

# **National clinical guideline on the treatment of age-related cataracts**

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and**

**Department of Ophthalmology  
Center of Head and Orthopedics  
Rigshospitalet – Glostrup**

**Denmark**

# Danish healthcare

- Tax financed
- No patient fee on visits or surgery performed by doctors
- High patient fee on everything done by dentists
- No patient fee on hospital stay
- Patients pay for medicine and glasses

# Danish healthcare

Secondary sector:

- 1 month diagnostic guarantee
- 2 months treatment guarantee

If the secondary sector cannot meet this guarantee, the patients are referred to the private system (reimbursed)

# Danish Ophthalmology

- Primary sector – reimbursed
  - ~200 private eye clinics
- Secondary sector – hospitals
  - 17 departments of ophthalmology (1-70 doctors/department, total ~250)
- Outside reimbursed system: 22 full-time ophthalmologists

# Cataracts in Denmark

- ~50.000 surgeries/year in reimbursed health care system
- Unknown number of surgeries financed by patients directly or via health insurances
- Reimbursement for cataract surgery: 600-1000 Euro
- Private price: 1300-2600 Euro

# Treatment guideline

Evidence based

NATIONAL KLINISK  
RETNINGSLINJE FOR  
BEHANDLING AF  
ALDERSBETINGET GRÅ STÆR

2013

# Access to treatment guideline

Consensus based

BEHANDLING AF  
ALDERSBETINGET GRÅ STÆR  
FAGLIG VISITATIONSRETNINGSLINJE

2014

## **Working group:**

### Representing public hospitals appointed by the Danish Ophthalmological Society:

- Jesper Hjortdal (Chairman of the Danish Ophthalmological Society, senior consultant, professor, Dr.Med.Sci, PhD, Department of Ophthalmology, Aarhus University Hospital NBG)
- Ditte Erngaard (Head of Department of Ophthalmology, Næstved Hospital)

### Representing private Ophthalmologists appointed by the Danish Ophthalmological Society:

- Per Flesner, Ophthalmologist, PhD, Odense
- Jens Lundgaard Andresen, Ophthalmologist, PhD, Skanderborg

### Appointed by the Danish Nurses' Organization:

- Nana Christensen (nurse, Department of Ophthalmology, Aarhus University Hospital NBG)

### Danish Health and Medicines Authority:

- Johannes Gaub (chairman, Dr.Med.Sci.)
- Kristoffer Lande Andersen (academic secretary)
- Line Kessel (medical advisor, PhD, FEBO)
- Britta Tendal (methodologists, PhD, the Nordic Cochrane Center)
- Birgitte Holm Pedersen (informationist specialist)

## **Reference group:**

### Representing the Danish Regions (administrative body of Danish healthcare):

- Morten de la Cour. Professor, senior consultant, Dr.Med.Sci. Department of Ophthalmology, Glostrup Hospital
- Pernille Theil. Senior consultant, PhD, Department of Ophthalmology Roskilde Hospital
- Niels Lyhne. Senior consultant, PhD, Department of Ophthalmology, Odense University Hospital

### Representing the local Danish governments:

- Lone Ipsen, district nurse

### Ministry of Health:

- Gertrud Rex Baungaard, administrative officer

### Patient associations:

- Erik Lohman, Administrative Director, Øjenforeningen Værn om Synet (Protect Vision)

## **Peer review**

- Birgitte Haargaard, senior consultant, PhD, Glostrup Hospital
- Jens Christian Nørregaard. Private Ophthalmologist, PhD. Dr.Med.Sci Klinikken i Haven, Frederiksberg



Skriv søgeord



Sundhed & behandling

Medicin & medicinsk udstyr

Uddannelse, autorisation & tilsyn

Om os English Nyheder Kampagner Udgivelser

Sundhed & behandling / Kvalitet og retningslinjer / Nationale Kliniske Retningslinjer / Udgivelser / Grå stær

- Kvalitet og retningslinjer
  - Nationale Kliniske Retningslinjer
    - Udgivelser
      - Cerebral parese
      - Demens
      - Diabetiske fodsår
      - Grå stær
      - Hjerterehabilitering
      - Tandplejen
      - Udvalgte skulderlidelser
      - Visitationsretningslinjer
    - Igangværende
    - Kommende
    - Nationale udvalg
    - Metode
    - Konference
  - Medicinsk Teknologivurdering (MTV)
  - Udgivelser

## National Klinisk Retningslinje: Grå stær

6. marts 2013, Opdateret 22. april 2014

Sundhedsstyrelsen offentliggjorde den 30. september 2013 National Klinisk Retningslinje (NKR) for behandling af aldersbetonet grå stær. Retningslinjen indeholder en række anbefalinger inden for følgende områder:

- operationsindikation
- kunstig linse implantater
- forebyggelse af endoftalmitis, postoperativ inflammation og nethindehævelse
- sammedagskirugi og
- førstedagskontroller.

Retningslinjen offentliggøres dels i en fuld tekst version, dels som en 'quick guide', som alene indeholder retningslinjens anbefalinger.

### NKR

[National Klinisk Retningslinje \(NKR\) for aldersbetonet grå stær](#)

### QUICK GUIDE

[Quick Guide til NKR for aldersbetonet grå stær](#)

### SØGEPROTOKOL

[Høringsnotat - NKR for aldersbetonet grå stær](#)

[Hørings svar - NKR for aldersbetonet grå stær](#)

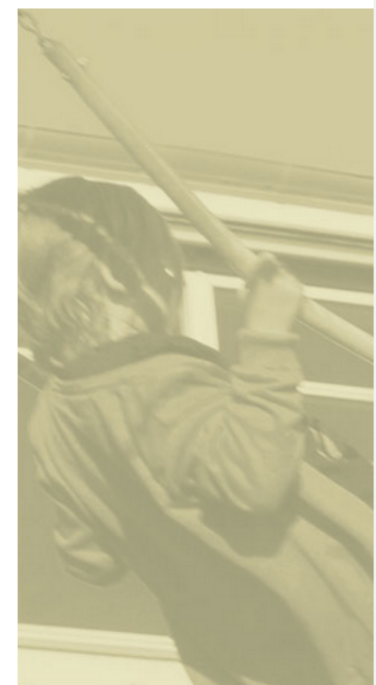
[Høringsportalen - national klinisk retningslinje for aldersbetonet grå stær](#)

### FAGLIG VISITATIONSRETNINGSLINJE

[Faglig visitationsretningslinje for behandling af grå stær](#)

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# National clinical guidelines

