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Cataract Surgery and All-Cause and Cause-Specific Mortality in Elderly Patients with Cataract: Nationwide Population-Based Cohort Study

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Introduction

- **Cataract surgery**
  - Well-established treatment for visually significant cataract which is the leading cause of visual loss among adults
  - Associated with a **decreased mortality** in cataract patients

    Am J Ophthalmol 157(2014)
  - **Decreased all-cause mortality** in cataract patients from the US Medicare population

    Ophthalmology 123 (2016)
  - Associated with **increased total and cause-specific mortality with the exception of neurologic causes in older women** with cataract from the Women's Health Initiative

    JAMA Ophthalmol 136 (2018)

Introduction

- **Purpose**
  - No previous studies investigating the relationship between cataract surgery and mortality in Korean elderly patients with cataract

➡ Investigate the relationship between cataract surgery **total and cause-specific mortality** in the Korean elderly population using a nationwide cohort, the Korean National Health Insurance Service-Senior cohort (NHIS-Senior) database

Methods

- **Study population**
  - 558,147 individuals randomly sampled from 10% of approximately 5.5 million Korean individuals aged >60 years, complied by the Korean NHIS
  - At least one NHIS record between January 1, 2002 and December 31, 2015
  - Age 60 years or older during this period
  - KCD-7 code for cataract
  - Exclusions :
    - Infantile & juvenile cataract, traumatic cataract
    - Cataract secondary to intraocular surgery
    - pseudophakia
    - Other disorders of lens : lens dislocation, aphakia

Methods

- **Study population**
  - Cataract surgery patient
    - Extracapsular or intracapsular extraction(KEDI code S5111, S5113) or phacoemulsification(S5119) + primary intraocular lens implantation(S5117) on same day
    - Procedures in combination with vitrectomy or glaucoma surgery were excluded
  - Cataract patients
    - Participants with diagnosis code for cataract but without KEDI code for cataract surgery

Methods

- **Classification**
  - Demographics
    - Age, gender, residence(metropolitan & provincial), income(above 20% & below 20%)
  - Cause of death
    - Cancer, Vascular, Pulmonary, Neurologic, Infectious, Accident or trauma-related conditions
  - Participants without a recorded death were censored on the last known date or on December 31, 2015

Results – basic characteristics

- **Total** (n=241,062) = **Cataract surgery** (n=127,941) + **Cataract diagnosis** (n=113,121)

Variable		Total (n=241,062)	Cataract surgery (n=127,941)	Cataract diagnosis (n=113,121)	ASD
Age (years)	<70	82,011 (34.0)	44,118 (34.5)	37,893 (33.5)	
	70-74	78,585 (32.6)	42,067 (32.9)	36,518 (32.3)	
	75-79	47,942 (19.9)	26,228 (20.5)	21,714 (19.2)	**0.1107**
	80-84	22,410 (9.3)	11,417 (8.9)	10,993 (9.7)	
	≥85	10,114 (4.2)	4,111 (3.2)	6,003 (5.3)	
Mean ± SD		72.6 ± 6.1	72.4 ± 5.8	72.8 ± 6.3	0.0741
Gender	Male	89,305 (37.0)	4,3994 (34.4)	4,5311 (40.1)	**0.1175**
	Female	151,757 (63.0)	83,947 (65.6)	67,810 (59.9)	
Residence	Metropolitan	100,398 (41.6)	51,243 (40.1)	49,155 (43.5)	0.0690
	Provincial	140,664 (58.4)	76,698 (59.9)	63,966 (56.5)	
Income	Below 20 percentiles	56,908 (23.6)	30,879 (24.1)	26,029 (23.0)	0.0265
	Above 20 percentiles	184,154 (76.4)	97,062 (75.9)	87,092 (77.0)	

ASD : absolute standardized difference

Results – basic characteristics

- **Total** (n=241,062) = **Cataract surgery** (n=127,941) + **Cataract diagnosis** (n=113,121)

Variable		Total (n=241,062)	Cataract surgery (n=127,941)	Cataract diagnosis (n=113,121)	ASD
CCI	0	36,616 (15.2)	18,923 (14.8)	17,693 (15.6)	0.0510
	1	48,097 (20.0)	25,534 (20.0)	22,563 (19.9)	
	2	45,589 (18.9)	24,754 (19.3)	20,835 (18.4)	
	3	35,883 (14.9)	19,559 (15.3)	16,324 (14.4)	
	4	26,200 (10.9)	14,180 (11.1)	12,020 (10.6)	
	≥5	48,677 (20.2)	24,991 (19.5)	23,686 (20.9)	

ASD : absolute standardized difference, CCI : Charlson Comorbidity Index

Results – basic characteristics

- **Total** (n=241,062) = **Cataract surgery** (n=127,941) + **Cataract diagnosis** (n=113,121)

