

ORIGINAL RESEARCH & CONTRIBUTIONS

Are There Differences in Access to Care, Treatment, and Outcomes for Children with Appendicitis Treated at County versus Private Hospitals?

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Abstract

Introduction: We conducted a study to determine whether hospital type (county [ie, safety-net] vs private) affects health care access (appendiceal perforation [AP] rates), treatment (laparoscopic appendectomy [LA] rates), and outcomes in children with appendicitis.

Methods: A review of cases involving children who had appendicitis between 1998 and 2007 was performed. Data from county and private hospitals were compared. Outcomes were AP rates, LA rates, need for postoperative abscess drainage, length of hospitalization (LOH), and cost.

Results: Multivariate analysis confirmed that among 7902 patients, (county = 682; private = 7220), county-hospital patients had lower incomes, higher AP rates, higher LA rates, lower postoperative abscess drainage rates, and longer LOH than did private-hospital patients. The longer LOH at the county institution led to higher costs. Within the county hospital, outcomes were similar across all ethnic groups and income levels.

Conclusions: Children with appendicitis treated at a county hospital were of lower socioeconomic background and had higher AP rates, longer LOH, and higher costs than their counterparts at private hospitals, but were more likely to undergo LA and require less abscess drainage. Within the county hospital, ethnic and socioeconomic disparities were not apparent; thus, these differences between institutions might have been caused by underlying disparities in ethnicity, income, and health care access.

Introduction

Eliminating disparities in health care has become an increasingly important issue for health services research. With respect to surgical care, significant ethnic and socioeconomic differences have led to unequal access to care.¹⁻⁷ Appendicitis is one of the most common surgical emergencies and is also a time-sensitive condition. Delays in treatment increase the risk of appendiceal perforation (AP), and thus AP rates have been used as a proxy to measure access to surgical care.¹⁻³ Differences in ethnicity and socioeconomic status have led to marked differences in AP rates.¹⁻⁷ However, when patients have equal access to care, these differences are eliminated.^{8,9}

Currently, significant ethnic and socioeconomic differences also exist with respect to treatment, as minorities and uninsured or publicly insured patients undergo fewer minimally invasive procedures.¹⁰ Studies of adults and children have shown similar

disparities with respect to laparoscopic appendectomy (LA) in the treatment of appendicitis.¹¹⁻¹³ What remains relatively unknown is whether hospital factors play a role in these disparities. Thus, we conducted a study to determine whether hospital type (county vs private) affects health care access (AP rates), treatment (LA rates), and outcomes in children with appendicitis. We hypothesized that children with appendicitis treated at a county hospital would have worse access to care, treatment, and outcomes.

Methods

Our study was approved by the institutional review board at Kaiser Permanente (KP) Los Angeles Medical Center and Harbor-UCLA Medical Center. A retrospective review of the KP Southern California Discharge Abstract Database was performed to identify pediatric patients (age <18 years) with a diagnosis of appendicitis (*International Classification of Diseases, Ninth Revision* [ICD-9] codes 540.0, 540.1, 540.9) between January 1, 1998, and December 31, 2007. A similar review was performed at Harbor-UCLA.

KP Southern California consists of 11 medical centers and provides comprehensive medical care to more than 3.5 million members. All members are insured and have equal access to any of the KP clinics, Emergency Departments (EDs), and medical centers. Harbor-UCLA is a safety-net hospital that provides care to anyone who presents to the ED independent of insurance, financial, or immigration status. For this study, Harbor-UCLA represents the county hospital and KP represents the private hospitals.

Study outcomes were AP rates, LA rates, need for postoperative abscess drainage, length of hospitalization (LOH), and cost. Independent variables included age, sex, ethnicity, per capita income, and hospital type. With respect to ethnicity, patients were categorized as white, black, Hispanic, Asian, Native American, other, multiple, or unknown. White patients served as the reference group in the multivariate analysis. Patients in the other, multiple, unknown, or Native American categories were excluded from this study. Median per capita income was based on the patient's zip code of residence and extracted from the US Census database. Patients with zip codes outside of California or residing in areas with zip codes for which there was no census data were excluded. Data from the county hospital were compared with those for the private hospitals. Finally, multivariate analyses were performed to determine predictors of AP rate, LA rate, need for postoperative abscess drainage, and LOH. The predictor variables that were assessed included age,

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sex, ethnicity, income level, perforation status, type of operation (laparoscopic vs open), and hospital type (county vs private).

