

Open versus laparoscopic cholecystectomies in patients with or without type 2 diabetes mellitus in Spain from 2003 to 2013

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BACKGROUND: This study aimed to compare the rates of open and laparoscopic cholecystectomies and outcomes in patients with or without type 2 diabetes mellitus (T2DM) in Spain from 2003 to 2013.

METHODS: We collected all cases of open and laparoscopic cholecystectomies using national hospital discharge data and evaluated the annual cholecystectomy rates stratified by T2DM status. We analyzed tendency for in-hospital mortality (IHM). We also analyzed the impact of T2DM on IHM in patients who underwent cholecystectomies.

RESULTS: We identified 611 533 cholecystectomies (71.3% laparoscopic) in the patients, in whom 78 227 (12.8%) patients had T2DM. The rates of open cholecystectomies were 3-fold higher ($130.0/10^5$ vs $41.1/10^5$) in patients with T2DM than in

those without T2DM, and the rate of laparoscopic cholecystectomies was almost 2-fold higher ($195.2/10^5$ vs $111.8/10^5$) in patients with T2DM. The annual rate of laparoscopic procedures showed an 11-year relative increase of 88.3% (from $117.0/10^5$ to $220.3/10^5$) in T2DM and 49.2% (from $79.2/10^5$ to $118.2/10^5$) in patients without T2DM ($P<0.001$), whereas the rate of open procedures showed an 11-year relative decrease of 27.6% in patients with T2DM and 37.9% in those without T2DM ($P<0.001$). The rate of emergency laparoscopic cholecystectomy was increased in the 11 years, whereas the rate of emergency open cholecystectomies was decreased (both $P<0.001$). Multivariate analysis revealed that older age, higher comorbidity and emergency cholecystectomy were associated with a higher IHM. Compared with patients without T2DM, patients with T2DM demonstrated a lower IHM after open cholecystectomy [OR=0.82 (0.78-0.87)], but a higher IHM after laparoscopic cholecystectomy [OR=1.18 (1.03-1.35)]. Time-trend analyses showed a significant reduction in IHM in patients with or without T2DM after the two procedures.

CONCLUSION: The rate of cholecystectomy was higher in patients with T2DM, and laparoscopic cholecystectomy was popularized in the past 11 years both in selective and emergency cholecystectomies.

(*Hepatobiliary Pancreat Dis Int* 2016;15:525-532)

KEY WORDS: diabetes mellitus;
cholecystectomy;
mortality;
in-hospital mortality

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doi: 10.1016/S1499-3872(16)60091-7

Published online May 9, 2016.

Introduction

Cholecystectomy is an optimal treatment of many gallbladder diseases. Laparoscopic cholecystectomy is recommended because of lower in-hospital mortality (IHM), decreased disability, less discomfort

and shorter length of hospital stay (LOS), compared with open cholecystectomy.^[1] For the past years, the number of procedures has increased in most developed countries, largely driven by the increasing rate of laparoscopic procedure.^[2-6]

Gallstones are frequently seen in diabetic patients and their presence has also been associated with older age, obesity and a family history of gallstones.^[7] A previous study^[8] demonstrated a higher rate of complications, a higher rate of conversion from laparoscopic to open cholecystectomies, and a higher mortality rate in patients with type 2 diabetes mellitus (T2DM). Yet, Paajanen et al^[9] reported 2600 patients (9% of them had diabetes), who were operated on at a single institution.

Diabetes is a prevalent chronic disease.^[10, 11] If we could detect that such a large population is differentially exposed to a lower rate of laparoscopic procedures or associated with a higher mortality risk after cholecystectomy, this would add evidence to design specific strategies to increase the rate of less invasive procedures and to improve the outcomes in patients with T2DM. Using national hospital discharge data, we compared the rates and outcomes (LOS and IHM) of open and laparoscopic cholecystectomies performed in patients with or without T2DM in Spain between 2003 and 2013.

Methods

Participants

This cohort-based, retrospective, observational study was based on the Spanish National Hospital Database (Minimum Basic Data Set, MBDS). The database is managed by the Spanish Ministry of Health, Social Policy and Equality and consists of all the public and private hospital data, covering more than 95% of hospital discharges.^[12] The MBDS includes patient-related variables (gender, date of birth), date of admission, emergency vs regular admission, and date of discharge. The data included up to 14 discharge diagnoses, up to 20 procedures, and if the patient died during the hospitalization. The Spanish Ministry of Health, Social Policy and Equality sets standards for registration and performs periodic audits. We analyzed the data of 11 years between January 1, 2003 and December 31, 2013.

We chose the disease and procedure criteria of the International Classification Diseases-Ninth Revision, Clinical Modification (ICD-9-CM),^[13] which is used in the Spanish MBDS. We selected all patients for open cholecystectomy (ICD-9-CM codes 51.21 and 51.22) and laparoscopic cholecystectomy (codes 51.23 and 51.24), based on any procedural field. We grouped discharge dia-

betes status as follows: patients with no diabetes vs those with T2DM. We identified T2DM with the ICD-9-CM codes: 250.x0 and 250.x2. We excluded patients with type 1 diabetes mellitus (ICD-9-CM codes: 250.x1 and 250.x3) and those younger than 18 years old. Clinical characteristics included information on overall comorbidity at the time of diagnosis based on the Charlson comorbidity index (CCI).^[14, 15] The index applied to 17 disease categories whose scores were totaled to obtain an overall score for each patient. The index was subsequently categorized into three levels: 0, no disease; 1, one or two diseases; and 2, three or more than three diseases. We used 16 disease categories after excluding diabetes to calculate our modified CCI.

We considered other risk factors in the data analysis: obesity (ICD-9-CM codes: 278.0, 278.0x, 278.1 and 278.8), a diagnosis of gallbladder or pancreas cancer (ICD-9-CM codes: 156.x and 157.x, respectively), whether or not the procedure was performed during an emergency admission and conversion from laparoscopic to open cholecystectomy due to the technical infeasibility of the former (ICD-9-CM diagnosis code: V64.41; only available since 2006). The outcomes of interest included the proportion of patients who died during the admission defined as IHM and LOS.

Ethical aspects

We maintained data confidentiality at all times according to Spanish legislation. Participants' identifiers were deleted before the database was provided to the authors in order to keep patients anonymous. Given the anonymous and mandatory nature of the dataset, it was deemed not necessary to obtain informed consent.

Statistical analysis

We estimated the rates of open and laparoscopic cholecystectomies for the patients with or without T2DM per 100 000 inhabitants. We calculated the age-, gender-specific incidence rates for diabetic patients by dividing the number of patients per year, gender, and age group and the corresponding estimated number of patients in the population group with diabetes according to data from the Spanish National Institute of Statistics, as reported on December 31 each year.^[16] The estimated prevalence of diabetes for gender and age groups was obtained from data from the Spanish Di@bet.es Study and the National Health Surveys conducted in April 2003, July 2006, October 2009, and December 2011.^[11, 17] In a similar fashion, we also calculated the age-, gender-specific incidence rates for non-T2DM patients by dividing the number of patients per year, gender, and age group and by the corresponding number of patients in the population group

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