age of 18 and prisoners were excluded.

Study Protocol, Measurements, and Key Outcomes. Data were obtained from patients electronic medical records. Demographic data (e.g., age, sex, and race), body mass index (BMI), initial vitals (e.g., heart rate, blood pressure, and temperature), initial laboratory values (e.g., white blood cell count, hemoglobin, creatinine, carbon dioxide, and total bilirubin), and Emergency Severity Index were collected.

Emergency Severity Index is a five-level emergency department triage algorithm. The five levels correspond to patient condition as follows: 1 = immediate, life-saving interventions are required for conditions such as cardiac arrest or massive bleeding; 2 = emergent conditions with high risk of patient deterioration such as cardiac-related chest pain or asthma attack, 3 = patient is stable, but needs urgent care requiring multiple resources, for conditions such as abdominal pain or high fever with cough, 4 = less urgent patients needing only one type of resource for conditions such as simple laceration or pain on urination, 5 = nonurgent conditions such as rash or prescription refill. Type of initial provider was recorded as emergency physician or PA/APRN. The number and types of laboratory tests ordered by the providers were recorded: complete blood count (CBC), comprehensive metabolic panel (CMP), lactic acid,

and a category of 'other laboratory tests' (which included urine pregnancy test, rapid fingerstick glucose, urine drug screen, B natriuretic peptide, and lipase). The number and type of radiographic studies also was recorded. The patient's disposition was obtained: discharge home, admission to the hospital under a surgical service, admission under a non-surgical service, or in ED death. The total length of time in the ED from admission to final disposition and the time from admission to surgical consult were obtained. Length of hospital stay also was collected. If the patient required general surgical operative intervention, the time from presentation to the ED to arrival to the operating room was ascertained. The ED provider's diagnosis at time of discharge from the ED was obtained from the ED provider's note and final diagnosis at time of surgical discharge was obtained from the surgeon's notes.

Data Analysis. The data were compiled, evaluated, and summarized by calculating means and standard deviations for continuous data and proportions for discrete data. Primary comparisons were conducted comparing patients first evaluated by an emergency physician and those first evaluated by a PA/APRN. An independent samples t-test was used to compare continuous data when normally distributed. Variables that were not distributed normally were reported with medians and interquartile ranges, then compared using the Mann-Whitney U-Test. Chi-square analysis was used for comparison of categorical data. All analyses were run as two-tailed tests and results of analyses were considered significant if the resultant p value was less than or equal to 0.05. Analyses were performed using SPSS 19.0 (2010. IBM Corp, Armonk, NY).

RESULTS

Of the patients presenting to the ED during the study period, 654 presented with a chief complaint of abdominal pain. One hundred thirteen of these patients presenting with abdominal pain (17.3%) required a consult from a general surgeon, either as a documented over the phone consultation between the ED provider and the surgeon or as an in-person evaluation. Four patients were excluded because they were below the age of 18 or prisoners and eleven patients were excluded due to incomplete documentation, leaving 98 patients as the focus of this investigation.

Table 1 lists the demographic, physical characteristics, laboratory values, and final diagnoses in the groups seen by either an emergency physician or a PA/APRN. The majority (61.2%) of patients initially were evaluated by an emergency physician and self-identified as white (81.6%) with one person declining to answer. The median age of these patients was 53.5 years. The majority (63.3%) were obese/overweight. Overall, there was not a significant difference in sex, race, or vitals between the two groups; however, patients first seen by an emergency physician were older (62.0 vs. 45.5 years of age; $p = 0.017$), more often had elevated creatinine levels (46.7% vs. 25.7%; $p = 0.043$), and were more often anemic (28.3% vs. 14.3%; $p = 0.008$). There was no statistically significant difference ($p = 0.073$) in blood pressure between the two groups; however, all the hypotensive patients in this study were seen by emergency physicians (five patients). While the median emergency severity index score was 3 for both groups, the distribution of scores indicated that patients with scores indicative of more critical issues were seen more often by an emergency physician. Emergency physicians saw

more patients with a score of 1 or 2 (21.6% of patients) compared to those seen by a PA/APRN (5.3% of patients; $p = 0.014$).