Data were exported to SAS (version 9.13; SAS Institute, Cary, NC) statistical software for subsequent analysis. Statistical significance was determined using Wilcoxon rank-sum test, χ^2 test, and multivariate linear and logistic regression. A *p* value of <0.05 was considered statistically significant.

Results

A total of 7902 patients (county = 682; private = 7220) were identified for our study. Demographic data and results of the univariate analysis are summarized in Table 1. Younger patients were treated at the county hospital, and more male than female patients were treated at the private hospitals. Differences in the ethnic background of the patients were seen between the public and private hospitals. Patients at the county hospital had lower mean per capita incomes (\$11,600 vs \$15,900; *p* < 0.0001), higher AP rates at presentation (42% vs 30%; *p* < 0.0001), higher LA rates (66% vs 43%; *p* < 0.0001), lower postoperative abscess drainage rates (2.2% vs 3.9%; *p* = 0.0008), and longer LOH (3.9 ± 3.3 days vs 2.9 ± 3.4 days; *p* < 0.0001) than did patients at the private hospitals. Multivariate analysis confirmed a higher AP rate (odds ratio [OR], 1.8; confidence interval [CI], 1.5–2.2), LA rate (OR, 2.6; CI, 2.2–31), and LOH (parameter estimate = 0.6; *p* < 0.0001) and lower abscess drainage (OR, 0.4; CI, 0.2–0.6) at the county hospital vs the private hospitals. The longer LOH at the county institution was associated with higher costs (\$2145 per patient). Within the county hospital, AP rate, LA rate, abscess drainage, and LOH were similar across all ethnicities and income levels.

Discussion

Previous studies have shown that members of ethnic minorities and patients with public insurance have higher AP rates, reflecting decreased access to care, compared with whites and patients with private insurance.^{1–7} Furthermore, there have also been ethnic and socioeconomic disparities with respect to the treatment of appendicitis. Studies have shown that members of ethnic minorities and patients with public insurance have less access to advanced technology—namely, laparoscopy—compared with whites and patients with private insurance.^{10–13} In our previous studies, we have shown that disparities in AP rates and LOH were eliminated in a setting of equal health care access.^{8,9} These studies included patients who received health care within a single-provider system in which all patients had insurance and equal access to clinics, urgent-care centers, and EDs. However, the major criticism of our prior studies was that all of the participants had insurance and that patients in the lowest socioeconomic level (unemployed, uninsured, or publicly insured patients) were not specifically addressed. The purpose of the study we report here was to determine whether persons in the lowest socioeconomic level had differences in access to surgical care, treatment, and outcomes with respect to the treatment of appendicitis, compared with persons in higher socioeconomic levels.

To have access to persons in the lowest socioeconomic level, we studied those treated at a safety-net hospital (Harbor-UCLA).

Safety-net hospitals care for the highest percentage of uninsured patients.¹⁴ Our study confirmed that children treated at a safety-net hospital were of lower socioeconomic status, defined as having lower median per capita incomes. The existence of safety-net hospitals is also vital to health care access for the uninsured and unemployed. However, even though safety-net hospitals treat all comers, access continues to be problematic at them, as reflected by higher AP rates compared with private hospitals. Given the financial strain of treating uninsured patients and treating patients with advanced disease, it is not known whether patients treated at safety-net hospitals are treated differently, leading to worse outcomes. We found that access to advanced technology was not problematic at the safety-net hospital, as LA was performed more frequently at the public institution. Furthermore, postoperative morbidity (with respect to abscess drainage) was also lower at the safety-net hospital. However, variability exists in the treatment of postoperative abscess. It may be that more patients at the safety-net hospital were treated with intravenous antibiotics rather than percutaneous drainage, owing to available resources. Thus, the findings of our current study refute those of previous studies that suggest that patients treated at safety-net hospitals have worse outcomes than those treated at private hospitals.¹⁵ An unexpected finding was that the LOH was longer at the safety-net hospital by nearly 24 hours despite the higher use of LA and lower rate of postoperative abscess drainage. We believe that this finding may be because of the existence of fewer available resources for home care for children cared for at safety-net hospitals. Thus, discharge from the hospital may be delayed because of lack of transportation or insufficient home care because the children's parents are working. Unfortunately, the longer LOH leads to higher medical costs to the hospital and society as a whole.

