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Original Article

Incidence and Characteristics of Intraocular Lens Dislocation in South Korea from 2002 to 2021: A Nationwide Population-based Study

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Purpose: This study aimed to analyze the incidence and characteristics of intraocular lens (IOL) dislocation after cataract surgery in South Korea.

Methods: We retrospectively analyzed the incidence of IOL dislocation after cataract surgery in patients diagnosed between 2002 and 2021. Data of all pseudophakic patients who underwent secondary IOL or IOL exchange surgeries due to IOL dislocation were extracted from the Korean National Health Insurance System database and the Korean Standard Classification of Diseases 7th Revision codes. The incidence per 1,000,000 person-years and corresponding 95% confidence intervals (CIs) were calculated.

Results: Between 2002 and 2021, 39,965 of the 4,848,125 pseudophakic patients (0.82%) were diagnosed with IOL dislocation and surgically treated. The incidence of IOL dislocation requiring surgery in pseudophakic patients was 28,900 per 1,000,000 person-years (95% CI, 28,431–29,369), comprising 57,800 cases in male (95% CI, 56,730–58,870) and 10,800 in female patients (95% CI, 10,523–11,077), and the mean male to female ratio was 5.35. The incidence rate peaked in younger age group below 40 years, showing 107,000 per 1,000,000 person-years (95% CI, 102,900–111,100), and the average age of IOL dislocation requiring surgery was 68.1 ± 10.7 years. The average time lapse from cataract surgery to secondary IOL surgery due to IOL dislocation was 4.1 ± 4.7 years (median, 2.2 years), and the number of secondary IOL surgery due to dislocation of artificial lens rapidly occurred 10 years after cataract surgery among all age groups.

Conclusions: The incidence of IOL dislocation requiring surgery was higher in younger and male patients. Our findings could be expected to aid establishing future healthcare policies for South Korean populations with an increased risk of IOL dislocation after cataract surgery.

Key Words: Cataract extraction, Incidence, Intraocular lens implantation, Lens subluxation

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Cataracts are the leading cause of blindness and visual impairment worldwide; their prevalence increases as the world's population gradually ages [1,2]. Since cataracts are a relatively easy, safe, and cost-effective treatable cause of blindness [3], worldwide efforts have been made to increase the number of cataract surgeries performed. Cataract surgery is the most commonly performed surgical procedure worldwide, with an estimated 19 million surgeries performed annually to reduce avoidable blindness [4–6]. Based on a large population-based data in South Korea, cataract surgery is the most common surgery; the overall incidence of cataract surgery increased from 8.54 per 1,000 person-years in 2011 to 9.67 per 1,000 person-years in 2015 [7].

Intraocular lens (IOL) dislocation after cataract surgery commonly requires secondary intraocular implantation surgery due to potential complications such as retinal tears, retinal detachment, vitreous hemorrhage, and bullous keratopathy. This surgery has increased recently as cataract surgery increases [8,9]. The incidence of late-onset IOL dislocation varies worldwide from 0.05% to 1.7% [10–14]. Previous studies have reported that the incidence of IOL dislocation varies among countries, with various study designs and numbers of cases. Only a few studies have reported the incidence of IOL dislocation in Asia, showing that 0.7% of pseudophakic patients experienced IOL dislocation in South Korea over 8 years [9]. Previous studies investigating the incidence of IOL dislocation in Asia were limited to preliminary studies. Other Asian studies on IOL dislocation focused on a comparative incidence analysis based on risk factors or different surgical methods [15–21]. However, there have been reports of IOL dislocation even 10 years after cataract surgery, with a cumulative incidence of 0.1% to 3% over 10 to 25 years [10–14], indicating the necessity for long-term studies extending beyond 10 years in Asia.

In South Korea, all nationals must enroll in the Korean National Health Insurance Service (KNHIS); 97% and 3% of South Koreans are covered by the Medical Assistance Program and Medical Care for Patriots and Veterans Affairs Scheme, respectively. Thus, nearly all healthcare-related data are centralized in large databases. This study investigated the incidence and characteristics of surgically treated IOL dislocation after cataract surgery according to age and sex in the entire South Korean population from 2002 to 2021.