There was a high rate of use of laboratory evaluation (98%; Table 2). There was a trend for increased ordering of CBCs by emergency physicians (100% vs. 94.7%; $p = 0.073$). Emergency physicians were found to order both lactic acid (33.3% vs. 13.2%; $p = 0.026$) and comprehensive metabolic panels (CMPs; 100% vs. 92.1%; $p = 0.027$) more often than PA/APRNs. There was also a high rate of radiographic evaluation, although there was not a significant difference between total number of studies ordered by either group. Emergency physicians ordered significantly more computed tomography (CT) scans than PA/APRNs (88.3% vs. 68.4%; $p = 0.015$), while PA/APRNs ordered a higher percentage of CT scans with intravenous contrast (88.5% vs. 60.4%; $p = 0.011$).

Table 3 demonstrates the difference in outcomes between the two groups. There was no significant difference in disposition from the ED, hours in the ED (6.1 vs. 5.7 hours; $p = 0.519$), or hours to in-ED surgical consult (3.4 vs. 3.3 hours; $p = 0.298$) between those first seen by emergency physicians or PA/APRNs, respectively. There was also no significant difference between time to consult (12.4 vs. 55.7 hours; $p = 0.237$) for patients who were admitted to a non-surgical service and subsequently required a general surgery consult. While there was no significant difference between initial provider and proportion going to the operating room, there was a trend for longer time to the operating room for those patients first seen by an emergency physician (29.5 vs. 12.0 hours; $p = 0.075$). This difference was not seen when evaluating time to surgical consult either for patients who received in-ED surgical consult or for those admitted to a non-surgical service who subsequently received a post-ED surgical consult (99.8 vs. 39.5 hours; $p = 0.245$). There was general concordance between ED provider diagnosis and final surgical diagnosis, with 81.7% of those seen by an emergency physician in concordance compared to 73.7% of those seen by a PA/APRN ($p = 0.348$). Hospital length of stay was significantly longer for those patients first seen by an emergency physician compared to those first seen by a PA/APRN (four days vs. one day; $p = 0.001$). This included those who were discharged from the ED, which was 10.0% of patients seen by an emergency physician and 23.7% of patients seen by a PA/APRN; although this did not reach statistical significance, it showed a trend toward significance ($p = 0.067$). This difference in hospital length of stay remained higher for patients first seen by an emergency physician for those patients that were admitted to the hospital, excluding those discharged home from the ED (4.5 vs. 2.0 days; $p = 0.002$).

Finally, there was a difference in the number and type of diagnoses seen in each group (Table 4). PA/APRNs did not see any patients with perforated viscera or organ space infections, whereas perforated viscus was one of the more frequent diagnoses seen by emergency physicians (nine patients). Emergency physicians also treated all the patients with superficial or deep infections (four patients). Overall, emergency physicians also saw more patients with hernias (seven vs. two patients) while PA/APRNs saw more patients diagnosed with bowel obstructions (12 vs. 9 patients).

Table I. Comparison of patient demographics, initial vitals, and initial laboratory values between patients first evaluated by an emergency physician versus those first evaluated by a physician assistant (PA) or advanced practice registered nurse (APRN).

