



Original Research

Time trends in cataract surgery and after-cataract laser capsulotomy in Taiwan: A population-based retrospective cohort study



Jiahn-Shing Lee ^a, Chia-Chi Chung ^b, Ken-Kuo Lin ^a, Kuang-Hui Yu ^c, Chang-Fu Kuo ^c, Lai-Chu See ^{b, c, d, *}

^a Department of Ophthalmology, Chang Gung Memorial Hospital, Chang Gung University, Taiwan

^b Department of Public Health, College of Medicine, Chang Gung University, Taiwan

^c Division of Rheumatology, Allergy and Immunology, Chang Gung Memorial Hospital, Linkou, Taiwan

^d Biostatistics Core Laboratory, Molecular Medicine Research Center, Chang Gung University, Taiwan

HIGHLIGHTS

- Surgery is the most effective treatment for cataract. Some patients may develop after-cataract, needing further treatment.
- Few studies have investigated the population-based incidence of laser capsulotomy for after-cataract.
- We determine the incidence rate, risk factors, and time trends for cataract surgery and after-cataract laser capsulotomy.
- The incidence rate of cataract surgery over year 2000–2010 in Taiwan remained stable after age standardization.
- The incidence rate of laser capsulotomy for after-cataract significantly decreased during the 10-year study period in Taiwan.

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ABSTRACT

Objectives: Determine the incidence rate, risk factors, and time trends from 2000 to 2010 for cataract surgery and after-cataract laser capsulotomy.

Materials and methods: Longitudinal Health Insurance Databases (LHID) with approximately 3 million people in Taiwan National Health Insurance Program from 2000, 2005, and 2010 was used. Index year was defined as year 2000 for LHID2000, year 2005 for LHID2005, and year 2010 for LHID2010.

Results: The age-standardized rate of first-eye cataract surgery per 100,000 persons was 324 (95% confidence interval [CI] = 288–363) in 2000, 317 (95%CI = 288–353) in 2005, and 342 (95%CI = 308–379) in 2010. Risk factors related to the incidence of cataract surgery included age, sex, diabetes mellitus, geographic region, and income level (all p values < 0.05). The incidence rate of laser posterior capsulotomy within 2 years after cataract surgery was 23.3% in 2000 but decreased to 14.6% in 2005 and to 12.9% in 2010. The incidence of laser capsulotomy for after-cataract was significantly associated with index year, age, sex, in- or out-patient, and edge design of intraocular lenses (all p values < 0.05).

Conclusion: The incidence rate of cataract surgery over year 2000–2010 remained stable after age standardization. However, the incidence rate of laser capsulotomy for after-cataract significantly decreased during the 10-year study period.

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1. Introduction

As the global population ages, there is considerable interest in the trends of cataract incidence rate. In Western Australia and the United States, the incidence rate of cataract surgery has

progressively increased [1,2]. The incidence of cataract surgery in Sweden increased from 1992 to 2000, remained stable from 2000 to 2008³, and then increased again from 2008 to 2012 [4].

Surgery is the most effective treatment for cataract. However, about 30% of patients develop secondary cataract or posterior capsule opacification (PCO), which causes deterioration of vision sometime after cataract surgery [5]. Fortunately, Nd-YAG laser posterior capsulotomy is a quick, safe, and effective treatment for after-cataract. The incidence of after-cataract has decreased in most

* Corresponding author. Department of Public Health, College of Medicine, Chang Gung University, 259 Wen-Hwa 1st Road, Kweisan, Taoyuan, 333, Taiwan.

E-mail address: lichu@mail.cgu.edu.tw (L.-C. See).

institutional and case-control studies [5,6]. Few studies have investigated the population-based incidence of laser capsulotomy for after-cataract. In this study, we estimated the incidences and examine the risk factor of cataract surgery and laser capsulotomy for after-cataract in 2000, 2005, and 2010 in Taiwan.

2. Material

2.1. Data source

In 1995, Taiwan launched a compulsory single-payer National Health Insurance (NHI) system, which covered 99.9% of the population as of 2014 [7]. Three Longitudinal Health Insurance Databases (LHIDs) were released for research purpose: LHID2000, LHID2005, and LHID2010. For the LHID2000, one million individuals from all beneficiaries of the NHI program in 1996–2000 were randomly sampled. For the LHID2005 and LHID2010, two separate 1,000,000 individuals were randomly sampled from all beneficiaries of the NHI program in 2005 and in 2010, respectively. All data on registration, outpatient claims, and inpatient claims for these three samples of one million individuals—from their registration in the NHI program until 2013—were included in the LHID2000, LHID2005, and LHID2010. There were no significant differences in sex distribution between patients in the LHID and those in the original data [8].