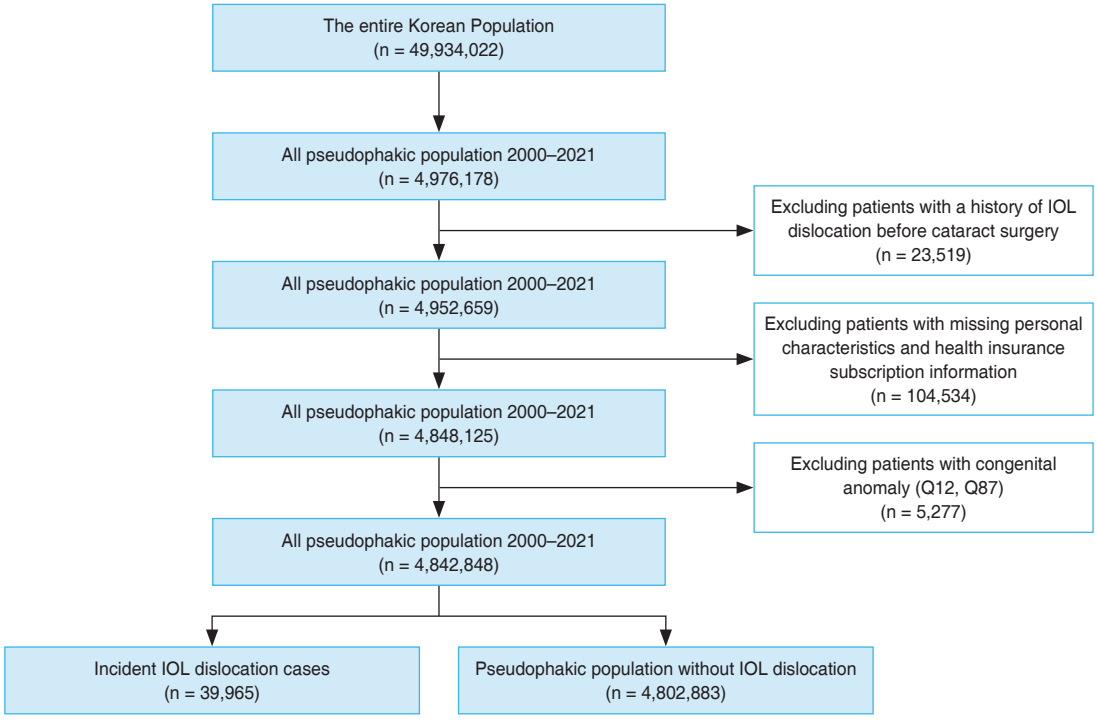

Fig. 1. The process of identifying intraocular lens (IOL) dislocation cases.

Materials and Methods

Ethics statement

This study was approved by the Institutional Review Board of National Health Insurance Service Ilsan Hospital (No. NHIMC 2023-01-031). The requirement for informed consent was waived due to the retrospective nature of the study and the deidentification of the database data. The study used the National Health Insurance Service-National Health Information Database (NHIS-NHID) data (No. NHIS-2023-1-222) from the KNHIS.

Data source

In this retrospective population-based study, data of all patients who underwent secondary IOL implantation or IOL exchange between January 1, 2002, and December 31, 2021, were retrieved from the NHIS-NHID 2002–2022, released by the KNHIS. Claims data were accompanied by data on demographic characteristics, including age, sex, diagnostic codes, and surgical procedures. Patient healthcare records were not duplicated because all Korean residents received unique identification numbers at birth, which prevented data loss. KNHIS uses the Korean Standard Classification of Diseases 7th Revision codes, which are similar to the International Classification of Diseases and Korean electronic data interchange (KEDI) codes. Annual population data were obtained from the Population and Housing Census conducted in 2010 (available from the Korean Statistical Information Service; https://kosis.kr/eng/). This study included data of patients with KEDI

