

Comparison of Appendicitis Outcomes Between Teaching and Nonteaching Hospitals in Salah Al-Deen Province, Iraq.

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ABSTRACT

Background: Appendicitis is one of the most common surgical emergencies encountered by surgeons, and appendectomy is the most common surgical emergency operation done by general surgeons. At the teaching hospital, the surgical residents are actively involved in all aspects of patient care including preoperative preparation, operatively as the primary surgeon in appendectomy and postoperative follow up. Senior resident surgeons typically serve as teaching assistants for the appendectomy cases under attending supervision. In contrast, no residents are present at the nonteaching institutions, and the attending surgeon performs all aspects of patient care.

Objectives: to determine the outcomes of appendicitis between a teaching and nonteaching hospital, in order to document the effect of residents acting as the surgeon for a surgical procedure .

Methods: A prospective study involved all patients with acute appendicitis, aged (10-50) years admitted either to Tikrit Teaching Hospital (TTH), or to Shirqat General Hospital (SGH) , which is nonteaching, during the period from January 2013, to June 2014. Patient's factors including: age, gender, and the presence of perforation were collected. Outcome variables were 30-day morbidity including wound infection, postoperative abscess drainage, and re-admission and length of hospitalization (LOH) recorded and compared between the two hospitals. Patients with perforated appendicitis treated nonoperatively were excluded from the analysis.

Results: One thousand, six hundreds, eighty-four (1684) patients were treated at the teaching institution(TTH) with mean age was 15.6 years, 58% males, and 738 patients at the nonteaching SGH with mean age of 17 years, 61% male. The perforated appendicitis rate was 20.3% at the teaching institution and 19.9% at the nonteaching institution . A 45 (13%) patients with perforated appendicitis were successfully treated nonoperatively at TTH and 8 (5.5%) at SGH.

For nonperforated appendicitis, rates of wound infection & postoperative abscess drainage were higher at the non teaching hospital with (2.7% vs. 1.8% ,and 1.3% vs. 0.6% respectively), the 30 days re-admission was higher at the teaching institution (2.2% vs. 2.0%). LOH was shorter in the teaching institution (1.0 ± 1.4 vs. 1.8 ± 1.2 days). For perforated appendicitis, lower rates of wound infection (10% vs. 24.4%) and abscess drainage (9.8% vs.11.5%) at TTH. The LOH is shorter at TTH($2.5 \pm 4.2d$) vs. ($3.3 \pm 5d$). The 30 days re-admission is the same (10.8%).

Conclusions: This study found that LOH was shorter in TTH than in SGH for both perforated and non perforated appendicitis. Regarding patients with perforated appendicitis, there was a lower rate of wound infection, with a higher percentage for those who were successfully treated non-operatively. So, the presence of surgical residents did not adversely affect the quality of care for patients with appendicitis.

Key words: appendicitis, Tikrit Teaching Hospital(TTH), nonteaching hospital.

Introduction

Appendicitis is one of the most common surgical emergencies encountered by surgeons. 1 At the teaching institutions, the surgical residents are actively involved in all aspects of patient care. They are the first to see consultations in the emergency room, serve as the primary surgeon, direct the postoperative care, & may participate in the follow up of patients at the out patient's clinic.2

In contrast, no residents are present at the nonteaching institution, and the attending surgeon performs all aspects of patient care. (2,3)

Thus, surgical residents gain experience managing patients with appendicitis early in their training. Because of this early exposure and experience performing appendectomy, this case is an ideal procedure for senior residents to assume the role of teaching assistant and lead junior residents through the procedure. 3

In addition to educating and training future generations of surgeons, academic surgeons have the dual responsibility of providing the best possible care to their patients. Therefore, it is important to document the effect of residents who act as the operating surgeon for a surgical procedure.4 Few studies have evaluated surgical outcomes at teaching hospitals in comparison with nonteaching hospitals. Thus, we chose to study the outcomes after the management of appendicitis in a teaching and nonteaching institution within the same province where the general health guidelines are even, aiming

to determine the effect of resident participation on the quality of care.

Patients & Methods

A prospective study involved all cases of acute appendicitis aged (10-50) years admitted either to Tikrit Teaching Hospital(TTH), or to Shirqat General Hospital(SGH) , which is nonteaching, during the period from January 2013, to June 2014. The study was accepted by the ethical committee of college of medicine, Tikrit University and Salah Al-Deen directorate of health.

Patient's factors collected included age, gender, and the presence of perforation. Outcome variables were 30-day morbidity and length of hospitalization (LOH). Thirty-day morbidity included wound infection, postoperative abscess drainage, and re-admission. Data were collected via a specially prepared questionnaire & recorded since the time of admission, till the patients discharged home and then followed postoperatively for 30 days during their visits to the hospitals' outpatient clinics, or to the surgeons' private clinics. Outcomes of patients with appendicitis were compared between Tikrit Teaching Hospital (TTH) and Shirqat General Hospital (SGH). Patients with perforated appendicitis treated nonoperatively were excluded from the analysis; however, the number of those patients was recorded.