The primary data source of this study was the LHID2000, LHID2005, and LHID2010. We defined the index year as year 2000 for LHID2000, year 2005 for LHID2005, and year 2010 for LHID2010. This study was approved by the Institutional Review Board of Chang Gung Memorial Hospital, Taiwan (103–7184B). The requirement for informed patient consent was waived, as all data were completely anonymized.

2.2. Study design

Three retrospective cohorts were used. There were slightly fewer than one million records in each of the three LHIDs, because of the removal of data on patients with rare diseases [9]. We first excluded individuals who had the same anonymized ID number on the LHID2005 and LHID2010 as the number on the LHID2000, to avoid double-counting of patient in the three LHIDs. Next, we excluded individuals with missing data on sex, date of birth, or death before the index year. To avoid the problem of aging over time in a fixed cohort [10] and immortal bias of data before the years of random sampling for the three LHIDs [11], we only computed prevalence rate and incidence rate of cataract surgery for the three index years. We also followed these patients who had cataract surgery for another two years to obtain the rate of second cataract surgery or after-cataract laser capsulotomy (Fig. 1).

2.3. Ascertainment of cataract surgery and laser capsulotomy for after-cataract

Records with a cataract case payment system code (97605K, 97606A, 97607B, 97608C, 97601K, 97602A, 97603B) and the payment code for cataract surgery (86008C) were identified. Laser capsulotomy for after-cataract was those with a payment code for ND-YAG laser posterior capsulotomy (60013C, 60014C) within 2 years after initial cataract surgery.

2.4. Diabetes mellitus, income level, climate (sun exposure)

Diabetes mellitus (DM) was defined as at least one hospitalization with DM as one of the diagnoses (Acode A181 before 2000, or International Classification of Diseases, Ninth Revision, Clinical

Modification [ICD-9-CM] code 250 after 2000) or at least two outpatient visits for DM. Income level was based on the payroll-related amount and was categorized by tertile and dependent. Because the Tropic of Cancer runs through the center of Taiwan, we divided Taiwan into three regions: subtropical, intermediate, and tropical.

2.5. Statistics

For prevalence rate, the numerator was the number of patients who received cataract surgery and the denominator was the number of NHI beneficiaries in the index year. For incidence rate, we excluded patients who had cataract surgery during the 3 years before the index year, in order to obtain “new” patients receiving cataract surgery in the index year. Because there was no information indicating which eye underwent cataract surgery, the incidence rate was calculated as the number of “new” cataract surgeries for the first eye divided by the population at risk for three index years, respectively. The 95% confidence intervals (CIs) for the incidence rate were estimated, assuming a Poisson distribution. We used the Standard Population of World Health Organization [12] to perform the direct age standardization to allow comparison of the three incidence rates. Poisson regression was used to determine risk factors on receipt of cataract surgery. The χ^2 test was used to compare data among groups. To calculate the rate of after-cataract laser capsulotomy in patients receiving cataract surgery, we further followed the patients until laser capsulotomy, death, or 2 years after the initial cataract surgery, whichever occurred first. The denominator of the incidence rate of laser capsulotomy for after-cataract was the number of people who received cataract surgery dividing the follow-up time involved. Cox's proportional hazard model was used to determine which factors were associated with laser capsulotomy for after-cataract. Statistical significance was defined as $p < 0.05$.

3. Results

3.1. Prevalence and incidence of cataract surgery

A total of 3896 individuals (4652 eyes) in 2000, 4304 (5188 eyes) in 2005, and 4904 (6111 eyes) in 2010 received cataract surgery, corresponding to prevalence rates (per 100,000 persons) of 406 in 2000, 449 in 2005, and 540 in 2010. The incidence rates of first-eye cataract surgery (per 100,000 persons) of 324 in 2000, 358 in 2005, and 441 in 2010 (Fig. 1).

The curves for the sexes behaved similarly: an increase at age 45–49, a peak at age 75–79, and a subsequent decrease. The curve for women was higher and slightly shifted to the left, indicating more women received cataract surgery and at a younger age (Fig. 2). The age-standardized rate of first-eye cataract surgery (per 100,000 persons) was 324 (95%CI = 288–363) in 2000, 317 (95%CI = 283–353) in 2005, and 342 (95%CI = 308–379) in 2010.

The incidence rate of cataract surgery was much higher in the regions at and below the Tropic of Cancer (tropical) than in the northern region (subtropical) (Table 1, Fig. 3a). The age-standardized rate (per 100,000 persons) was 306 (95%CI = 283–331) for the subtropical region, 317 (95%CI = 240–413) for the intermediate region, and 393 (95%CI = 349–440) for the tropical region (Fig. 3b).

Patients with DM had a significantly higher rate of cataract surgery than those without DM (2021 vs. 289 per 100,000 person-years, respectively; $p < 0.0001$). Patients with middle incomes had the highest incidence rate of cataract surgery, and those with high incomes had the lowest incidence rate ($p < 0.0001$). Sex, age, DM, region, and income level remained significantly associated with the

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