Variable	All Patients	Study Group		p Value
		PA/APRN	Emergency Physician	
Number of patients	98 (100%)	38 (39.8%)	60 (61.2%)	---
Age (years)	53.5 (40.0 - 66.0)	45.5 (40.0 - 58.3)	62.0 (40.3 - 72.0)	0.017
Gender [†]				0.800
Male	48 (49.0%)	18 (47.4%)	30 (50.0%)	
Female	50 (51.0%)	20 (52.6%)	30 (50.0%)	
White race	80 (81.6%)	31 (81.6%)	49 (83.1%)	0.852
Body mass index (BMI) (kg/m ²) [‡]				0.260
Underweight (BMI < 18.5)	2 (2.5%)	1 (3.7%)	1 (1.9%)	
Normal weight (BMI 18.5 - 24.9)	27 (34.2%)	6 (22.2%)	21 (40.4%)	
Overweight or obese (BMI > 24.9)	50 (63.3%)	20 (74.1%)	30 (57.7%)	
Heart rate (HR)				0.733
Bradycardia (HR < 60)	4 (4.1%)	1 (2.6%)	3 (5.0%)	
Normal HR (HR 60 - 90)	54 (55.1%)	20 (52.6%)	34 (56.7%)	
Tachycardia (HR > 90)	40 (40.8%)	17 (44.7%)	23 (38.3%)	
Temperature (°C)				0.959
Hypothermic (< 35.8)	3 (3.1%)	1 (2.6%)	2 (3.4%)	
Normothermic (35.8 - 37.3)	87 (89.7%)	34 (89.5%)	53 (89.8%)	
Hyperthermic (> 37.3)	7 (7.2%)	3 (7.9%)	4 (6.8%)	
Systolic blood pressure (SBP) (mmHg)				0.073
Hypotensive (SBP < 90)	5 (5.1%)	0 (0.0%)	5 (8.3%)	
Normotensive (SBP 90 - 140)	59 (60.2%)	21 (55.3%)	38 (63.3%)	
Hypertensive (SBP > 140)	34 (34.7%)	17 (44.7%)	17 (28.3%)	
White Blood Cell Count (WBC) (cells x 10 ³ /uL)				0.643
Lymphopenia (< 4.8)	5 (5.3%)	1 (2.9%)	4 (6.8%)	
Normal WBC (4.8 - 10.8)	42 (44.7%)	15 (42.9%)	27 (45.8%)	
Leukocytosis (> 10.8)	47 (50.0%)	19 (54.3%)	28 (47.5%)	
Creatinine (mg/dL)				0.043
Normal Creatinine (< 1.03)	58 (61.1%)	26 (74.3%)	32 (53.3%)	
Elevated Creatinine (≥ 1.03)	37 (38.9%)	9 (25.7%)	28 (46.7%)	
Carbon dioxide (mEq/L)				0.108
Hypocarbica (< 22)	23 (24.2%)	5 (14.3%)	18 (30.0%)	
Normal (22 - 32)	71 (74.7%)	29 (82.9%)	42 (70.0%)	
Hypercarbia (> 32)	1 (1.1%)	1 (2.9%)	0 (0.0%)	
Hemoglobin (gm/dL)				0.008
Anemia (< 12)	22 (23.2%)	5 (14.3%)	17 (28.3%)	
Normal (12 - 16)	61 (64.2%)	21 (60.0%)	40 (66.7%)	
Elevated hemoglobin (> 16)	12 (12.6%)	9 (25.7%)	3 (5.0%)	
Bilirubin (mg/dL)				0.164
Normal bilirubin (< 1.2)	71 (74.7%)	29 (82.9%)	42 (70.0%)	
Hyperbilirubinemia (> 1.2)	24 (25.3%)	6 (17.1%)	18 (30.0%)	

Table 1. Comparison of patient demographics, initial vitals, and initial laboratory values between patients first evaluated by an emergency physician versus those first evaluated by a physician assistant (PA) or advanced practice registered nurse (APRN). cont.

Variable	All Patients	Study Group		p Value
		PA/APRN	Emergency Physician	
ED Emergency Severity Index Score	3 (3 - 3)	3 (3 - 3)	3 (3 - 3)	0.014
1	5 (5.1%)	0 (0.0%)	5 (8.3%)	
2	10 (10.2%)	2 (5.3%)	8 (13.3%)	
3	82 (83.7%)	35 (92.1%)	47 (78.3%)	
4	1 (1.0%)	1 (2.6%)	0 (0.0%)	

**Presented as n (%) or median (interquartile range).

†One patient did not have a race listed.

‡Nineteen patients did not have a height or weight listed.

Table 2. Comparison of laboratory test and imaging ordering patterns between patients first evaluated by an emergency physician versus those first evaluated by a physician assistant (PA) or advanced practice registered nurse (APRN).*