- The Danish Finance Act of 2012 appropriated DKK 20 million (~270,000 Euro) annually in the period from 2012 to 2015 for the preparation of 50 national clinical guidelines.
- A national clinical guideline is a set of systematically prepared, scientific recommendations describing diagnosis, treatment, care and rehabilitation for specific patient groups – based on evidence for the effect and best practice

# National clinical guidelines

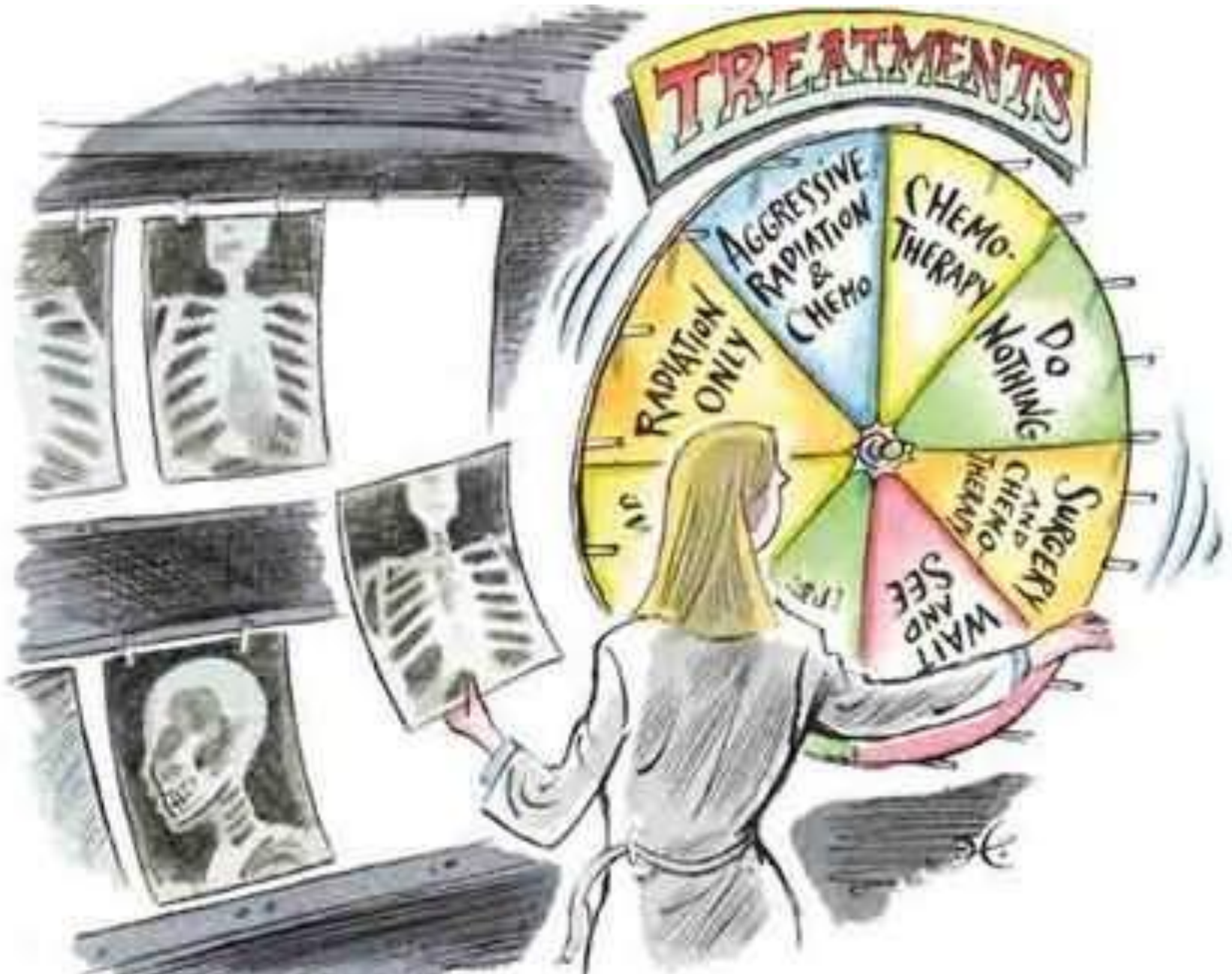
- Aim: to improve the quality of health care services in Denmark
- The aim was not to cut down health care expenditures
- NCGs: ADHD (children and adolescents). Treatment of brain metastasis. Physiotherapy in Cerebral palsy. Diagnosing polycystic ovarian syndrome. Dementia. Diabetic foot ulcers. Pharmacological treatment of bipolar disorders. Cataract. Rehabilitation after cardiac disease

# Guidelines for access to treatment

- Published by the Danish Health and Medicines Authorities
- Political agreement between the government and Danish Regions (local governments administering health care)
- Aim: to control access to treatment and to regulate health care expenditures

# Why do we need evidence-based medicine?





# Evidence-based medicine

Systematic approach to medical science

Meta-analyses

Recommendations based on:

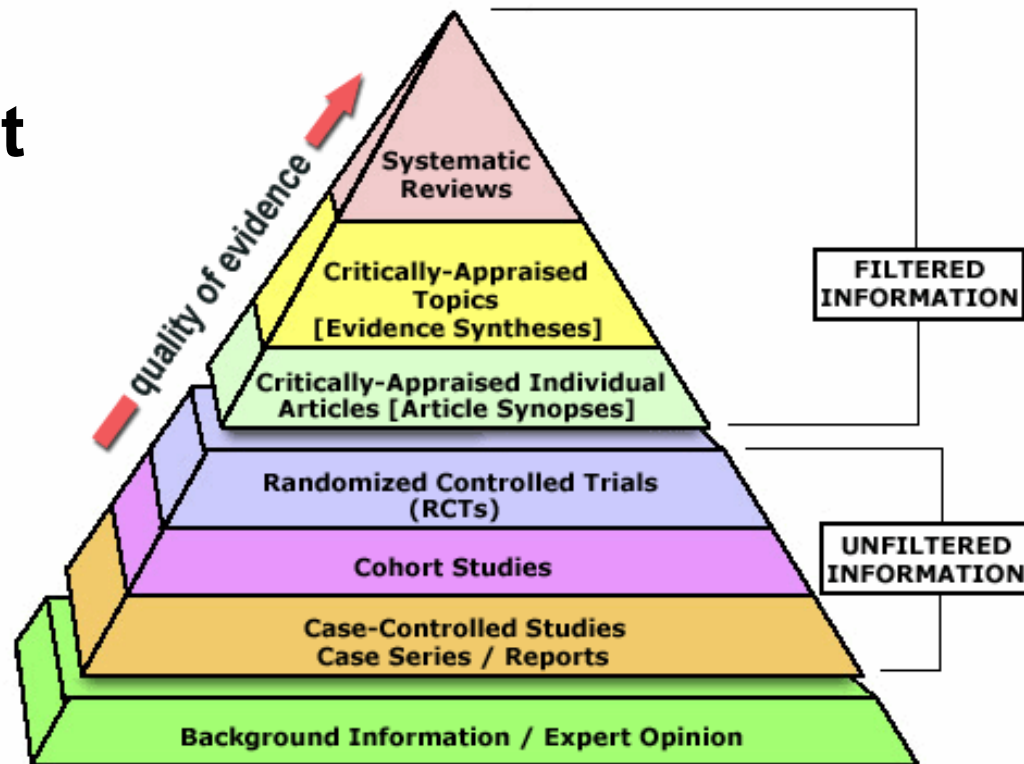
- Treatment effect
- Harms/side effects
- Costs
- Availability
- Quality of evidence
- Preferences



