



Original Contribution

Effects of pain severity and CT imaging on analgesia prescription in acute appendicitis[☆]Daniel D. Singer, BA, MS, Henry C. Thode Jr., PhD, Adam J. Singer, MD^{*}

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ARTICLE INFO

Article history:

Received 30 July 2015

Received in revised form 9 September 2015

Accepted 9 September 2015

ABSTRACT

Background: Previously, analgesics were avoided in suspected appendicitis to avoid masking the diagnosis. We determined use of analgesia in patients with appendicitis to determine recent trends over time and explore predictors of use of analgesia.

Methods: A retrospective review of the National Hospital Ambulatory Medical Care Survey 2006–2010 was conducted including emergency department (ED) patients with acute appendicitis (ICD-9-CM 540.xx). The association between demographic and clinical information with ED visit prescription of analgesics/opioids was determined using univariate (χ^2) and multivariate (logistic regression) analyses.

Results: There were an estimated 763,000 ED patient visits for acute appendicitis from 2006 to 2010. Mean age was 32, 74% were under age 19, 69% were male. Sixty-four percent of patients received any analgesia in the ED and 58% received an opioid; use of analgesics did not change over time. Of all patients, 68% had computed tomographic (CT) imaging. There was a positive trend in analgesic use with increasing pain (27% for no pain to 71% for severe pain, $P = .08$); a similar trend was seen for opioids but was not significant ($P = .12$). Analgesic use was lower for elderly (age >65) patients (odds ratio [OR] 0.09, 95% confidence interval [CI] 0.01–0.56) and private insurance (OR 0.14, 95% CI 0.05–0.43), and higher for patients with CT scans (OR 3.73, 95% CI 1.61–8.66). Pain severity was not associated with administration of analgesics after controlling for other factors.

Conclusions: Use of analgesia and opioids analgesia has remained stable over time. Factors associated with prescription of any analgesia and opioids were older age and payment source. Use of CT was associated with prescription of analgesics.

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1. Introduction

Acute appendicitis is the most common surgical emergency presenting to the emergency department. A recent study based on the Nationwide Inpatient Sample discharge data and US Census data found that the incidence of acute appendicitis increased from 7.62 per 10,000 in 1993 to 9.38 per 10,000 in 2008 [1].

As early as 1921, Cope and Sile argued that analgesia could alter or mask clinical signs during physical examination [2]. As a result, traditionally, analgesics were withheld prior to definitive diagnosis and a decision to operate, for fear of masking the diagnosis. However, a large body of evidence, both in adults and children, has shown that administration of analgesics does not mask the diagnosis, reducing pain and possibly enhancing the ability to localize the pain and come to a diagnosis.

The largest randomized clinical trial reported to date was performed by Vermeulen et al in Switzerland in 1999 [3]. This study included 340

patients over 16 years of age who presented to the ED with pain in the right lower part of the abdomen and were randomized to morphine 10 mg IV or placebo. Pain relief was greater in the morphine group; among female patients, the decision to operate was appropriate more often in the morphine group; and, in male patients and overall, opioid analgesia did not influence the appropriateness of the decision. A more recent randomized clinical trial of 106 adults between the ages of 16 to 70 with suspected appendicitis also found that abdominal pain was significantly relieved and the patients' cooperation was improved in the morphine group compared with the control group and that the physical signs were unaffected by either treatment [4]. These results have been echoed in several meta-analyses both in children [5] and adults [6]. Poonai et al included 342 children ages 5 to 18 years with suspected acute appendicitis enrolled in six randomized controlled trials comparing opioids and placebo and demonstrated that there was no significant increase in the risk of perforation or abscess associated with opioids in cases of appendicitis (relative risk = 1.03, 95% confidence interval [CI] = 0.55–1.93) [5]. They also found that the pooled reduction in self-reported pain scores after receiving analgesia was 19.6 mm (95% CI = −1.2 to 40.4 mm) lower in those receiving opioid analgesia. Mantenola et al reviewed eight randomized clinical trials that included 923 adult patients randomized to an opioid or placebo and concluded that the use of opioid analgesics in patients with acute

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abdominal pain does not increase the risk of diagnostic error or the risk of error in making decisions regarding treatment [6].