Variable	All Patients	Study Group		p Value
		PA/APRN	Emergency Physician	
Number of patients	98 (100.0%)	38 (38.8%)	60 (61.2%)	---
Complete blood count	96 (98.0%)	36 (94.7%)	60 (100%)	0.073
CMPs	95 (96.9%)	35 (92.1%)	60 (100%)	0.027
Lactic acid	25 (25.5%)	5 (13.2%)	20 (33.3%)	0.026
Total labs	4 (4 - 5)	4 (4 - 5)	5 (4 - 6)	0.122
Ultrasound	20 (20.4%)	10 (26.3%)	10 (16.7%)	0.248
CT	79 (80.6%)	26 (68.4%)	53 (88.3%)	0.015
CT with contrast	55 (69.6%)	23 (88.5%)	32 (60.4%)	0.011
CT and Ultrasound	10 (10.2%)	5 (13.2%)	5 (8.3%)	0.442
Number of in-ED imaging studies ordered by ED provider	1 (1 - 1)	1 (1 - 1)	1 (1 - 2)	---
0	12 (12.2%)	8 (21.1%)	4 (6.7%)	0.062
1	64 (65.3%)	24 (63.2%)	40 (66.7%)	
2	17 (17.3%)	3 (7.9%)	14 (23.3%)	
3	4 (4.1%)	2 (5.3%)	2 (3.3%)	
4	1 (1.0%)	1 (2.6%)	0 (0.0%)	
Total number of in-ED studies ordered by non-ED provider	0 (1 - 1)	0 (0 - 0)	0 (0 - 0)	0.560
0	92 (93.9%)	35 (92.1%)	57 (95.0%)	
1	6 (6.1%)	3 (7.9%)	3 (5.0%)	

*Presented as n (%) or median (IQR).

CT = computed tomography; ED = emergency department; CMP = complete metabolic panel

Table 3. Comparison of hospital outcomes and diagnostic concordance between patients first evaluated by an emergency physician versus those first evaluated by a physician assistant (PA) or advanced practice registered nurse (APRN).*

Variable	All Patients		Study Group				p Value
			PA/APRN		Emergency Physician		
Number of patients	98	100%	38	38.8%	60	61.2%	---
Disposition from ED							0.170
Discharged home	98	14 (14.3%)	38	8 (21.1%)	60	6 (10.0%)	
Admitted to surgery	98	58 (59.2%)	38	23 (60.5%)	60	35 (58.3%)	
Admitted to other service	98	26 (26.5%)	38	7 (18.4%)	60	19 (31.7%)	
Death in ED	98	0 (0.0%)	38	0 (0.0%)	60	0 (0.0%)	
Time in ED (hours)	98	5.9 ± 2.5	38	5.7 ± 2.6	60	6.1 ± 2.4	0.519
Time to surgical consult (hours)	97	3.3 (2.5 - 4.6)	37	3.3 (1.9 - 4.4)	60	3.4 (2.5 - 5.3)	0.298
Time to surgical consult (hours) for in-ED consults	86	3.3 (2.3 - 4.2)	35	3.3 (1.9 - 4.1)	51	3.2 (2.4 - 4.3)	0.571
Time to surgical consult (hours) for post-ED consults	11	12.4 (6.5 - 22.5)	2	55.7 (12.4 - 99.0)	9	12.4 (6.3 - 20.3)	0.237
Operative intervention	97	47 (48.5%)	38	15 (39.5%)	59	32 (54.2%)	0.156
Time to OR (hours)	47	24.4 (10.2 - 85.5)	15	12.0 (8.0 - 79.1)	32	29.5 (11.2 - 113.1)	0.075
Time to OR (hours) for in-ED consults	40	18.7 (10.2 - 76.6)	13	12.0 (8.4 - 56.6)	27	23.4 (10.2 - 113.1)	0.220
Time to OR (hours) for post-ED consults	7	79.1 (24.7 - 113.1)	2	39.5 (0 - 79.1)	5	99.8 (50.4 - 127.7)	0.245
Hospital LOS (days)	96	2.0 (1.0 - 5.8)	38	1 (0.8 - 2.5)	58	4 (1.0 - 8.3)	0.001
Hospital LOS (days) for those not discharged home from the ED	84	3.0 (1.0 - 6.8)	30	2.0 (1.0 - 4.3)	54	4.5 (2.0 - 9.0)	0.002
Diagnostic concordance	98	77 (78.6%)	38	28 (73.7%)	60	49 (81.7%)	0.348

*Presented as n (%), median (IQR), or mean ± standard deviation.