# Quality of evidence

Randomized trials **start**  
as high quality

Observational studies  
**start** as low quality





Parachutes reduce the risk of injury after gravitational challenge, but their effectiveness has not been proved with randomised controlled trials



# Assessing the quality of evidence

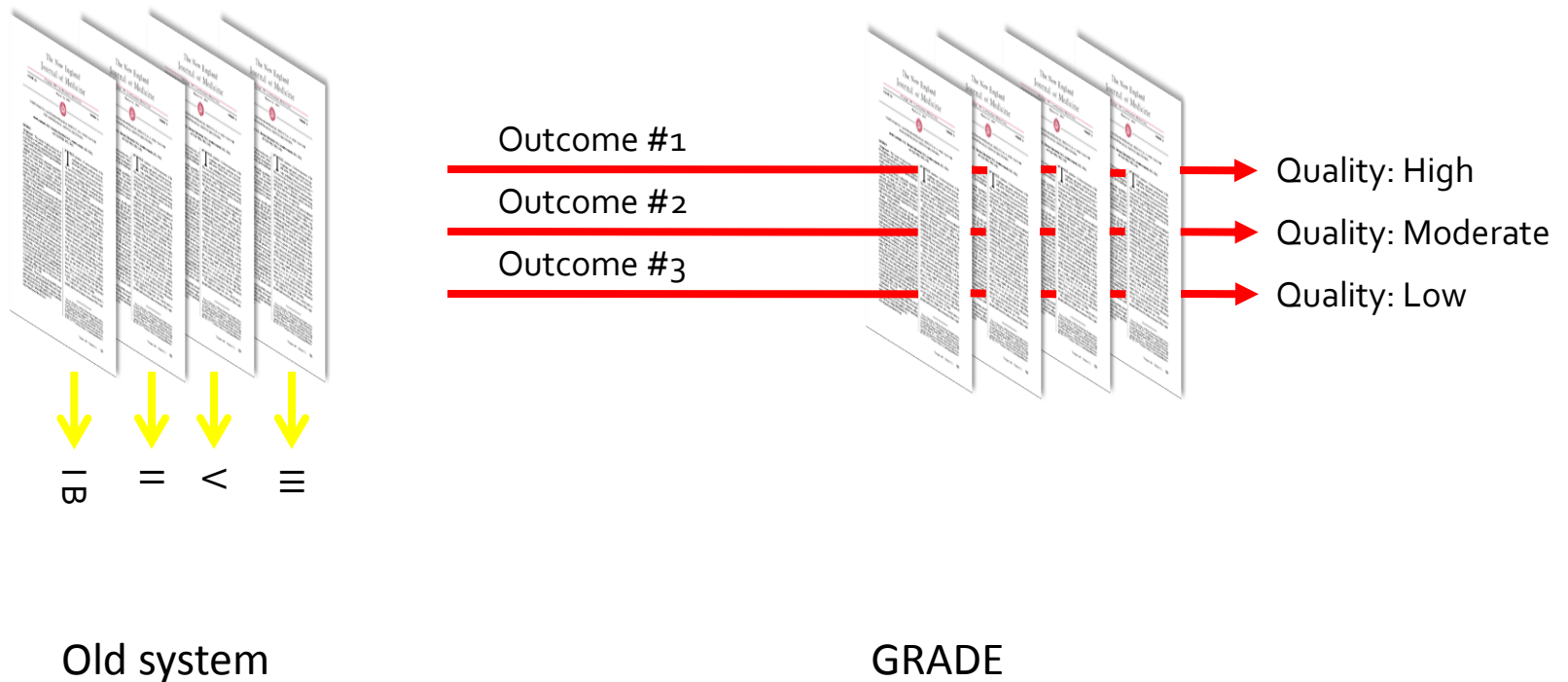
## Down-grading

- Methodological limitations (risk of bias)
- Inconsistency between studies
- Indirectness
- Imprecision
- Publication bias

## Up-grading

- Very high effect
- Dose-response

# Quality of evidence is assessed across studies



# How to interpret the quality of the evidence?

**High:** We are certain that the true treatment effect is very close to the estimated effect.

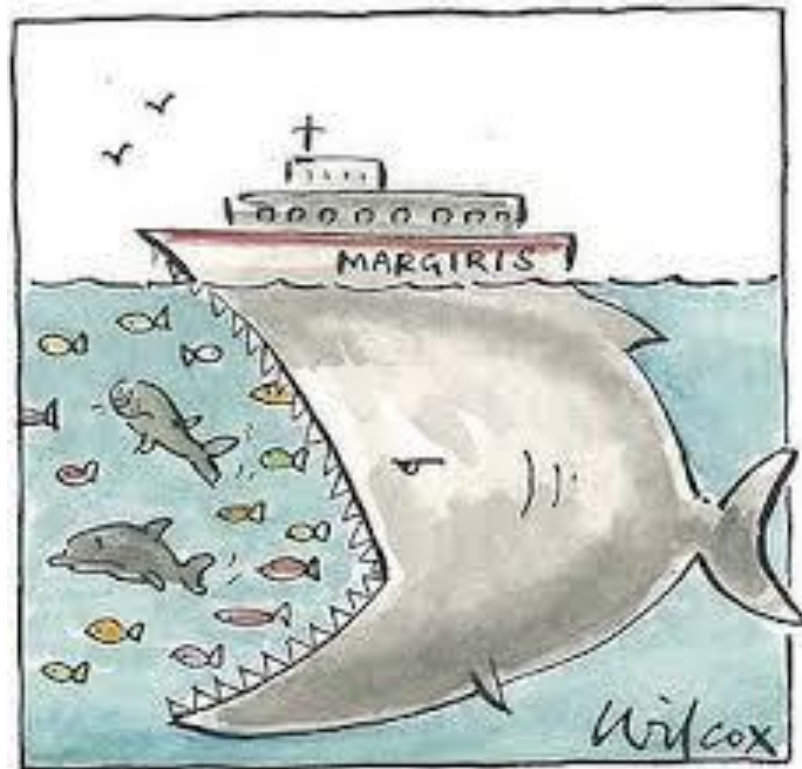
**Moderate:** The true effect is most likely close to the estimated effect but it may be different.