Table 1. Demographic characteristics of South Korean patients at the time of secondary IOL implantation (2002–2021)

Characteristic	Control group (n = 4,802,883)	IOL dislocation (n = 39,965)	*p*-value
Age (yr)	60.6 ± 13.2	68.1 ± 10.7	<0.001
<40	48,396 (1.0)	2,107 (5.3)	
40–49	209,565 (4.4)	6,345 (15.9)	
50–59	700,110 (14.6)	9,624 (24.1)	
60–69	1,440,184 (30.0)	10,662 (26.7)	
70–79	1,800,513 (37.5)	8,745 (21.9)	
≥80	604,115 (12.6)	2,482 (6.2)	
Sex			<0.001
Male	1,966,349 (40.9)	25,297 (63.3)	
Female	2,836,534 (59.1)	14,668 (36.7)	
Household income relative to the median			<0.001
Eligible recipients of medical benefits	336,009 (7.0)	2,009 (5.0)	
0%–25%	818,075 (17.0)	6,590 (16.5)	
25%–50%	750,616 (15.6)	6,616 (16.6)	
50%–75%	1,047,488 (21.8)	9,237 (23.1)	
75%–100%	1,850,695 (38.5)	15,513 (38.8)	
Residential area			<0.001
Capital area	1,789,579 (37.3)	13,395 (33.5)	
Metropolitan city	1,157,852 (24.1)	11,120 (27.8)	
Other	1,855,452 (38.6)	15,450 (38.7)	
Disability			0.004
No	4,148,665 (86.4)	34,718 (86.9)	
Yes	654,218 (13.6)	5,247 (13.1)	

Values are presented as mean ± standard deviation or number (%). Percentages may not total 100 due to rounding.
IOL = intraocular lens.

Table 2. Incidence rate (per 1,000,000 person-years) of intraocular lens dislocation in the pseudophakic cohort in South Korea from 2002 to 2021

Age (yr)	Total			Sex					
				Male			Female		
	No. of patients	Incidence rate	95% CI	No. of patients	Incidence rate	95% CI	No. of patients	Incidence rate	95% CI
<40	2,107	107,000	102,900–111,100	1,686	130,100	124,700–135,500	421	47,600	44,520–50,680
40–49	6,345	97,400	95,310–99,490	5,208	115,200	112,610–117,790	1,137	43,000	40,500–45,500
50–59	9,624	48,500	47,260–49,740	7,067	73,000	70,870–75,130	2,557	19,100	18,268–19,932
60–69	10,662	16,200	15,804–16,596	6,353	29,500	28,596–30,404	4,309	9,390	8,984–9,796
70–79	8,745	8,530	8,124–8,936	4,005	14,600	12,650–16,550	4,740	6,520	6,227–6,813
≥80	2,482	5,410	5,217–5,603	978	7,570	6,657–8,483	1,504	4,730	4,581–4,879
Overall	39,965	28,900	28,431–29,369	25,297	57,800	56,730–58,870	14,668	10,800	10,523–11,077

CI = confidence interval.

Table 3. Accumulative incidence rate (per 1,000,000 person-years) of intraocular lens dislocation in the pseudophakic cohort in South Korea from 2002 to 2021 by age group