The collected data were statistically analyzed using statistical package for social science (SPSS) version 17, while Z-test was used to compare the statistical difference among variables. A p value of ≤ 0.05 was regarded as statistically significant.

Results

One thousand, six hundreds, eighty-four (1684) patients were treated at the teaching institution(TTH) with mean age 15.6 years, and 58% of them were males (977 patients), while 738 patients at the nonteaching Shirqat hospital (SGH) with a mean age of 17 years, and 61% male(450 patients) as shown in (table 1). The perforated appendicitis rate was 20.3% at the teaching institution and 19.9% at the nonteaching institution ($P=0.64$).

Regarding patients admitted with perforated appendicitis. There were 342 patients managed at TTH as 297 patients (87%) treated operatively by appendectomy, while the remaining 45 patients (13%) treated non-operatively. On the other hand a 147 patients were treated at SGH, where a significantly lower percentage (only 8 patients, 5.5%) of non-operative treatment practiced as compared to TTH with $p=0.01$, while 139 patients (94.5%) were operatively treated as explained below in table 2. Those patients who treated conservatively were excluded from the final analysis.

Table 3, summarizes the results with respect to postoperative morbidity and LOH for patients with nonperforated appendicitis. Rates of wound infection and postoperative abscess drainage were higher at the non teaching hospital with percentages of 2.7% versus 1.8% ($p=0.19$), and 1.3% vs 0.6% ($p=0.13$) respectively, while the rate of readmission within 30 days were slightly higher at the teaching institution ($p=0.7$). Length of hospitalization was shorter in TTH (1.0 ± 1.4 vs 1.2 ± 1.8 days; $P=0.007$) for nonperforated appendicitis.

For perforated appendicitis, lower rates of wound infection (teaching = 10% vs. nonteaching = 24.4%, $p=0.0001$) and also for abscess drainage (9.8% vs. 11.5%, $p=0.46$) were noted at the teaching hospital. While the LOH is again shorter at TTH(2.5 ± 4.2), than at SGH(3.3 ± 5), $p=0.0001$. The overall 30 days re-admission is nearly the same between both study groups (10.8), $p=0.83$.

Discussion

Appendectomy is the most common emergency procedure performed by general surgeons. Residents in general surgery gain extensive experience with managing appendicitis early in their training and learn to perform laparoscopic or open appendectomy under the supervision of an attending surgeon. 5

The academic surgeon has the dual responsibility of ensuring the best possible care to patients while simultaneously training and educating future generations of surgeons. On one hand, the recent recommendations by the Institute of Medicine call for further work hour restrictions as well as increased supervision for residents, to minimize errors and improve quality of care. 6 On the other hand, training programs in surgery follow a model of graded responsibility. The program requirements for surgery state that operative skill is essential and can be acquired only through personal experience. 7

Previous studies examining other procedures and health conditions have shown contrasting outcomes with respect to the quality of care at teaching institutions. Ayanian et al. performed a retrospective study of congestive heart failure and pneumonia outcomes study in

Medicare beneficiaries and found that the quality of care was rated better in the teaching hospitals.⁸ This same group of authors performed a meta-analysis of the literature and found that teaching hospitals provide moderately strong evidence of better quality and lower risk-adjusted mortality for elderly patients with common conditions, such as acute myocardial infarction, congestive heart failure, and pneumonia. A few studies, however, found nursing care, pediatric intensive care, and some surgical outcomes to be better in nonteaching hospitals.⁹ Khuri et al. specifically have evaluated surgical outcomes by performing a study of the Veteran's Administration database for all noncardiac operations. They found that, in comparison with nonteaching hospitals, the patient populations in teaching hospitals had a higher prevalence of comorbid conditions, underwent more complex operations, and had longer operation times. Risk-adjusted mortality rates were not different between the teaching and nonteaching hospitals in the specialties and operations studied. The unadjusted complication rate was higher in teaching hospitals in 6 of 7 specialties and in 4 of 8 operations. Length of stay after major operations was not consistently different between teaching and nonteaching hospitals. The limitations of the aforementioned studies are that they evaluate outcomes of complex procedures where residents typically play the role of an assistant rather than act as the primary surgeon.² Looking at more routine operations, Hwang et al. performed an analysis of outcomes of bowel resection, laparoscopic cholecystectomy, hernia, mastectomy, and appendectomy of 4

attendings who worked with residents versus 4 who did not. Comparing all procedures together, no differences were found in complications between the groups, although greater mortality, a greater duration of stay, and higher costs occurred in the resident group. When comparing the 5 most common procedures individually, no difference was noted in complications or mortality, although a greater length of stay and higher costs were observed in the teaching group.³

In general, previous studies have shown that quality of care was similar at teaching institutions. (3,10,11,12,13) A prior study compared 1 teaching and 1 nonteaching hospital, found comparable quality of care when outcomes for pediatric appendicitis were analyzed. 4 Another, but a multi-institutional study revealed a higher wound infection rate at the teaching institution for both nonperforated appendicitis and perforated appendicitis, besides a lower rate of postoperative abscess drainage for nonperforated appendicitis in the teaching institution. 5