**Low:** We have low confidence in the estimated effect. The true effect may be markedly different from the estimated effect

**Very low:** We have very low confidence in the estimated effect. The true effect is most likely very different from the estimated effect

# National clinical guidelines

Based on in-depth analysis of few topics rather than broad coverage of many topics



# National clinical guideline on treatment of age-related cataracts

- Indication for surgery
- Cataract surgery in patients with age-related macular degeneration
- Toric implant lenses (IOL)
- Antibiotic prevention of endophthalmitis
- Control of inflammation and prevention of cystoid macular edema
- Immediate sequential bilateral surgery
- Post-operative controls

4514 REFERENCES IDENTIFIED

Review of title and abstract

1250 included

Excluded: 3264 references

After reading

180 included

Excluded: 1070 references

### GRADE evaluation

Focus question 1: 7 observational

Focus question 2: 0 references

Focus question 3: 2 RCT + 1 observational

Focus question 4: 3 RCT

Focus question 5: 1 RCT + 12 observational

Focus question 6: 1 RCT + 1 observational

Focus question 7: 15 RCT

Focus question 8: 2 RCT

Focus question 9: 3 RCT

Excluded: 2 references

+

Background references

112 references

160 references to NKR

# Indication for cataract surgery



Nationella Kataraktregister - Kirurgdagen - 15 oktober 2015 - Line Kessel

# Can we tell pre-operatively who is going to benefit from surgery?

The patient with fair or poor pre-operative visual acuity?

The patient with fair visual acuity but many visual complaints or the patient with poor visual acuity but few visual complaints?



# Can we tell pre-operatively who is going to benefit from surgery?

The patient with fair or poor pre-operative visual acuity?

The patient with fair visual acuity but few visual complaints?

**No references could be identified**

# Indication for cataract surgery

## 8 observational studies:

Davies 2012, BMC Geriatr 12: 50

Douthwaite 2007, Br J Ophthalmol; 91: 638-643

Garcia-Gutierrez 2012, Health Expectations; doi:  
10.1111/j.1369-7625.2012.00801.x

Kantan 2011, Clin Exp Ophthalmol; 39: 201-206

Lundström 1999, Br J Ophthalmol; 83: 1272-1276

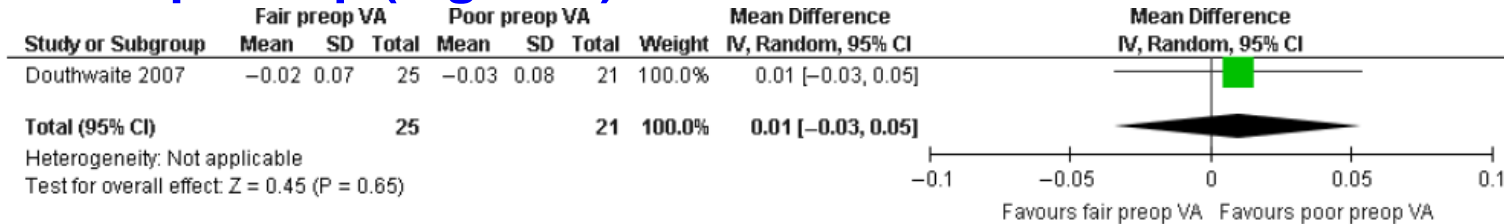
Lundström 2013, J Cataract Refract Surg; in press

Rosen 2005, J Cataract Refract Surg; 31: 369-378

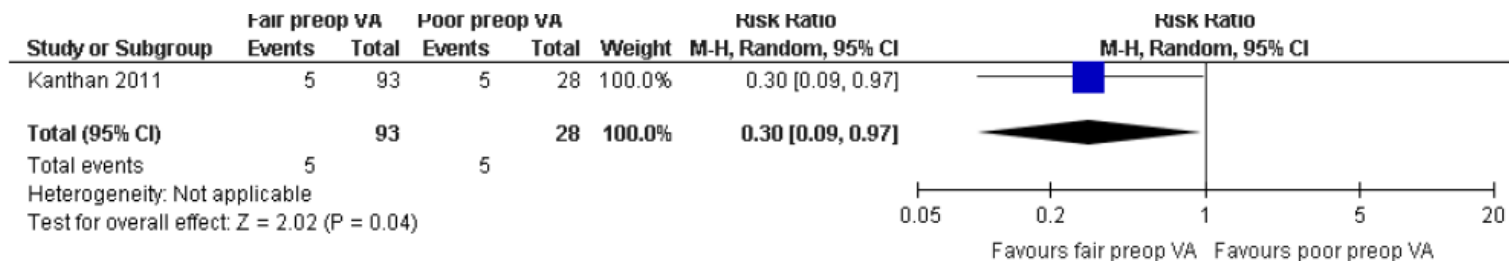
Saw 2002, J Cataract Surg; 28: 445-453

# Objective visual improvement

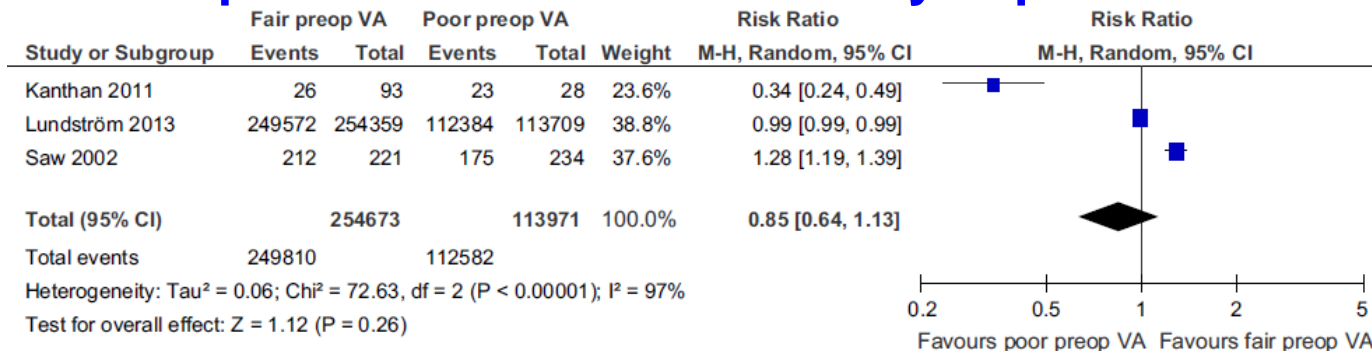
## BCDVA post-op (logMAR)