Period	Age (yr)											
	<40		40–49		50–59		60–69		70–79		≥80	
	No. of patients	Incidence rate (95% CI)	No. of patients	Incidence rate (95% CI)	No. of patients	Incidence rate (95% CI)	No. of patients	Incidence rate (95% CI)	No. of patients	Incidence rate (95% CI)	No. of patients	Incidence rate (95% CI)
1 wk	129	2,560 (2,335–2,785)	278	1,290 (1,213–1,367)	669	944 (908–980)	1,175	811 (787–835)	1,402	775 (754–796)	633	1,040 (999–1,081)
1 mon	215	4,260 (3,970–4,550)	622	2,890 (2,774–3,006)	1,424	2,020 (1,967–2,073)	2,285	1,580 (1,547–1,613)	2,591	1,440 (1,412–1,468)	1,131	1,870 (1,814–1,926)
3 mon	307	6,100 (5,753–6,447)	948	4,430 (4,286–4,574)	2,230	3,180 (3,113–3,247)	3,336	2,320 (2,280–2,360)	3,652	2,030 (1,996–2,064)	1,569	2,600 (2,534–2,666)
1 yr	493	9,890 (9,447–10,333)	1,340	6,360 (6,187–6,533)	3,102	4,510 (4,429–4,591)	4,658	3,290 (3,242–3,338)	4,844	2,720 (2,681–2,759)	1,870	3,130 (3,058–3,202)
5 yr	828	17,600 (16,990–18,210)	2,469	13,500 (13,225–13,775)	5,681	10,200 (10,061–10,339)	7,744	6,300 (6,227–6,373)	7,371	4,590 (4,536–4,644)	2,357	4,290 (4,200–4,380)
10 yr	1,307	33,600 (32,656–34,544)	4,093	30,300 (29,802–30,798)	7,963	19,900 (19,651–20,149)	9,619	9,540 (9,435–9,645)	8,456	6,080 (6,009–6,150)	2,468	4,980 (4,866–5,094)
15 yr	1,881	66,000 (64,360–67,640)	5,809	64,200 (63,239–65,161)	9,265	33,400 (32,938–33,862)	10,494	13,100 (12,935–13,265)	8,711	7,170 (7,065–7,275)	2,482	5,410 (5,217–5,603)
20 yr	2,107	107,000 (102,900–111,100)	6,345	97,400 (95,310–99,490)	9,624	48,500 (47,260–49,740)	10,662	16,200 (15,804–16,596)	8,745	8,530 (8,124–8,936)	2,482	5,410 (5,217–5,603)

CI = confidence rate.

codes S5111 and S5117, S5119 and S5117 from 2002 to 2021.

Data extraction

All patients who underwent cataract surgery in South Korea between 2002 and 2021 were enrolled in the study. Pseudophakic patients were defined as individuals with IOL (KEDI code, Z961) or evidence of surgery by phacoemulsification (KEDI code, S5119) or intracapsular cataract extraction (ICCE)/extracapsular cataract extraction (ECCE; KEDI code, S5111) and IOL implantation (KEDI code, S5117) on the same day. We retrieved the following data of all pseudophakic patients: baseline sociodemographic variables, including age, sex, residence, and income level. Residential area was divided into capital area, metropolitan city, and others according to the administrative unit of Korea. Household income was grouped as 0%–25%, 25%–50%, 50%–75%, and 75%–100% relative to the median value. Preoperative ocular characteristics, including high myopia, retinal detachment, posterior capsular rupture during cataract surgery, history of ocular surgery, and ocular trauma, were analyzed.

In our study, patients with dislocated artificial IOLs were defined as individuals who underwent either "secondary IOL implantation (KEDI code, S5116)" or "IOL exchange (KEDI code, S5118)" only among whom diagnosed with either "IOL dislocation (KEDI code, H27.1)" or "mechanical complication of IOL (KEDI code, T85.2)" after cataract surgery. The patients with very early IOL dislocation after cataract surgery or mild IOL subluxation, which did not require surgical intervention were excluded from the study. Patients who underwent IOL dislocation on the same day after cataract surgery were also excluded. In addition, patients with congenital diseases such as Marfan syndrome or congenital anomalies were not included (Fig. 1).

Statistical analysis

Data are presented as number (%) for categorical variables and mean ± standard deviation or median (interquartile range) for continuous variables. The incidence per 1,000 person-years, based on the 2002 census, was estimated using survival analysis. The annual incidence from 2002 to 2021 and overall incidence were estimated using 95% confidence intervals (CIs). Age- and sex-specific incidence rates were also estimated. The significance level was set at $p < 0.05$. All statistical analyses were performed using the SAS ver. 9.4 (SAS Institute Inc).

