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Pseudoexfoliation and increased intraocular pressure as risk factors for open-angle glaucoma

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Abbreviations

- CI Confidence interval
- IOP Intraocular pressure
- OAG Open-angle glaucoma
- OR Odds ratio
- PEX Pseudoexfoliation
- SMR Standardized morbidity ratio



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Classification of glaucoma

OAG

- Capsular glaucoma (with PEX)
- Chronic simple glaucoma (without PEX)

World Health Organization, International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10), Volume 1, Geneva 1992, pp. 448–449.



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The cohort study on risk factors for incident OAG in Tierp



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The Tierp glaucoma survey

The Tierp Glaucoma Survey in south central Sweden was conducted in 1984–86, including 760 people 65–74 years of age.

Automated perimetry (Competer 350) was used to identify glaucoma suspects.

Definite OAG was found in 43 subjects, 23 of whom were diagnosed in the survey.

Ekström C. Acta Ophthalmol Scand 1996; 74 (2): 107–112.



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Five-year follow-up study

- Visual fields were examined with the Competer 350 automated perimeter.
- Reliable visual fields from both eyes were available for 413 subjects
- A visual field defect was a prerequisite for a diagnosis of OAG.

Ekström C. Acta Ophthalmol 1993; 71 (2): 189–195.



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Results

By September 1992, 10 cases of capsular and 3 cases of chronic simple glaucoma had been identified.



Incidence rates of OAG, by IOP category in the five-year follow-up study in Tierp

IOP	No. of Cases	Person- years	Incidence Rate
≥ 21 mmHg	8	390.5	0.0205
< 21 mmHg	5	1517.1	0.00330

Rate ratio = 6.2 (95% CI: 2.0–19)



Incidence rates of OAG, by PEX category in the five-year follow-up study in Tierp

PEX	No. of Cases	Person- years	Incidence Rate
Yes	10	335.7	0.0298
No	3	1571.9	0.00191

Rate ratio = 15.6 (95% CI: 4.3–56.7)



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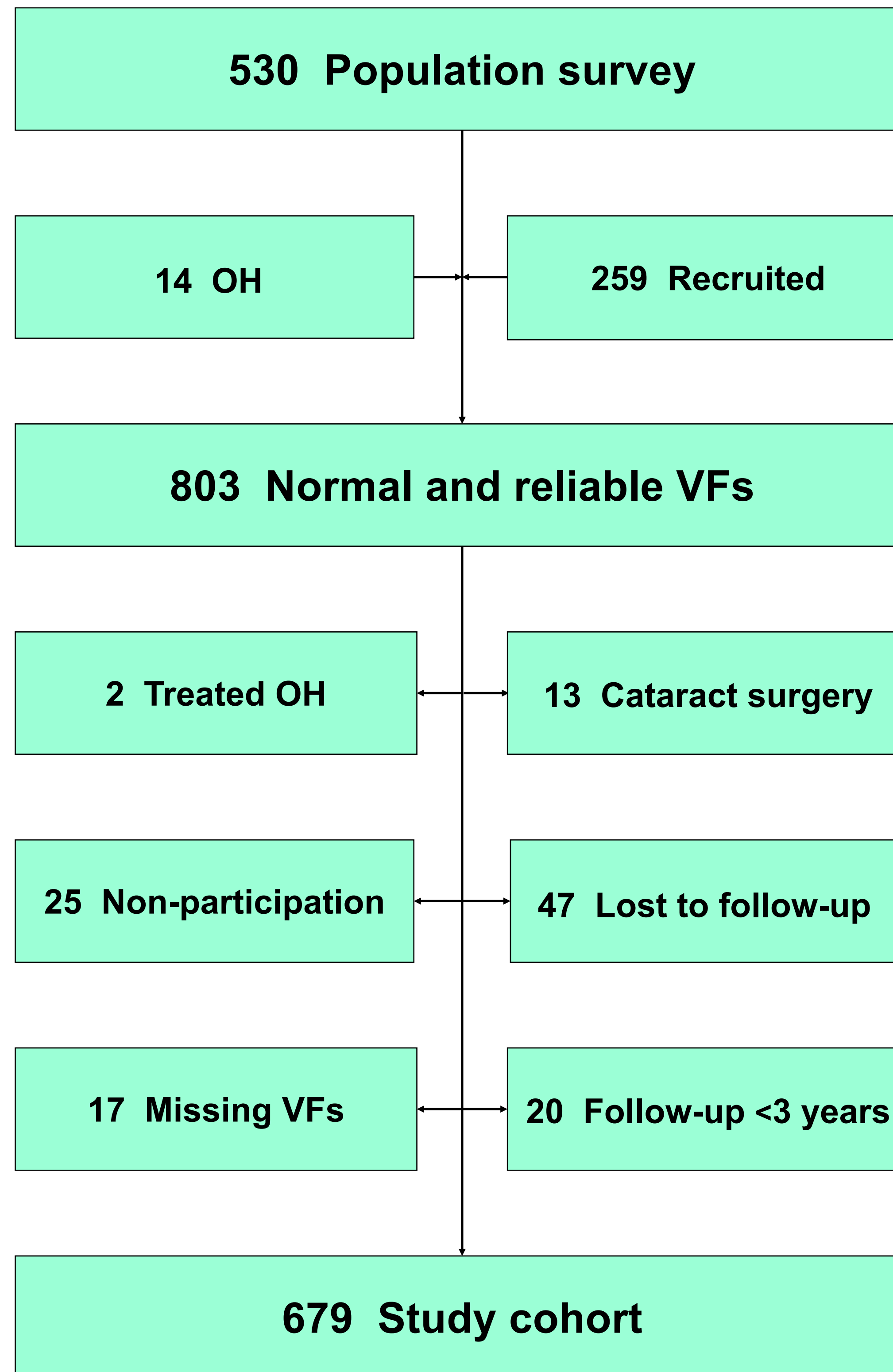
Twenty-year follow-up study