In a study by Tsze et al from 1996 to 2006, the percentage of patients with appendicitis who received a CT scan increased from 6.3% (95% CI 0%–15.3%) to 69% (95% CI 55.5%–81.7%) for adults and from 0% to 59.8% (95% CI 31.6%–87.9%) for children. The same study found that use of pain medications increased from 24.8% (95% CI 11.3%–38.4%) to 69.9% (95% CI 56.7%–83.1%) for adults and from 27.2% (95% CI 5.7%–48.8%) to 42.8% (95% CI 18.1%–67.5%) for children. The proportion of children who received parenteral narcotics (13.7% [95% CI 9.3%–18.0%]) was less than that of adults (23% [95% CI 18.9%–27.1%]). However, in this study the effects of pain severity and CT imaging on analgesic prescription were not explored. Since the tendency to prescribe analgesics to patients with suspected acute appendicitis may be influenced by both pain severity and diagnostic certainty, it is possible that practitioners may be more comfortable prescribing analgesics in general and opioids more specifically in patients undergoing CT imaging which reduces diagnostic uncertainty. Furthermore, patients with severe pain may be more likely to receive analgesia than those with less severe pain. The purpose of the current study was to determine the association between prescription of analgesics (including opioids) and pain severity as well as use of abdominal CT imaging.

2. Methods

2.1. Study design and data source

This study is a secondary analysis of data collected in the National Hospital Ambulatory Medical Care Survey (NHAMCS). As described by its developers, “The NHAMCS is an annual, national probability sample of ambulatory visits made to non-federal, general, and short-stay US hospitals conducted by the Centers for Disease Control and Prevention, National Center for Health Statistics. Although the survey includes visits to selected ambulatory care departments, this analysis focuses solely on the visits to hospital emergency departments (EDs). The multi-staged sample design is comprised of three stages for the ED component: (1) 112 geographic primary sampling units; (2) approximately 480 hospitals within primary sampling units; and (3) patient visits within emergency service areas.” [7] Per NHAMCS protocol, trained hospital staff members abstract ED visit data using a structured data entry form during 4-week data periods randomly assigned for each sampled hospital. The sampled data are extrapolated to national estimates through use of assigned patient visit weights, which account for probability of visit selection, nonresponse, and ratio of sampled hospitals to hospital universe. The study was exempt from review by the institutional review.

2.2. Patients

The study included all patients with an ED diagnosis of acute appendicitis (*ICD-9-CM 540.xx*) who were included in the NHAMCS database during the years 2006 to 2010.

2.3. Data analysis

We report actual ED visits from the hospitals included in the NHAMCS sample, national estimates based on survey visit weights, and 95% CIs based on standard errors provided by NHAMCS. The analyses follow recommendations on the NHAMCS website for using the sampling weights in the dataset to project, for all ED visits in the United States, the proportions with the specified characteristics [7]. Confidence intervals were calculated using standard methods for survey data collected with stratified sampling, based on weights provided by NHAMCS. All estimates conform to National Center for Health Statistics standards. Unweighted estimates based on less than 30 records are considered unreliable [8].

The association between demographic and clinical information with ED visit prescription of analgesics/opioids was determined using univariate (χ^2) and multivariate (logistic regression) analyses. The association of CT imaging, use of analgesia, and use of opioids with ED length of stay was calculated using non-parametric tests. All analyses were performed using SPSS version 22.0 for Windows (SPSS Inc, Chicago, IL).

3. Results

3.1. General characteristics

The 2006 to 2010 NHAMCS datasets contain 175 351 records, each representing a unique ED visit. Of these visits, an estimated 0.12% (95% CI, 0.10–0.14) had an ED discharge diagnosis of acute appendicitis.

There were an estimated 763 000 ED patient visits for acute appendicitis from 2006 to 2010. Mean age was 32, 74% were under age 19, 69% were male, 61% were non-Hispanic white, 7% non-Hispanic black, and 23% Hispanic, 64% had Medicare as their primary insurance.

3.2. Pain severity and management

Of all study patients, 79% rated their pain as moderate or severe (Table 1). Sixty-four percent of patients received any analgesia in the ED and 58% received an opioid. Of all patients, 68% had CT imaging.

Table 1
Baseline characteristics

Characteristic	
Males	69%
Mean age (SD)	32 (2)
Age < 19	26%
Race/ethnicity	
Non-Hispanic white	61%
Non-Hispanic black	7%
Hispanic	23%
Other	10%
Primary payer	
Commercial	63%
Medicare	5%
Medicaid	12%
Self pay	13%
Other/unknown	7%
MSA region	88
Geographic region	
Northeast	22%
Midwest	18%
South	34%
West	26%
Hospital ownership	
Nonprofit	80%
Government	12%
Proprietary	9%
Mode of arrival	
Walk in	82%
Ambulance	8%
Other/unknown	10%
Pain	
None	1%
Mild	7%
Moderate	34%
Severe	49%
Unknown	9%
CT scan	68%
X-ray	20%
Received any analgesic	64%
Received opioid analgesic	58%
Received non-opioid analgesic	6%
Ketorolac	5.3%
Aspirin	0.4%
Ibuprofen	0.3%
Acetaminophen	<0.1%
Admitted	88%
Admitted to ICU	2%

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