## Number of patients with post-op visual acuity 20/40 (0.5) or less

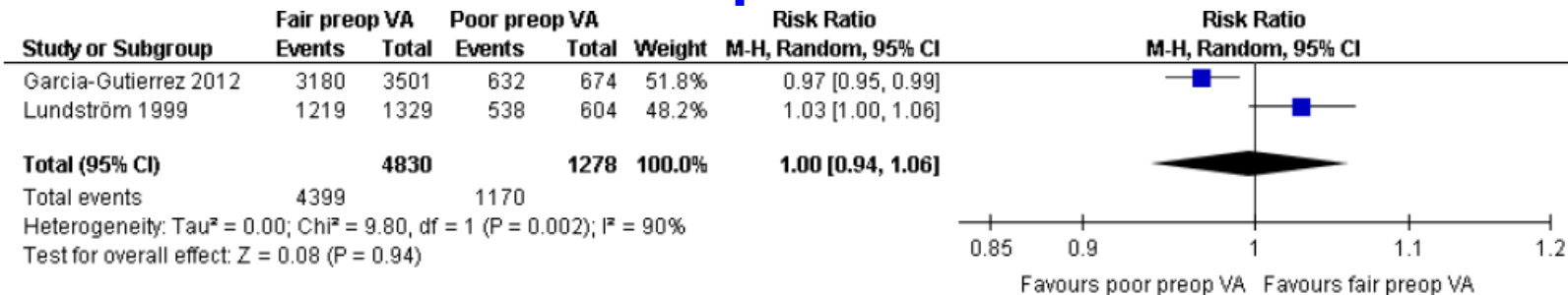


## Number of patients whose visual acuity improved after surgery

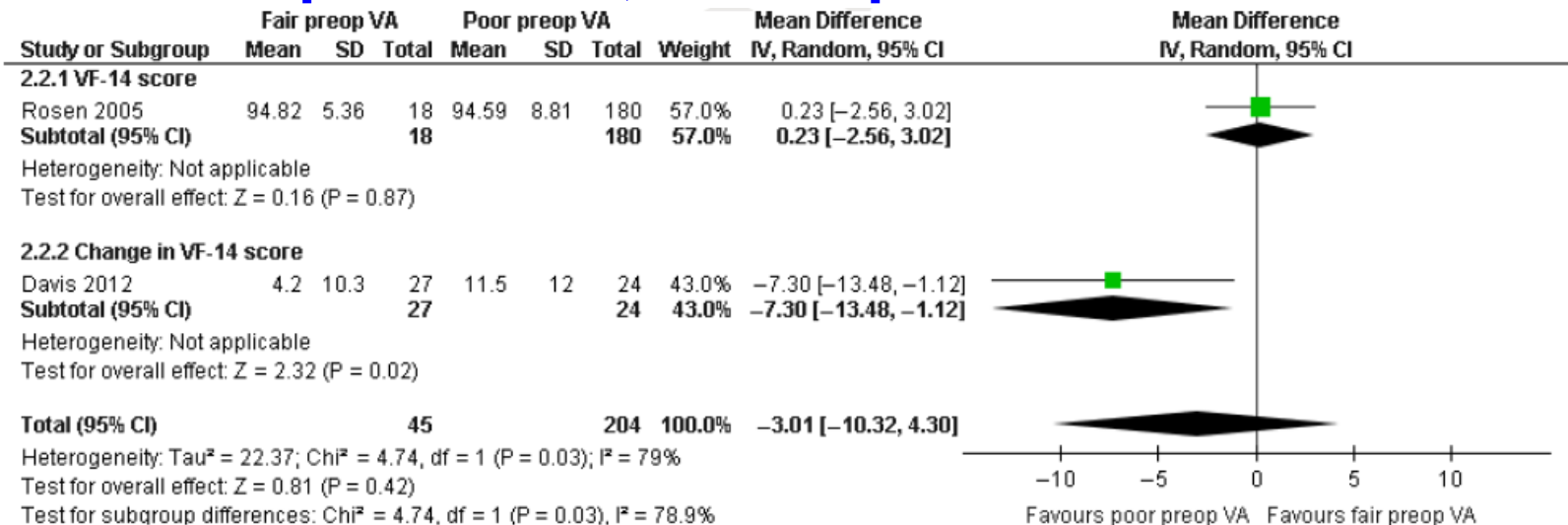


# Subjective visual improvement

## Self-assessed visual improvement



## Visual improvement, VF-14 questionnaire



# Recommendation – indications for cataract surgery

Outcome after cataract surgery is the same in patients with fair and poor pre-operative visual acuity. The quality of evidence is very low

 We do not recommend using pre-operative visual acuity as the only indicator for cataract surgery (⊕○○○)

# How do we decide which patients to offer surgery?

Several systems prioritize patients on waiting lists. None of them can predict if the patient will benefit from surgery!

The only system shown to have a predictive value is the Swedish NIKE (Nationell Indikationsmodell for Katarakt Ekstraktion)

NIKE score is calculated based on pre-op visual acuity, visual complaints and medical grounds for surgery

# Guideline for access to treatment

<b>NIKE</b>		Cpr.nr
National Indikationsmodel for Kataraktekstraktion		Navn
<b>Værktøjet forudsætter patientsamarbejde!</b>		

Bedømmelsen gælder operation af	OD <input type="checkbox"/>	OS <input type="checkbox"/>	Begge <input type="checkbox"/>
---------------------------------	-----------------------------	-----------------------------	--------------------------------

1. Er der medicinsk indikation for operation?  Hvis ja, spring til indikationsgruppe 1  
(f.eks matur katarakt)

2. Bedst korrigeret synsstyrke	H: <0,1 0,1 0,2 0,3 0,4 0,5 0,6 0,7 0,8 0,9 1,0	Point
	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	3 3 2 2 1 1 1 Point	
	V: <0,1 0,1 0,2 0,3 0,4 0,5 0,6 0,7 0,8 0,9 1,0	Point
	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	3 3 2 2 1 1 1 Point	

3A. Synsbesvær i dagligdagen (fra spørgeskema).	Meget stort (3)	Stort (2)	Noget (1)	Intet (0)
3B. Kataraktsymptomer. Blænding og samsynsproblemer (fra spørgeskema).	Meget stort (3)	Stort (2)	Noget (1)	Intet (0)
3C. Synsbesvær ved arbejde, bilkørsel eller i forbindelse med at klare sig selv (fra spørgeskema).	Meget stort (3)	Stort (2)	Noget (1)	Intet (0)