- To expand the sample size, 273 patients at the Eye Department in Tierp were recruited.
- Individuals with follow-up time less than 3 years were removed from the study.
- Reliable visual fields from at least one eye were available for 679 subjects.

Ekström C. Acta Ophthalmol 2012; 90 (4): 316–321.



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Results

By the end of study in December 2006, 64 cases of definite OAG had been detected, 29 of whom were exposed to PEX at baseline.

Three cases of capsular and 10 of chronic simple glaucoma (13 subjects) were diagnosed as normal tension glaucoma.



Associations of ocular risk factors at baseline and OAG, standardized for age in the twenty-year follow-up study in Tierp

Risk factor, either eye		SMR	95% CI
IOP \geq 20 mmHg	No	1.0	
	Yes	6.83	3.99–11.7
PEX	No	1.0	
	Yes	5.68	3.47–9.31



Risk for OAG, by increased IOP and PEX at baseline, standardized for age in the twenty-year follow-up study in Tierp

IOP mmHg	PEX		No PEX	
	SMR	95% CI	SMR	95% CI
<20	5.01	1.97–12.8	1.00	
20–24	19.4	8.97–41.9	5.49	2.60–11.6
≥25	41.1	16.6–102	10.6	3.96–28.2



Risk for OAG, by mean IOP at follow-up and PEX at baseline, standardized for age in the twenty-year follow-up study in Tierp

IOP mmHg	PEX		No PEX	
	SMR	95% CI	SMR	95% CI
<20	2.27	0.50–10.4	1.00	
20–24.99	9.90	3.38–29.0	6.76	2.91–15.7
≥25	55.9	25.9–121	28.8	11.3–59.0



Conclusion

- Increased IOP and PEX were associated with the development of OAG.
- PEX modified the effect of increased IOP.
- PEX was an independent risk factor for the development of OAG.
- The effect of PEX was mediated by increased IOP.



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Case-control study on risk factors for OAG



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Case-control study

This unpublished study in Tierp was conducted in 1988–2003, including 527 people 55–84 years of age with reliable visual fields on at least one eye.

Automated perimetry (Competer 350) was used to identify cases of OAG.



Methods

- Patients seeking medical attention at the Eye Department were included in the study.
- The study was designed as a case-control study nested in a cohort.
- Visual fields were tested in subjects with a mean IOP ≥ 18 mmHg.
- During the last year of the study, subjects with a mean IOP < 18 mmHg were examined.



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Results

Definite OAG was found in 105 subjects, 55 with capsular and 50 with chronic simple glaucoma.

Six patients were diagnosed with normal tension glaucoma.

Fifteen patients decided not to participate.