ED = emergency department; OR = operative intervention; LOS = length of stay

Table 4. Concordance of ED and hospital discharge diagnosis between patients first evaluated by an emergency physician versus those first evaluated by a physician assistant (PA) or advanced practice registered nurse (APRN).*

Diagnosis	Number at ED Discharge	Study Group	
		PA/APRN	Emergency Physician
Number of patients	98 (100%)	38 (38.8%)	60 (61.2%)
Bowel Obstruction	21 (21.4%)	12 (31.6%)	9 (15.0%)
Concordant with final diagnosis	16 (76.2%)	8 (66.7%)	8 (88.9%)
Appendicitis	11 (11.2%)	5 (13.2%)	6 (10.0%)
Concordant with final diagnosis	9 (81.8%)	4 (80%)	5 (83.3%)
Benign Biliary	9 (9.2%)	3 (7.9%)	6 (10.0%)
Concordant with final diagnosis	8 (88.9%)	3 (100%)	5 (83.3%)
Hernia	9 (9.2%)	2 (5.3%)	7 (11.7%)
Concordant with final diagnosis	7 (77.8%)	2 (100%)	5 (71.4%)
Perforated Viscus	9 (9.2%)	0 (0.0%)	9 (15.0%)
Concordant with final diagnosis	8 (88.9%)	-	8 (88.9%)
Cholecystitis	7 (7.1%)	4 (10.5%)	3 (5.0%)
Concordant with final diagnosis	6 (85.7%)	3 (75.0%)	3 (100%)
Benign Bowel Complaint	5 (5.1%)	2 (5.3%)	3 (5.0%)
Concordant with final diagnosis	2 (40.0%)	1 (50.0%)	1 (33.3%)
Post-Operative Problem	5 (5.1%)	2 (5.3%)	3 (5.0%)
Concordant with final diagnosis	5 (100%)	2 (100%)	3 (100%)
Skin or Organ Space Infection	4 (4.1%)	0 (0.0%)	4 (6.7%)
Concordant with final diagnosis	4 (100%)	-	4 (100%)

Table 4. Concordance of ED and hospital discharge diagnosis between patients first evaluated by an emergency physician versus those first evaluated by a physician assistant (PA) or advanced practice registered nurse (APRN).* *cont.*

Diagnosis	Number at ED Discharge	Study Group	
		PA/APRN	Emergency Physician
Pancreatitis	3 (3.1%)	2 (5.3%)	1 (1.7%)
Concordant with final diagnosis	3 (100%)	2 (100%)	1 (100%)
Other	15 (15.3%)	6 (15.8%)	9 (15.0%)
Concordant with final diagnosis	9 (60.0%)	3 (50.0%)	6 (66.7%)

*Presented as n (%).

DISCUSSION

This study demonstrated that the majority of patients presenting to this ED with abdominal pain who receive a surgical consult will be admitted to the hospital (85.7%), although most will not require operative intervention. The rate of operative intervention (48.5%) was somewhat higher than the rate of 28.8% found by Gale et al.¹ in their analysis of the Nationwide Inpatient Sample. Our patient population had a comparable average age (53.5 years) to their national data (58 years), and the most common diagnoses of bowel obstruction, appendicitis, hernia, perforated viscus, and benign biliary complaint in our study were compatible with the most common procedures performed nationally (cholecystectomy, appendectomy, laparotomy, partial small bowel resection, partial colectomy, and operative management of peptic ulcer disease).¹³ Our higher operative rate may be accounted for by the data of the study, as Gale et al.¹ found an increase in operations by 32.3% from 2001 to 2010; furthermore, our study population was restricted to patients with abdominal pain, whereas their study population was derived from the National Inpatient Sample.

This study demonstrated widespread use of laboratory and radiographic evaluation of patients prior to and in conjunction with surgical consult among emergency physicians and PA/APRNs. There was a statistically significant difference in the rate of CT usage between emergency physicians and PA/APRNs, with emergency physicians having a higher use of CT scans and CT scans without contrast. This finding differed compared to other studies that have demonstrated modest increase in resources by PA/APRNs compared to emergency physicians.^{14,15} For example, Aledheim et al.¹⁵ demonstrated 4.5 more radiographs and 1.7 more CTs ordered by PA/APRNs than emergency physicians; however, this was adjusted for patient acuity, annual volume, and attending hours. The older population had a higher proportion of patients with elevated creatinine, which could be a marker of renal failure, as well as the higher rate of perforated viscus as an underlying diagnosis seen by emergency physicians in our study and may account for the higher use of CT scans and particularly CT scans without contrast by emergency physicians. When looking at the rate of obtaining both an ultrasound and a CT, PA/APRNs had a higher percentage of ordering both (13.2%) than emergency physicians (8.2%), although this was not statistically significant ($p = 0.442$). PA/APRNs also tended to order more in-ED imaging studies with higher percentages ordering more than two in-ED imaging studies than emergency physicians (7.8%

vs. 3.3%), although this was not statistically significant ($p = 0.062$).