Results

Over the 20-year period, 39,965 of the 4,848,125 pseudophakic patients (0.82%) were diagnosed with IOL dislocation requiring surgical intervention (Fig. 1). The overall incidence of IOL dislocation with surgery was 28,900 per 1,000,000 person-years. The baseline demographic characteristics of the patients are presented in Table 1. The mean age of pseudophakic patients without IOL dislocation was 60.6 ± 13.2 years, while the mean age of patients with IOL dislocation requiring surgical intervention was 68.1 ± 10.7 years. The number of IOL dislocations with surgery in

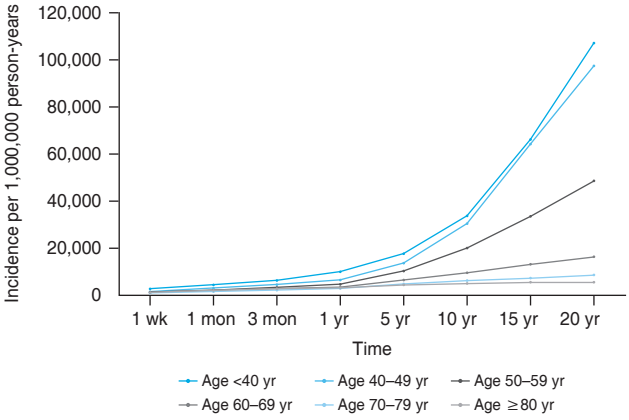

Fig. 2. Cumulative incidence rate (per 1,000,000 person-years) of intraocular lens dislocation in the pseudophakic cohort in South Korea from 2002 to 2021 by age group.

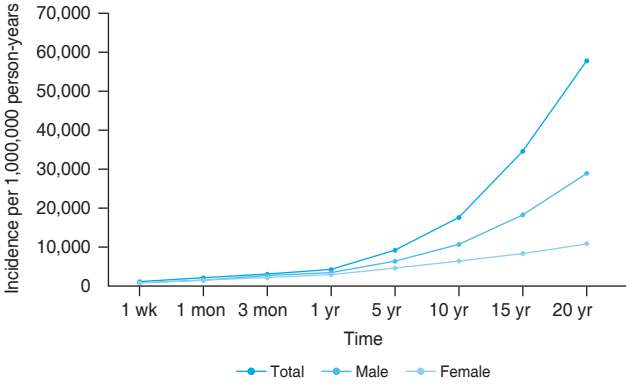

Fig. 3. Cumulative incidence rate (per 1,000,000 person-years) of intraocular lens dislocation in the pseudophakic cohort in South Korea from 2002 to 2021 by sex group.

Table 4. Accumulative incidence rate (per 1,000,000 person-years) of intraocular lens dislocation in the pseudophakic cohort in South Korea from 2002 to 2021 by sex

Period	Total			Sex					
				Male			Female		
	No. of patients	Incidence rate	95% CI	No. of patients	Incidence rate	95% CI	No. of patients	Incidence rate	95% CI
1 wk	4,286	886	872–900	2,155	1,080	1,057–1,103	2,131	748	732–764
1 mon	8,268	1,710	1,691–1,729	4,011	2,020	1,988–2,052	4,257	1,500	1,477–1,523
3 mon	12,042	2,510	2,487–2,533	5,904	2,990	2,951–3,029	6,138	2,170	2,142–2,198
1 yr	16,307	3,440	3,413–3,467	8,223	4,230	4,183–4,277	8,084	2,890	2,858–2,922
5 yr	26,450	6,410	6,370–6,450	14,738	9,040	8,964–9,116	11,712	4,630	4,587–4,673
10 yr	33,906	10,700	10,636–10,764	20,288	17,500	17,360–17,640	13,618	6,330	6,271–6,389
15 yr	38,642	18,200	18,067–18,333	24,164	34,500	34,180–34,820	14,478	8,400	8,304–8,496
20 yr	39,965	28,900	28,431–29,369	25,297	57,800	56,730–58,870	14,668	10,800	10,523–11,077

CI = confidence interval.

male patients was higher than in female patients during the 20-year period, with 25,297 cases in male and 14,668 cases in female patients (63.3% vs.36.7%, $p < 0.001$) (Table 1).