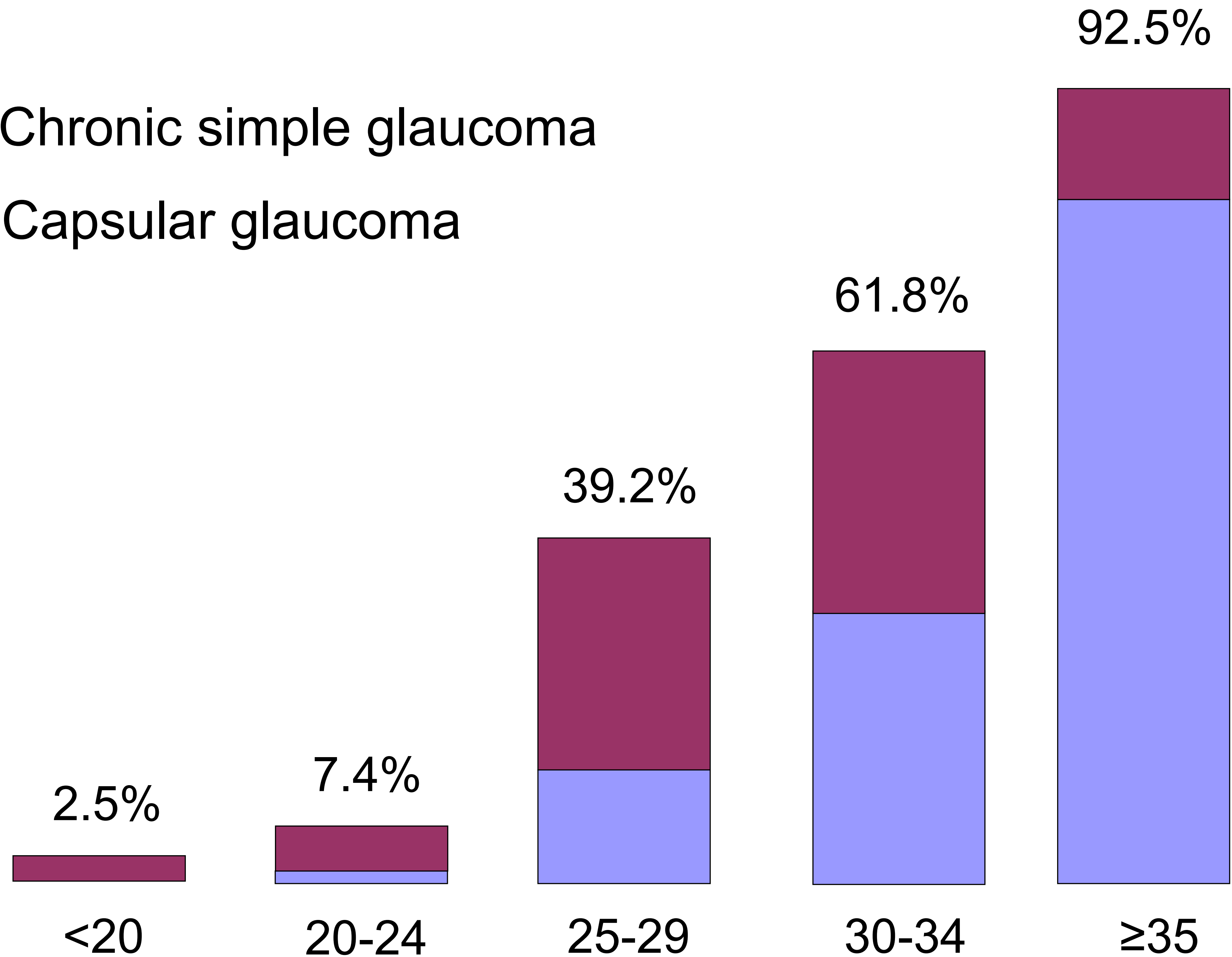


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Proportion of OAG by IOP (mmHg)

■ Chronic simple glaucoma

■ Capsular glaucoma





Logistic regression model assessing risk factors for OAG in the case-control study in Tierp

Covariate		No. of OAG	OR	95% CI
Age, per year		105	1.06	1.01–1.10
Male gender	No	53	1.00	
	Yes	52	2.01	1.07–3.79
M-IOP, per 5 mmHg		105	4.46	3.23–6.18
PEX	No	43	1.00	
	Yes	62	1.24	0.63–2.43

M-IOP = mean of the first two IOP readings at presentation.



Conclusion

- There was an exponential rise in the risk for having OAG at increasing levels of IOP.
- At an IOP of 35 mmHg or higher, practically all patients had definite OAG.
- A close connection between increased IOP and PEX was demonstrated.