

Diabetes increases the risk of an appendectomy in patients with antibiotic treatment of noncomplicated appendicitis



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Appendectomy;
Diabetes;
Antibiotic treatment

Abstract

BACKGROUND: This retrospective cohort study examined whether diabetic patients have a higher risk for recurrent appendicitis during a 1-year follow-up period after successful antibiotic treatment for patients with acute uncomplicated appendicitis than nondiabetic patients using a population-based database.

METHODS: We included 541 appendicitis patients who received antibiotic treatment for acute appendicitis. We individually tracked each patient for a 1-year period to identify those who subsequently underwent an appendectomy during the follow-up period.

RESULTS: Cox proportional hazard regressions suggested that the adjusted hazard ratio of an appendectomy during the 1-year follow-up period was 1.75 for appendicitis patients with diabetes than appendicitis patients without diabetes. We found that among females, the adjusted hazard ratio of an appendectomy was 2.18 for acute appendicitis patients with diabetes than their counterparts without diabetes. However, we failed to observe this relationship in males.

CONCLUSIONS: We demonstrated a relationship between diabetes and a subsequent appendectomy in females who underwent antibiotic treatment for noncomplicated appendicitis.

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An appendectomy is considered the gold standard of treatment for acute appendicitis because of the potential risk of disease progression to perforation, gangrene, and peritonitis.^{1,2} However, it is associated with postoperative complications in about 2% to 23% of patients who undergo this procedure.³⁻⁵ Previous studies also showed that changes in immune function after an appendectomy may be associated with a variety of diseases such as coeliac disease, ulcerative colitis, Crohn's disease, *Clostridium*

difficile infection, ischemic heart disease, pulmonary tuberculosis, rheumatoid arthritis, and diabetes.^{6–15}

In 1959, Coldrey¹⁶ first reported the successful treatment of 471 patients with an acute appendicitis with antibiotics therapy. Recent studies suggested that antibiotics are both safe and effective as primary treatment for patients with acute uncomplicated appendicitis to avoid an unnecessary appendectomy.^{5,17–20} On the other hand, some studies reported that antibiotics are not noninferior to an emergency appendectomy due to there being an increased risk of recurrence.^{1,21} In particular, studies reported that antibiotic treatment failure in patients was due to acute complicated appendicitis or acute uncomplicated appendicitis with a fecalith and diabetes.^{1,22} A study by Tsai et al²² also indicated that diabetic patients had a higher risk of developing complicated acute appendicitis than nondiabetic patients.

Contrary to a mechanical obstruction cause of acute appendicitis, bacteria and dysfunction of the neuromusculature at the appendiceocecal juncture are considered other causes of appendiceal inflammation, which are related to host immunity and autonomic neuropathy.^{23–29} Patients with diabetes may have altered gastrointestinal neurohumoral function and impaired host immunity.^{22,30} Therefore, it is reasonable to consider the relationship between diabetes and recurrent appendicitis in acute uncomplicated appendicitis patients after successful antibiotic treatment. So, this retrospective cohort study examined whether diabetic patients had a higher risk of recurrent appendicitis during a 1-year follow-up period after successful antibiotic treatment of patients with acute uncomplicated appendicitis than nondiabetic patients using a population-based database.

Methods

Database

We retrieved data for this study from the “Longitudinal Health Insurance Database 2005” (LHID2005). Taiwan began the National Health Insurance (NHI) program in 1995, and the coverage rate has been maintained at about 98.4% since its inception. The LHID2000 covers registration files and original medical claims for 1,000,000 enrollees randomly selected from all enrollees listed in the 2000 Registry of Beneficiaries under the NHI program ($n = 25.68$ million) by the Taiwan National Health Research Institutes. Therefore, the LHID2005 enables researchers in Taiwan to longitudinally follow-up utilization of medical services by these selected 1,000,000 enrollees since the beginning of the NHI in 1995.

This study was exempt from full review by the Institutional Review Board (TMU-JIRB 201412035) since the LHID2005 consisted of de-identified secondary data released to the public for research purposes.

Study sample

We first identified 7,747 patients who were hospitalized with a principal discharge diagnosis of noncomplicated appendicitis (International Classification of Disease, Ninth Revision, Clinical Modification [ICD-9-CM] code 540 or 540.9) between January 2001 and December 2012. If a patient had ≥ 2 hospitalizations during the study period, we only selected the first hospitalization for treatment of noncomplicated appendicitis as the index hospitalization. We further excluded 7,070 acute appendicitis patients who underwent an appendectomy (ICD-9-CM procedure code 470, 470.1, or 470.9) during their index hospitalization. In addition, we excluded 106 appendicitis patients who were aged less than 18 years to limit the study sample to the adult population. As a result, 571 appendicitis patients who received antibiotic treatment for acute appendicitis were included in this study. The antibiotics used to treat acute appendicitis included cephalosporins, penicillins, aminoglycosides, fluoroquinolones, and metronidazole. Of these 541 appendicitis patients, 108 (20.0%) had been diagnosed with diabetes before their index hospitalization. Thereafter, we individually tracked each patient for a 1-year period from the discharge date of their index hospitalization to identify those who subsequently underwent an appendectomy during the follow-up period.

Statistical analysis

We used the SAS system (version 9.1, SAS Institute, Cary, NC) for statistical analyses. Pearson Chi-squared tests were performed to compare differences between acute appendicitis patients with and those without diabetes in terms of monthly income (NT\$0 ~ 15,840, NT\$15,841 ~ 25,000, and \geq NT\$25,001; the average exchange rate in 2007 was US\$1.00 \approx New Taiwan [NT]\$30), geographical location (northern, central, eastern, and southern Taiwan), urbanization level of the patient’s residence (5 levels with 1 being the most urbanized and 5 being the least), and the Charlson Comorbidity Index (CCI). We also performed Cox proportional hazard regressions to calculate the hazard ratio (HR) and its corresponding 95% confidence interval (CI) for a subsequent appendectomy during the 1-year follow-up period between appendicitis patients with and those without diabetes. We used a significance level of .05.

Results

Table 1 presents the distributions of demographic characteristics and the CCI between acute appendicitis patients with and those without diabetes. It shows that there was a significant difference in the mean age ($P < .001$) and CCI ($P < .001$) between appendicitis patients with and those without diabetes. Acute appendicitis patients with diabetes were more likely to be older than their

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