The overall 20-year incidence rate of IOL dislocation among pseudophakic patients was 28,900 per 1,000,000 person-years (95% CI, 28,431–29,369) (Table 2). The age-specific incidence was highest in the under 40 years age group at 107,000 per 1,000,000 person-years and gradually decreased as age increased, reaching the lowest at 5,410 per 1,000,000 person-years for those aged 80 years and above (Tables 2, 3). However, the age group with the highest incidence of IOL dislocation was those aged 60–69 years, accounting for 10,662 patients (26.7%) (Table 1).

Between 2002 and 2021, pseudophakic patients experienced a significant increase in the dislocation of intraocular artificial lens 10 years after cataract surgery, and this trend appeared consistently regardless of sex and age (Figs. 2, 3 and Tables 3, 4). The cumulative incidence of IOL dislocation within 1 year after cataract surgery was 3,440 per 1,000,000 person-years. However, it gradually increased, reaching 6,410 per 1,000,000 person-years within 5 years, and showed a sharp rise to 10,700 per 1,000,000 person-years after 10 years, marking a significant 3.11-fold increase (Table 4). The cumulative incidence rate over 20 years was always higher in male patients than in female patients (Table 4 and Fig. 3).

Discussion

In our study, 0.82% of the patients who underwent cataract surgery were diagnosed with IOL dislocation and then underwent surgical treatment in South Korea between 2002 and 2021. The overall incidence rate was 28,900 cases per 1,000,000 person-years, which was notably higher in male than in female patients (male to female ratio, 5.35). The highest incidence was seen in those under 40 years, despite the average age of occurrence being 68.1 ± 10.7 years. IOL dislocation occurred with an average duration of 4.1 ± 4.7 years, with a rapid increase of 3.11-fold after 10 years of cataract surgery in all age groups.

Compared with our study, Pueringer et al. [12] showed a lower incidence rate of 16 of 14,471 patients (0.1%) over a 30-year period in the United States; additionally, 111 of 46,632 patients (0.16%) similarly underwent IOL dislocation in Austria [13]. However, Monestam [22] reported that

the 10-year cumulative incidence of IOL dislocation was 1% in Northern Sweden, which is higher than our results in South Korea. The different estimated results between the two countries might be due to the higher prevalence of pseudoexfoliation in the Scandinavian population, ranging between 11% and 42%, which is known as a significant risk factor for late IOL dislocation [23]. Further studies are necessary to evaluate the association between the incidence rate of IOL dislocation and other risk factors, such as the rate of ocular trauma and pseudoexfoliation, in our country. Recently, Bothun et al. [24] reported 80 cases of IOL dislocation among 148,201 patients. However, this study did not suggest whether all patients in the cohort were pseudophakic.

Moreover, changes in the cataract surgical techniques may influence the incidence of IOL dislocation. Some previous studies included phacoemulsification and conventional ECCE [12–14,22]. Therefore, our results were different because we evaluated the incidence of IOL dislocation only after phacoemulsification. Clark et al. [25] reported that the prevalence of IOL dislocation was only 0.17% between 1985 and 1989, which is much lower than our results. This could be due to the shorter study duration and a larger proportion of patients undergoing cataract surgery with ECCE (36.8%), which is uncommon today compared with our study. Phacoemulsification and ECCE might have different zonular stresses. Therefore, the current surgical technique can result in different outcomes of IOL dislocation. Therefore, comparing the incidence rates of cohort groups prior to 2000 was not appropriate.