Variable		Total (n=241,062)	Cataract surgery (n=127,941)	Cataract diagnosis (n=113,121)	ASD*
Ocular comorbidity	No	125,666 (52.1)	59,311 (46.4)	66,355 (58.7)	**0.2482**
	Yes	115,396 (47.9)	68,630 (53.6)	46,766 (41.3)	
Severe cataract	No	183,959 (76.3)	91,627 (71.6)	92,332 (81.6)	**0.2381**
	Yes	57,103 (23.7)	36,314 (28.4)	20,789 (18.4)	
Glaucoma	No	165,321 (68.6)	82,498 (64.5)	82,823 (73.2)	**0.1895**
	Yes	75,741 (31.4)	45,443 (35.5)	30,298 (26.8)	
Age-related macular degeneration	No	238,302 (98.9)	126,321 (98.7)	111,981 (99.0)	0.0244
	Yes	2,760 (1.1)	1,620 (1.3)	1,140 (1.0)	
DM with ophthalmic manifestations	No	236,417 (98.1)	125,141 (97.8)	111,276 (98.4)	0.0407
	Yes	4,645 (1.9)	2,800 (2.2)	1,845 (1.6)	

ASD : absolute standardized difference, DM : diabetes mellitus

Results – Hazards of total and cause-specific mortality in the Korean elderly patients with cataract by surgery status

- **Total** (n=241,062) = **Cataract surgery** (n=127,941) + **Cataract diagnosis** (n=113,121)

Cause of mortality (No. of participants)	Unadjusted Cox Model Hazard Ratio (95% CI)[a]	P-value	Adjusted Cox Model Hazard Ratio (95% CI)[a,b]	P-value	Adjusted Cox Model Hazard Ratio (95% CI)[a,c]	P-value
All-cause	1.03 (1.01-1.05)	<0.001	**0.95 (0.94-0.97)**	**<0.001**	**0.93 (0.92-0.95)**	**<0.001**
Cancer	1.04 (1.01-1.08)	0.010	1.01 (0.98-1.04)	0.545	1.00 (0.97-1.03)	0.925
Vascular	1.02 (0.98-1.05)	0.337	**0.93 (0.90-0.96)**	**<0.001**	**0.92 (0.89-0.95)**	**<0.001**
Pulmonary	1.10 (1.04-1.15)	<0.001	1.01 (0.96-1.06)	0.726	0.98 (0.93-1.03)	0.358
Neurologic	**0.71 (0.65-0.78)**	**<0.001**	**0.66 (0.60-0.72)**	**<0.001**	**0.64 (0.58-0.71)**	**<0.001**
Infectious	1.25 (1.13-1.38)	<0.001	1.15 (1.04-1.28)	0.005	1.12 (1.01-1.24)	0.034
Accident or trauma	1.19 (1.12-1.27)	<0.001	1.14 (1.06-1.21)	<0.001	1.10 (1.03-1.17)	0.006

CI : confidence interval
[a]Cox model with cataract surgery status as a time-varying covariate
[b]Adjusted for age and sex
[c]Adjusted for age, sex, income, region, Charlson Comorbidity Index (0, 1, 2, 3, 4, ≥5), glaucoma, age-related macular degeneration, DM with ophthalmic manifestations, and cataract severity

Results – Hazards of mortality in patients with cataract surgery versus cataract diagnosis

- **Total** (n=241,062) = **Cataract surgery** (n=127,941) + **Cataract diagnosis** (n=113,121)

		Adjusted Hazard Ratio (95% CI)	P-value	P-value for interaction
Age (years)	<70	1.05 (1.02-1.09)	0.005	**<0.001**
	70-74	0.98 (0.95-1.01)	0.238	
	75-79	0.92 (0.89-0.95)	<0.001	
	80-84	0.88 (0.85-0.92)	<0.001	
	≥85	0.75 (0.71-0.79)	<0.001	
Gender	Male	1.00 (0.97-1.02)	0.717	**<0.001**
	Female	0.88 (0.86-0.90)	<0.001	
Residence	Metropolitan	0.93 (0.91-0.95)	<0.001	0.831
	Provincial	0.93 (0.91-0.95)	<0.001	
Income	Below 20 percentiles	0.90 (0.87-0.93)	<0.001	**0.006**
	Above 20 percentiles	0.94 (0.93-0.96)	<0.001	

Cataract diagnosis group was used as a reference in all models
Adjusted for age, gender, income, region, Charlson Comorbidity Index (0, 1, 2, 3, 4, ≥5), glaucoma, age-related macular degeneration, DM with ophthalmic manifestations and cataract severity

Results – Hazards of mortality in patients with cataract surgery versus cataract diagnosis

- **Total** (n=241,062) = **Cataract surgery** (n=127,941) + **Cataract diagnosis** (n=113,121)