Indikationsgruppe	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	Total
Point-interval	15 - 12	11 - 7	6 - 4	3 - 0	

Hvis det er tvivlsomt om man kan forvente synsfremgang pga anden øjenssygdom, flyttes til en højere indikationsgruppe =svagere indikation for operation

Korrigeret indikationsgruppe

Dato:

Ansvarlig læge:

**Medical indication**

**Visual acuity**

**Visual complaints**

**Not likely to benefit**

<b>NIKE</b> National Indikationsmodel for Kataraktekstraktion		Cpr.nr			
<b>Værktøjet forudsætter patientsamarbejde!</b>		Navn			
Bedømmelsen gælder operation af		OD <input type="checkbox"/> OS <input type="checkbox"/> Begge <input type="checkbox"/>			
1. Er der medicinsk indikation for operation? (f.eks matur katarakt)		<input type="checkbox"/> Hvis ja, spring til indikationsgruppe 1			
2. Bedst korrigeret synsstyrke	H: <0,1 0,1 0,2 0,3 0,4 0,5 0,6 0,7 0,8 0,9 1,0 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Point			
	3 3 2 2 1 1 1 Point				
V: <0,1 0,1 0,2 0,3 0,4 0,5 0,6 0,7 0,8 0,9 1,0 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Point				
		3 3 2 2 1 1 1 Point			
3A. Synsbesvær i dagligdagen (fra spørgeskema).	Meget stort (3)	Stort (2)	Noget (1)	Intet (0)	Total
3B. Kataraktsymptomer. Blænding og samsynsproblemer (fra spørgeskema).	Meget stort (3)	Stort (2)	Noget (1)	Intet (0)	
3C. Synsbesvær ved arbejde, bilkørsel eller i forbindelse med at klare sig selv (fra spørgeskema).	Meget stort (3)	Stort (2)	Noget (1)	Intet (0)	
Indikationsgruppe	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	Total
Point-interval	15 - 12	11 - 7	6 - 4	3 - 0	
Hvis det er tvivlsomt om man kan forvente synsfremgang pga anden øjenssygdom, flyttes til en højere indikationsgruppe =svagere indikation for operation		Korrigeret indikationsgruppe <input type="checkbox"/>			
Dato:					
Ansvarlig læge:					



**NIKE**  
National Indikationsmodel for Kataraktekstraktion

Cpr.nr  
Navn

**Værktøjet forudsætter patientsamarbejde!**

Bedømmelsen gælder operation af OD  OS  Begge

1. Er der medicinsk indikation for operation? (f.eks matur katarakt)  Hvis ja, spring til indikationsgruppe 1

2. Bedst korrigeret synsstyrke

H: <0,1	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	3	2	2	1	1	1				
Point										
V: <0,1	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	3	2	2	1	1	1				
Point										

3A. Synsbesvær i dagligdagen (fra spørgeskema).

Meget stort (3)	Stort (2)	Noget (1)	Intet (0)
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3B. Kataraktsymptomer og samsynsproblemer (fra spørgeskema).

(3)	(2)	(1)	(0)
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3C. Synsbesvær ved bilkørsel eller i forbindelse med at klare sig selv (fra spørgeskema).

(3)	(2)	(1)	(0)
-----	-----	-----	-----

Indikationsgruppe

1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	Total
15 - 12	11 - 7	6 - 4	3 - 0	

Point-interval

Hvis det er tvivlsomt om man kan forvente synsfremgang pga anden øjensygdom, flyttes til en højere indikationsgruppe svagere indikation for operation

Korrigeret indikationsgruppe

Dato:

Ansvarlig læge:

**Surgery**

**Benefit from surgery**

**No benefit/worse after surgery**

**No surgery**

## Review Article

# Indication for cataract surgery. Do we have evidence of who will benefit from surgery? A systematic review and meta-analysis

Line Kessel,<sup>1,2</sup> Jens Andresen,<sup>3</sup> Ditte Erngaard,<sup>4</sup> Per Flesner,<sup>5</sup> Britta Tendal<sup>2</sup> and Jesper Hjortdal<sup>6</sup>

<sup>1</sup>Department of Ophthalmology, Rigshospitalet - Glostrup, Glostrup, Denmark

<sup>2</sup>Danish Health and Medicines Authorities, Copenhagen, Denmark

<sup>3</sup>Skanderborg Eye Clinic, Skanderborg, Denmark

<sup>4</sup>Department of Ophthalmology, Næstved Hospital, Næstved, Denmark

<sup>5</sup>Odense Eye Clinic, Odense, Denmark

<sup>6</sup>Department of Ophthalmology, Aarhus University Hospital NBG, Aarhus, Denmark

## ABSTRACT.

The need for cataract surgery is expected to rise dramatically in the future due to the increasing proportion of elderly citizens and increasing demands for optimum visual function. The aim of this study was to provide an evidence-based recommendation for the indication of cataract surgery based on which group of patients are most likely to benefit from surgery. A systematic literature search was performed in the MEDLINE, CINAHL, EMBASE and COCHRANE LIBRARY databases. Studies evaluating the outcome after cataract surgery according to preoperative visual acuity and visual complaints were included in a meta-analysis. We identified eight observational studies comparing outcome after cataract surgery in patients with poor (<20/40) and fair (>20/40) preoperative visual acuity. We could not find any studies that compared outcome after cataract surgery in patients with few or many preoperative visual complaints. A meta-analysis showed that the outcome of cataract surgery, evaluated as objective and subjective visual improvement, was independent on preoperative visual acuity. There is a lack of scientific evidence to guide the clinician in deciding which patients are most likely to benefit from surgery. To overcome this shortage of evidence, many systems have been developed internationally to prioritize patients on waiting lists for cataract surgery, but the Swedish NIKE (Nationell Indikationsmodell för Katarakt Ekstraktion) is the only system where an association to the preoperative scoring of a patient has been related to outcome of cataract surgery. We advise that clinicians are inspired by the NIKE system when they decide which patients to operate to ensure that surgery is only offered to patients who are expected to benefit from cataract surgery.

**Key words:** cataract – evidence – indication – visual acuity

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doi: 10.1111/aos.12758

## Introduction

Cataract is a clouding of the lens of the eye interfering with visual function. Globally, cataract is the leading cause of blindness and impaired visual acuity (Resnikoff et al. 2004). Cataract surgery is one of the most commonly performed elective surgical procedures performed in westernized countries. Indications for cataract surgery are changing with more patients being operated at younger ages and better visual acuities (Behndig et al. 2011; Kessel et al. 2011; Lundstrom et al. 2015). The annual number of surgeries increases (Solborg et al. 2015) and is expected to double within the next two decades (Tuulonen et al. 2009; Kessel 2011). This probably reflects increasing demands for optimum visual function in patients as well as improved outcomes and safer procedures lowering the physician's barrier for indication. A Finnish study showed that a surprisingly large proportion of patients with preoperative visual acuity 0.8 or better and in whom visual acuity could be improved by glasses still chose to have cataract surgery (Falck et al. 2012).