Lee et al. [9] reported that the cumulative probability of IOL dislocation was 2.73% per person in our country, which is higher compared with our result (0.82%). The incidence rate of IOL dislocation was higher than that in our study because a wide spectrum of cases of IOL dislocation, such as very early dislocation and insignificant IOL subluxation not requiring surgical intervention, were included. Despite the lower number of cases , the incidence rate in the current study was higher indicating 28,900 per 1,000,000 person-years for 20 years. These discrepancies possibly arise from differences in patient demographics and observation periods. First, our study spanned nearly three times longer compared with that study (20 years vs. 8 years). Given that IOL dislocation is a recognized long-term complication of cataract surgery, the extended duration of our study likely contributed to a higher cumulative incidence rate observed over time. Specifically, in our study, we found cumulative rates of 6,410 per 1,000,000 person-years over 5 years and 10,700 per 1,000,000 person-years over 10 years (Table 4), which is comparable to the results in the previous study (7,671 per 1,000,000 person-years for 8 years), indicating a substantial increase with prolonged follow-up. Second, Lee et al. [9] excluded individuals under 40 years of age from their study population, whereas we included this age group. This inclusion is significant as the incidence rate among those under 40 was the highest in the current study (107,000 per 1,000,000 person-years), explaining the higher cumulative incidence rate observed in our comprehensive analysis.

In our study, the age-specific incidence rate of IOL dislocation among the pseudophakic population was the highest in those under 40 years of age in both male and female patients (130,100 and 47,600 per 10,000,000 person-years, respectively), which was lower than that in another Korean population-based study reporting an age range of 50–54 years in male patients and 40–44 years in female patients [9]. However, Lee et al. [9] reported that the incidence rate of IOL dislocation for the 8 years of the study in the pseudophakic population aged 40 years or older was 7,671 per 1,000,000 person-years (95% CI, 7,616-7,727). This disparity in results of our study resulted from the exclusion of nonsurgery-requiring cases, leading to a lower number of IOL dislocation cases compared with the previous study. Pershing et al. [23] reported that the rate of procedure-related revisits after cataract surgery was highest in those in their 20s and 30s and lowest in those in their 70s. They also explained that younger patients are more likely to have other ophthalmologic causes leading to cataracts at an early age, such as ocular trauma or other ocular surgeries, leading to more complicated surgeries with more chances of IOL dislocation.

With an increase in the aging population and advances in surgical devices, the incidence of cataract surgery has increased worldwide, including South Korea [7,26–28]. As the number of cataract surgeries increases with age worldwide, the possibility of postoperative complications, including IOL dislocation, may increase. Previous studies have shown an increased incidence of IOL dislocation due to increased cataract surgery [12,14]. However, our results showed that the rate of IOL dislocation peaked at <40 years of age with male dominance among pseudophakic patients. Hence, the increasing number of cataract surger-

ies does not simply influence IOL dislocation. Another study reported that the increasing incidence of this complication cannot be explained by the growing pseudophakic population only [14], but by a longer duration of pseudophakia in Sweden, which was also found in the present study.

In addition, male patients had a higher incidence of IOL dislocation than the female patients in all age groups among the pseudophakic population (Table 2); in contrast, cataract surgery was more common in female than male patients (Table 1) [14]. This surprising finding is similar to that of other previous studies showing that male sex is a predisposing factor for readmission after cataract surgery [17,22,23]. As shown in previous studies, there were multiple predisposing factors of IOL dislocation including aging, high myopia, uveitis, trauma, previous vitreoretinal surgery although 90% of cases show zonular weakness [29–32]. Other complications, including postoperative endophthalmitis and retinal detachment after cataract surgery, occurred more frequently in men, as shown in our previous studies [33,34], and these results could be associated the cause of our male dominant result. Another explanation may be that male patients have more tendency to ocular trauma that might have happened a long time ago and was forgotten at the time of cataract surgery so that they might have a history of underreported trauma [22,35]. In another study, some investigators suggested that there may be a sex-related difference that results in weaker zonule in men with pseudoexfoliation (PEX) leading to more prevalent IOL dislocation in spite of higher incidence of PEX in female patients [29]. Further studies on the biological differences such as the different extent of zonular weakness between men and women after cataract surgery need to be more precisely conducted.