		Adjusted Hazard Ratio (95% CI)	P-value	P-value for interaction
CCI	0	1.00 (0.96-1.05)	0.908	**<0.001**
	1	1.01 (0.97-1.05)	0.625	
	2	0.99 (0.95-1.03)	0.741	
	3	1.01 (0.97-1.06)	0.579	
	4	0.94 (0.90-0.99)	**0.018**	
	≥5	0.80 (0.78-0.83)	**<0.001**	

CCI : Charlson Comorbidity Index
Cataract diagnosis group was used as a reference in all models
Adjusted for age, gender, income, region, Charlson Comorbidity Index (0, 1, 2, 3, 4, ≥5), glaucoma, age-related macular degeneration, DM with ophthalmic manifestations and cataract severity

Results – Hazards of mortality in patients with cataract surgery versus cataract diagnosis

- **Total** (n=241,062) = **Cataract surgery** (n=127,941) + **Cataract diagnosis** (n=113,121)

		Adjusted Hazard Ratio (95% CI)	P-value	P-value for interaction
Severe cataract	No	0.93 (0.91-0.94)	<0.001	0.276
	Yes	0.95 (0.92-0.98)	0.001	
Glaucoma	No	0.91 (0.89-0.93)	**<0.001**	**<0.001**
	Yes	0.98 (0.95-1.01)	0.248	
Age-related macular degeneration	No	0.93 (0.92-0.95)	<0.001	0.279
	Yes	1.05 (0.84-1.31)	0.661	
DM with ophthalmic manifestations	No	0.93 (0.92-0.95)	<0.001	0.820
	Yes	0.94 (0.86-1.03)	0.203	

DM : diabetes mellitus
Cataract diagnosis group was used as a reference in all models
Adjusted for age, gender, income, region, Charlson Comorbidity Index (0, 1, 2, 3, 4, ≥5), glaucoma, age-related macular degeneration, DM with ophthalmic manifestations and cataract severity

Discussion

- **Decreased hazard** of all-cause mortality when compared with those who did not undergo surgery **after adjusting** for demographics and systemic & ocular comorbidities
  - unadjusted HR 1.03 / adjusted(demographics) HR **0.95** / adjusted(all) HR **0.93**
  - United States & Australia also reported that cataract surgery was associated with decrease all-cause mortality in patients with cataract

Ophthalmology 120 (2013) & 123 (2016)

- Cataract surgery can be **protective against all-cause mortality** by improving overall function
  - Improvements in quality of life and reduction in depressive symptoms after surgery

Am J Ophthalmol 146 (2008)

  - Patients report higher scores on cognition assessments after cataract surgery

Am J Ophthalmol 146 (2008) & J Cataract Refract Surg 30 (2004)

Discussion

- **Protective association** between cataract surgery and mortality in **neurologic disease**
  - unadjusted HR **0.71** / adjusted(demographics) HR **0.66** / adjusted(all) HR **0.64**

  - **Impairment in cognitive performance and vision** increased the odds for mortality
    - Among cognitive impaired elderly population, impairment in vision predicted
      - Nearly three-fold **higher risk** of all-cause mortality (HR 2.74; 95% CI 2.02-3.70)
      - Nearly four-fold **higher risk** of non-cardiovascular disease/non-cancer mortality (HR 3.72; 95% CI 2.30-6.00)

Front Aging Neurosci 11 (2019)

Discussion

- **Protective association** between cataract surgery and mortality from in **vascular disease**
  - Adjusted for demographics and systemic & ocular comorbidities : 0.93(0.92-0.95)

  - Hypertension is related to incident cataract, especially posterior subcapsular cataract

    PLoS One 9 (2014)

  - Cataract surgery performed at younger age in a high cardiovascular risk cohort

    Int J Cardiol 212 (2016)

  - Patients less than 65 years with hypertension medication and angina history showed a higher incidence of cataract surgery

    Ophthalmic Epidemiol 10 (2003) & 15 (2008)

Discussion

- **Limitation**
  - Based on data from a medical insurance claims database
    - Diagnostic accuracy of cataract cannot be guaranteed
      - Using KCE, KEDI codes
      - Cannot provide information about cataract grading, visual acuity, presence of pseudoexfoliation syndrome and postoperative inflammation grade
  - Lack of various covariates
    - Metabolic profiles, BMI, alcohol, smoking status…

- First report revealing relationship between cataract surgery and mortality in Korea population
- Low selective bias as the entire Korean population was enrolled in the same insurance

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Conclusion

- Cataract surgery decreased all-cause and cause-specific mortality (vascular and neurologic) in the Korean elderly patients with cataract
- Mechanisms underlying the relationship between cataract surgery and decreased mortality are unclear and need further studies

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Thank you for listening