Cataract is diagnosed clinically at the slit lamp. Objective measurements may assist the clinician in the diagnosis. Most objective systems measure the degree of light scattering, for example the dynamic light scattering method

# Cataract surgery and age-related macular degeneration



# AMD risk and cataract surgery?

## Epidemiologic findings

### INCREASED RISK

Beaver Dam: risk of late AMD increased in patients who had cataract surgery more than 5 yrs ago (OR 1.93)

Pooled data from Salisbury Eye Evaluation, Proyecto VER og Baltimore Eye Survey found an increased risk of late AMD after cataract surgery (OR 1.7)

Rotterdam: risk of late, dry AMD was increased (OR 3.44) but the risk of exudative or early AMD was not increased. Genetic profile associated with higher risks

### RISK NOT INCREASED

AREDS: no progression of AMD after cataract surgery

Beijing Eye Study: risk of AMD was the same in eyes with cataract/pseudophakia and fellow eyes

### UNCERTAIN

Blue Mountains Eye Study: OR 3.3 for development of neovascular AMD or geographic atrophy in patients who had surgery before baseline (1992-94) but risk not increased for patients who had surgery between baseline and 10 yr follow-up

Beaver Dam: risk of early AMD and risk of progression of AMD increased in patients with cataract (without surgery)

# AMD risk and cataract surgery?

## Epidemiologic findings

### INCREASED RISK

Beaver Dam: risk of late AMD increased in patients who had cataract surgery more than 5 yrs ago (OR 1.93)

Risk of AMD seems to be increased after cataract surgery but to the same extent as the risk increases by the patient having cataract without surgery

atrophy in patients who surgery before baseline (1992-94) but not for patients who surgery between baseline and 10 yr follow-up

Beaver Dam: risk of early AMD and risk of progression of AMD increased in patients with cataract (without surgery)

## Randomized studies:

Lamoureux EL, Hooper CY, Lim L et al. Impact of cataract surgery on quality of life in patients with early age-related macular degeneration. *Optom Vis Sci* 2007;**84**:683-688.

Hooper CY, Lamoureux EL, Lim L et al. Cataract surgery in high-risk age-related macular degeneration: a randomized controlled trial. *Clin Experiment Ophthalmol* 2009;**37**:570-576.

Brunner S, Mora A, Fonseca J et al. Monitoring of drusen and geographic atrophy area size after cataract surgery using the MD3RI tool for computer-aided contour drawing. *Ophthalmologica* 2013;**229**:86-93.

## Case-control studies

Armbrecht AM, Findlay C, Kaushal S et al. Is cataract surgery justified in patients with age related macular degeneration? A visual function and quality of life assessment. *Br J Ophthalmol* 2000;**84**:1343-1348.

Armbrecht AM, Findlay C, Aspinall PA et al. Cataract surgery in patients with age-related macular degeneration: one-year outcomes. *J Cataract Refract Surg* 2003;**29**:686-693.

Wang JJ, Fong CS, Rochtchina E et al. Risk of age-related macular degeneration 3 years after cataract surgery: paired eye comparisons. *Ophthalmology* 2012;**119**:2298-2303.

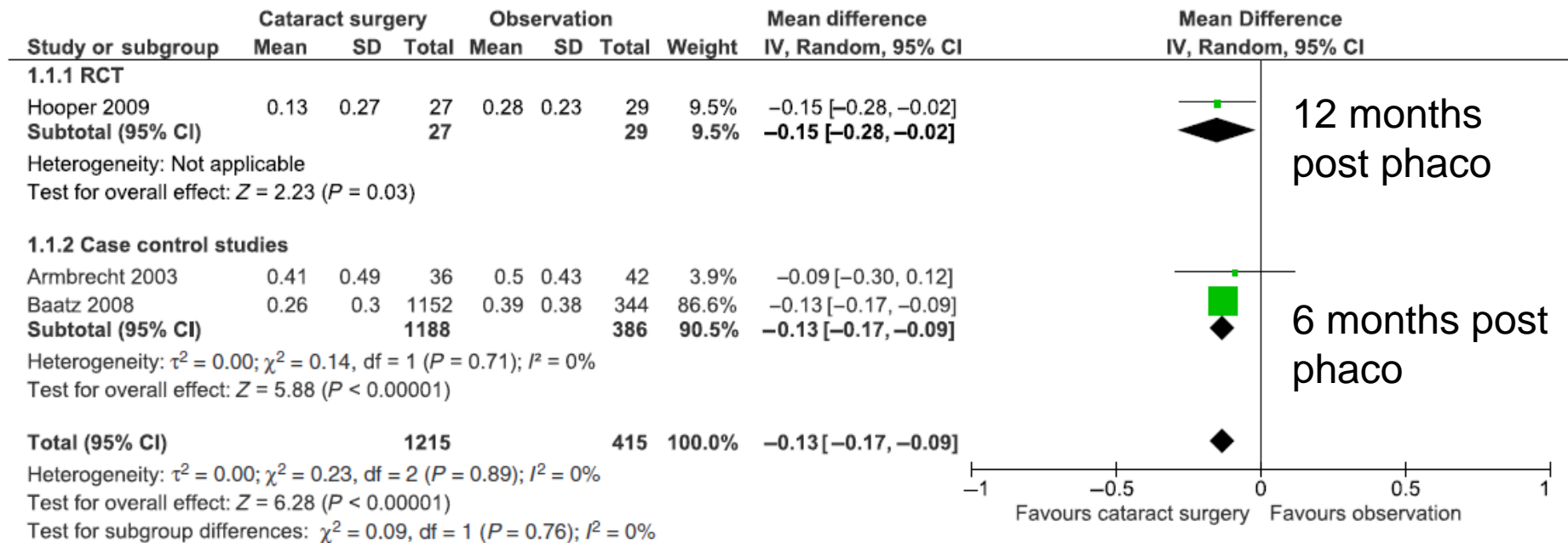
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- Lamoureux EL, Hooper CY, Lim L et al. Impact of cataract surgery on quality of life in patients with early age-related macular degeneration. *Optom Vis Sci* 2007;**84**:683-688.
- Hooper CY, Lamoureux EL, Lim L et al. Cataract surgery in high-risk age-related macular degeneration: a randomized controlled trial. *Clin Experiment Ophthalmol* 2009;**37**:570-576.
- Brunner S, Mora A, Fonseca J et al. Monitoring of drusen and geographic atrophy area size after cataract surgery using the MD3RI tool for computer-aided contour drawing. *Ophthalmologica* 2013;**229**:86-93.