Although the mean timing of artificial IOL dislocation requiring surgical treatment is approximately 4.1 ± 4.7 years, with a rapid increase of 3.11-fold from 1 year to 10 years after cataract surgery in all patients (Fig. 3 and Table 4). The fact that a dramatic increase in this unwanted complication occurred 10 years after cataract surgery is of particular concern. Although a few previous studies investigated a study duration of more than 10 years, different cataract surgery techniques were used, including ECCE, ICCE, and phacoemulsification, which may have different impacts on the incidence of IOL dislocation. However, our findings emphasize the importance of long-term follow-up care after cataract surgery, even in cases where the initial postoperative results seem satisfactory. Additionally, time-dependent increase of IOL dislocation after cataract surgery can be explained based on biological changes after surgery. Zonules become more friable with aging, particularly in eyes with PEX, which have more severe epithelial atrophy compared to non-PEX eyes of patients of the same age [32]. Another biological change after cataract surgery is contraction of capsular bag which happens as early as three months following phacoemulsification. Although not all capsular bag contractions lead to significant IOL displacement, some contraction results in additional stress on potentially weak zonules leading to IOL dislocation [17]. Due to sphincter effect of fibrosis around an intact continuous curvilinear capsulorhexis, especially if the diameter is very small, the progressive weakening of already compromised zonules may make them vulnerable to continuous centripetal forces and cause their rupture resulting in IOL dislocation [10].

However, this study has some limitations. First, compared with data reviewed and obtained from medical charts, the extraction of patients relied solely on health claims, which could be inaccurate and excluded patients without diagnostic codes despite experiencing IOL dislocation after cataract surgery. Patients who did not seek treatment at a hospital were also excluded, leading to underestimating the results. Second, determining whether a surgical procedure could be necessary because of the lack of clinical data is difficult, including patients' medical history, corneal endothelial status, visual acuity, and extent of IOL dislocation. Third, our study focused only on the residents in South Korea; therefore, our findings cannot be generalized to other ethnicities. Additionally, IOL dislocation could occur as early as less than 3 months or later, and these two types have quite different pathogenesis. Early IOL dislocation can be induced due to tearing of posterior capsule or rupture of equatorial syndrome usually happened during intraoperative or preoperative zonulopathy. Our results only suggested the mean time of IOL dislocation after cataract surgery regardless of cause of IOL dislocation so that a further study should be conducted.

The strengths of our study include the large sample size using a national database covering nearly the entire Korean general population for the long term and the multifaceted implications of our study. Only a few studies have analyzed IOL dislocation, focusing on Asian risk factors

[17,36,37]. We targeted the entire population of our country to establish representativeness of the analysis. First, this study will raise awareness among ophthalmologists about the potential for IOL dislocation. In addition, our study highlights the need for long-term monitoring of pseudophakic patients beyond the immediate stable postoperative period. Additionally, it can help identify patients with a higher risk of IOL dislocation, leading to the development of more personalized postoperative care plans.

In conclusion, the incidence rate of IOL dislocation requiring surgery was 0.82% in South Korea, with higher recurrence among younger age groups and in male patients. Although its incidence is relatively low, IOL dislocation is a vision-threatening complication. Given the sharp increase (more than twofold) in the incidence rate of IOL dislocation occurring over 10 years after cataract surgery, long-term follow-up is necessary in high-risk patients.

This study aimed to analyze the frequency of IOL dislocation and patterns of secondary IOL implantation surgery among patients who underwent cataract surgery in South Korea based on large retrospective data of the general population provided by the KNHIS. These findings are expected to serve as an important reference source for predicting complications that can cause severe visual loss, such as dislocation of the intraocular artificial lens following cataract surgery, the most common surgical procedure in South Korea, and assessing associated risk factors.

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