In the current study, an unexpected finding was that rates of wound infection and postoperative abscess drainage were lower in patients with both perforated & non-perforated appendicitis at teaching hospitals even that was not statistically significant. Given the relative inexperience of surgical residents on gentle tissue handling, one would have expected the opposite results for wound infection. It may be that tissue handling is not as crucial for appendectomy given the small wounds.⁵

The lower wound infection rate at teaching institutions also may be a result of the difference in severity of the clinical illness associated with perforated

appendicitis at the different institutions. Other explanation may be the high standards of sterilization techniques that practiced in the TTH, added the virtue the presence of resident doctors who implement preoperative & postoperative care, that are deficient in Shirqat hospital.⁴

According to Steven et al, showed similar postoperative morbidity in pediatrics appendicitis managed in teaching & non teaching hospitals.⁴ However, in his other multi-institutional survey, he observed a lower postoperative morbidity in cases of perforated appendicitis at the teaching hospitals.⁵

Previous studies that showed similar outcomes at teaching institutions were typically at the expense of longer LOH associated with resident care.^(3,5,14) A study by Hutter et al. in the evaluation of pancreatic resections demonstrated improved outcomes at the teaching hospitals; however, they found a longer length of stay.¹⁰ Similarly, a study evaluating abdominal aortic aneurysm repair found a lower mortality rate at teaching hospitals, although the length of stay was longer.¹⁵ Unlike these prior studies that demonstrated longer length of stays at teaching facilities, we found a decrease in LOH for patients with both groups of perforated and nonperforated appendicitis.

One possible explanation for this finding is that more patients at the teaching institution may have been discharged in the evening rather than the next morning given the availability of the resident team. If this were indeed the case, then this would have led to substantial cost savings in this group of patients making this finding clinically significant, though the

overall cost efficacy had not been studied here. Some authors observed a cost efficacy in regard to resident participation.^(14,16)

This finding mismatches that of Steven et al, who also noticed a slightly lower LOH period in the non-perforated cases, but a similar LOH in the perforated group.⁴

The present study also found that patients with perforated appendicitis were more likely to be managed nonoperatively at the teaching TTH. A potential explanation for this finding is that teaching institutions were more motivated to implement an evidence-based technique of nonoperative management based on research studies.^(17, 18,19)

Despite a higher rate of postoperative wound infection and abscess drainage in the non-teaching hospital, there was a similar re-admission rate within 30 days in the perforated cases, even a slightly lower in the non-perforated appendicitis, if compared with the teaching hospital.

This observation can relate to the difference in the quality of surgical patients, keeping in mind that all patients (including appendicitis) with comorbid medical diseases & those who may need an ICU admission are usually referred from general hospitals with limited facilities to TTH. So, the readmission within a month following appendicectomy might be for other non-surgical indications, added is the shortage of beds at Shirqat general hospital that limits unnecessary admissions.

This study concluded that the LOH was shorter in TTH than in SGH for both perforated and non perforated appendicitis. Regarding patients with perforated appendicitis, there was a lower rate of wound infection, with a higher

percentage who were successfully treated non-operatively. Thus the presence of surgical residents in TTH did not adversely affect the outcome of appendicitis.

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Table 1: Demographics of patients in both hospitals.

	Teaching hospital (TTH)	Non-teaching hosp.(SGH)	P
Female: male	1: 1.3	1: 1.5	0.08
Mean age(yrs)	15.6	17	0.6
Non-perforated	1342 (79.7%)	591 (80.1%)	0.9
Perforated	342 (20.3%)	147 (19.9%)	0.64
Total	1684 (100%)	738 (100%)	

Table 2: Distribution of patients with perforated appendicitis.

	Teaching hospital(TTH)	Non-teaching (SGH)	P
Operative	297 (87%)	139 (94.5%)	0.5
Non-operative	45 (13%)	8 (5.5%)	0.01
Total	342 (100%)	147 (100%)	

Table 3: Postoperative morbidity and LOH for patients with nonperforated appendicitis.

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	Teaching	Nonteaching	P
Wound infection	24 (1.8%)	16 (2.7%)	0.19
Abscess drainage	9 (0.6%)	8 (1.3%)	0.13
Re-admission within 30 days	30 (2.2%)	12 (2.0%)	0.7
LOH (days)	1 ± 1.4	1.2 ± 1.8	0.007

Table 4: Postoperative morbidity and LOH for patients with perforated appendicitis.

	Teaching	Non-teaching	P
Wound infection	30 (10%)	34 (24.4%)	0.0001
Abscess drainage	29 (9.8%)	16 (11.5%)	0.46
Re-admission within 30 days	32 (10.8%)	15 (10.79%)	0.83
LOH (days)	2.5 ± 4.2	3.3 ± 5	0.0001