Our study had a number of limitations. Our data came from a discharge database, and the ICD-9 coding of each diagnosis and procedure was not independently validated. Thus, we could not obtain negative appendectomy rates from that database, nor could we determine the duration of symptoms before presentation, both of which might have affected the rates of AP and use of LA. We also were not able to confirm the pathologic diagnosis.

LA was performed more frequently at the public institution. ... and postoperative morbidity was lower ...

Table 1. Demographic data and results of univariate analysis

| Parameter | County hospitals (n = 682) | Private hospitals (n = 7220) | <i>p</i> value |
|----------------------------------|----------------------------|------------------------------|----------------|
| Age | 10.9 ± 4.0 | 11.5 ± 3.7 | 0.0002 |
| Male sex | 345 (50.6%) | 4467 (61.9%) | <0.0001 |
| White | 274 (40.2%) | 1856 (25.7%) | <0.0001 |
| Black | 47 (6.9%) | 363 (5.0%) | 0.04 |
| Asian | 61 (8.9%) | 262 (3.6%) | <0.0001 |
| Hispanic | 295 (43.2%) | 4739 (65.6%) | <0.0001 |
| Mean per capita income | \$11,600 | \$15,900 | <0.0001 |
| Appendiceal perforation | 289 (42.4%) | 2147 (29.7%) | <0.0001 |
| Laparoscopic appendectomy | 452 (66.3%) | 3099 (42.9%) | <0.0001 |
| Abscess drainage | 15 (2.2%) | 279 (3.9%) | 0.0008 |
| Length of hospitalization (days) | 3.9 ± 3.3 | 2.9 ± 3.4 | <0.0001 |

We based income levels on the zip codes of patients' residence. Although this is commonly done in health care research, there is always a bias risk of using aggregate data instead of individual-level measurements. However, previous studies have shown that aggregate statistics from the census-block group is a useful proxy for individual-level measures.¹⁶ Furthermore, we were not able to determine the general and health literacy levels of patients treated at the two types of hospitals. Such variables might have influenced the AP rates. The ethnic diversity in our study may not reflect that of the populations in most other areas of the US, and thus our results may not be applicable nationally. However, the ethnic demographics seen in our study do closely resemble those of Los Angeles County and California as a whole.¹⁷ The sample sizes were different between the two groups, but the sample size difference seen in our study does reflect the ratio of private hospitals to safety-net hospitals in California and did not affect the power of the study.

In summary, we found that children with appendicitis treated at a safety-net hospital were of lower socioeconomic background than those who were treated at private hospitals. We also found a higher AP rate at the safety-net hospital than at private hospitals, indicating delayed access to surgical care. Despite a higher AP rate, disparities in the treatment of and outcomes for children with appendicitis treated at private and safety-net hospitals were minimal. Patients at the safety-net hospital were more likely to undergo LA and require less postoperative abscess drainage than those treated at the safety-net hospital. However, there was a longer LOH at the safety-net hospital, which leads to higher costs. Within the safety-net hospital, there were no disparities related to ethnicity or socioeconomic status with respect to health care access, treatment, or outcomes for children with appendicitis. Thus, the differences between public and private institutions may be caused by underlying ethnic and socioeconomic disparities and by differences in access to health care rather than by the type of hospital where patients are treated. These findings emphasize the need for further health care reform to improve health care access for all. ♦

Disclosure Statement

The author(s) have no conflicts of interest to disclose.

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Toothache

I haven't the slightest idea where fashions in pathology are born ... Possibly some of my older readers dimly recollect the days when modish scientists declared that the only dependable method of relieving a toothache was a clean, conclusive appendectomy.

— Ogden Nash, 1902-1971, American poet