While there was no statistically significant difference in the number of radiographic studies ordered per patient in the ED between the two groups, the institution may have a high rate of CT usage (80.6%). In comparison, a study by Ijaz et al.¹⁶ demonstrated a rate of CT usage in 55% of patients with abdominal pain and a review of CT usage by Larson et al.¹⁷ demonstrated a rate of 12.8% in 2007. However, our population consisted of patients with abdominal pain who went on to receive a surgical consult, which likely affected the use of CT ordering in the patient population.

There was no difference between the two groups in terms of disposition from the ED, time in the ED, or time to surgical consult. While this study did not evaluate the odds ratio (OR) of surgical consultation in the ED population, Ulloa et al.¹⁸ reported a lower rate of general surgical consultation from physicians compared to PA/APRNs in the outpatient setting (adjusted OR 0.66). Our total rate of surgical consultation request for patients presenting with abdominal pain as a chief complaint was 17.3% (113/654 patients). The evaluation of time to surgical consult specifically in the ED between physicians and PA/APRNs represented a novel area of inquiry in the literature.

Similarly, there was a paucity of data regarding diagnosis from the ED and final surgical diagnosis. This study overall demonstrated a concordance between diagnosis in the ED and final diagnosis (78.6%). This can assure the surgical consultant being called by ED colleagues that the need for surgical evaluation is legitimate. While just under one-half of this study population (48.5%) required operative intervention, this was reflective of underlying diagnoses in this population. Of those that required operative intervention, the variability of time to the operating room was also likely reflective of underlying diagnoses as well as systemic factors. For example, Davis et al.¹⁹ saw a decrease in time from 48.4 to 16.6 hours from radiographic diagnosis to the operating room with the development of a specific emergency general surgery service, and Smith et al.²⁰ showed an increased likelihood of mortality in those receiving an urgent surgery after a weekend admission compared to a weekday (OR 1.27; CI 1.08 - 1.49). Delaying operative intervention for those needing emergency surgery has been associated with a higher mortality rate, as McIsaac et al.²¹ demonstrated with an OR of 1.59 (CI 1.30 - 1.93) in a 2017 study, and as Nawijn et al.²² demonstrated with improved survival for those with operative intervention in under 12 hours from presentation with an OR of 0.41 (CI 0.27 - 0.61). Out of

ED mortality was not evaluated in our study. However, there was wide variability in time to the operating room for patients for whom surgical consults were placed after admission.

The longer hospital length of stay seen in those patients first evaluated by an emergency physician likely is reflective of the higher rate of perforated viscus and deep organ space infection seen by the emergency physician cohort, whereas PA/APRNs did not see any patients with perforated viscus. The emergency physicians also saw more patients with Severity Index scores of 1 or 2, reflecting that they cared for patients with more urgent and life-threatening issues. The older age of the patient population seen by emergency physicians also likely was associated with longer length of stay as a marker of increased frailty and a higher American Society of Anesthesiologists score as seen by Eamer et al.²³ who found increased hospital length of stay with an adjusted ratio of 1.24.

Limitations. This study was limited by its retrospective nature as well as the population size. The institution has 24-hour general surgical coverage with in-house residents, which may increase the use of general surgical consult compared to a facility without in-house coverage.

CONCLUSIONS

This study highlighted the rapid and extensive work-up that patients with abdominal pain who receive a surgical consult receive prior to ED disposition. There were some differences in imaging and laboratory use between PA/APRNs and emergency physicians, but hospital length of stay likely more was impacted by underlying patient diagnosis. Although PA/APRNs saw younger patients with lower rates of hypotension, anemia, and elevated creatinine, there was minimal effect on time in the ED or time to surgical consult. Further research is needed to determine appropriate initial evaluation of these surgical patients prior to and in conjunction with surgical consult.

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Keywords: general surgery, emergency department, physicians assistant, advanced practice nursing, evaluation study