## Case-control studies

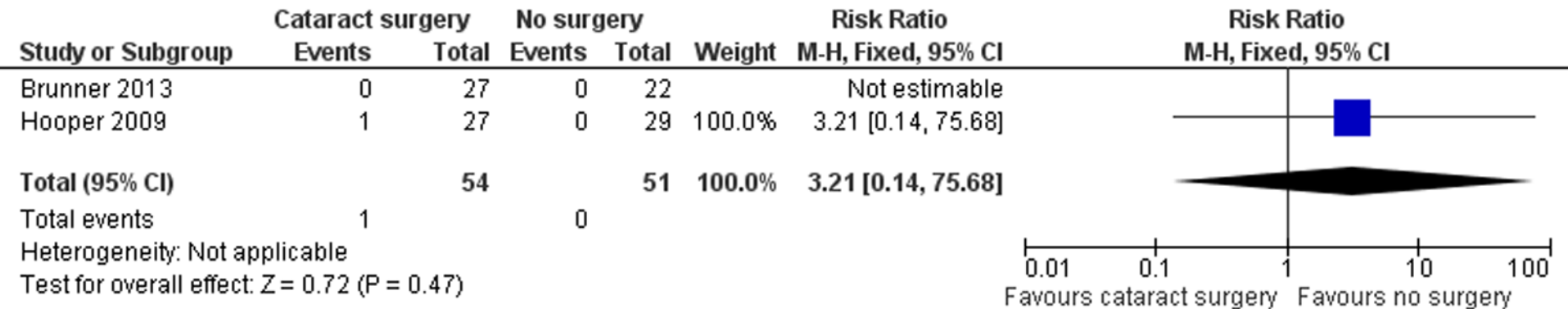
- Armbrecht AM, Findlay C, Kaushal S et al. Is cataract surgery justified in patients with age related macular degeneration? A visual function and quality of life assessment. *Br J Ophthalmol* 2000;**84**:1343-1348.
- Armbrecht AM, Findlay C, Aspinall PA et al. Cataract surgery in patients with age-related macular degeneration: one-year outcomes. *J Cataract Refract Surg* 2003;**29**:686-693.
- Wang JJ, Fong CS, Rochtchina E et al. Risk of age-related macular degeneration 3 years after cataract surgery: paired eye comparisons. *Ophthalmology* 2012;**119**:2298-2303.

# Visual acuity in after cataract surgery in AMD patients





# Progression to exudative AMD



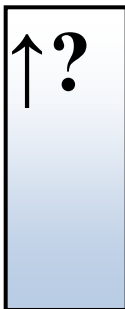
## RCT, 6-12 months follow-up post-phaco



## Case-control, 12 months follow-up post-phaco

# Recommendations – cataract surgery in patients with AMD

We found moderate quality scientific evidence that the risk of progression of AMD is not increased after cataract surgery. The number of included patients was very low and follow-up was short. Further studies may change the conclusion

 We recommend offering surgery to patients with AMD if the clinician thinks it will improve the visual function of the patient. The patient should be advised that outcome is limited by the retinal status (⊕⊕⊕○)

Review Article

## Cataract surgery and age-related macular degeneration. An evidence-based update

Line Kessel,<sup>1,2</sup> Ditte Erngaard,<sup>3</sup> Per Flesner,<sup>4</sup> Jens Andresen,<sup>5</sup> Britta Tendal<sup>2,6</sup> and Jesper Hjortdal<sup>7</sup>

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<sup>5</sup>Skanderborg Eye Clinic, Skanderborg, Denmark

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### ABSTRACT.

**Purpose:** Age-related macular degeneration (AMD) and cataract often coexist in patients and concerns that cataract surgery is associated with an increased risk of incidence or progression of existing AMD has been raised. This systematic review and meta-analysis is focused on presenting the evidence concerning progression of AMD in patients undergoing cataract surgery.

**Methods:** We performed a systematic literature search in the PubMed, Medline, Cochrane Library and CINAHL databases. Two randomized trials and two case-control trials were identified. Quality of the studies was assessed using the Cochrane risk of bias tool, data were extracted, and meta-analyses were performed. Quality of the available evidence was evaluated using the GRADE system.

**Results:** We found that visual acuity at 6–12 months follow-up was significantly better (6.5–7.5 letters) in eyes that had undergone cataract surgery than in unoperated eyes, but the included number of subjects was small, and hence, the quality of evidence was downgraded to moderate. We did not find an increased risk of progression to exudative AMD 6–12 months after cataract surgery [RR 3.21 (0.14–75.68)], but the included number of subjects was small, and thus, the quality of the evidence was moderate.

**Conclusion:** Cataract surgery increases visual acuity without an increased risk of progression to exudative AMD, but further research with longer follow-up is encouraged.

**Key words:** age-related macular degeneration – cataract surgery – exudative age-related macular degeneration – outcome – visual acuity

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### Introduction

Cataract and age-related macular degeneration (AMD) are both common

causes of impaired visual acuity and blindness in the elderly population in westernized countries. Globally, cataract is the most common cause of

blindness (Resnikoff et al. 2004). In westernized countries where there is relative easy access to cataract surgery, blindness from cataract is very rare, but it remains the leading cause of impaired visual acuity in the elderly population with AMD ranking second (Klaver et al. 1998). In Denmark, cataract and AMD together account for 74% of the number of visually impaired in the age group >65 years and 57% of the number of blinded individuals >65 years (Buch et al. 2004). Cataract can be treated effectively by removing the opaque lens, and exudative AMD can be treated by intravitreal injection of anti-VEGF, but we still do not have a treatment for the dry form of AMD.

Concern has been raised that cataract surgery may increase the risk of incident AMD or progression of pre-existing AMD. Early histological examinations (van der Schaft et al. 1994) and case studies reported an occurrence of wet AMD after cataract surgery (Blair & Ferguson 1979; Pollock et al. 1997, 1998). In theory, two likely mechanisms could lead to a progression in AMD after cataract surgery. One theory is based on blue light toxicity (Alvarez et al. 2006; Glazer-Hockstein & Dunaief 2006). Intense, acute exposures to short-wavelength irradiation are toxic to the retina (Ham Jr. et al. 1976). The aged human lens effectively absorbs short wavelengths (Kessel et al. 2010)

# Toric IOLs



# Toric IOLs

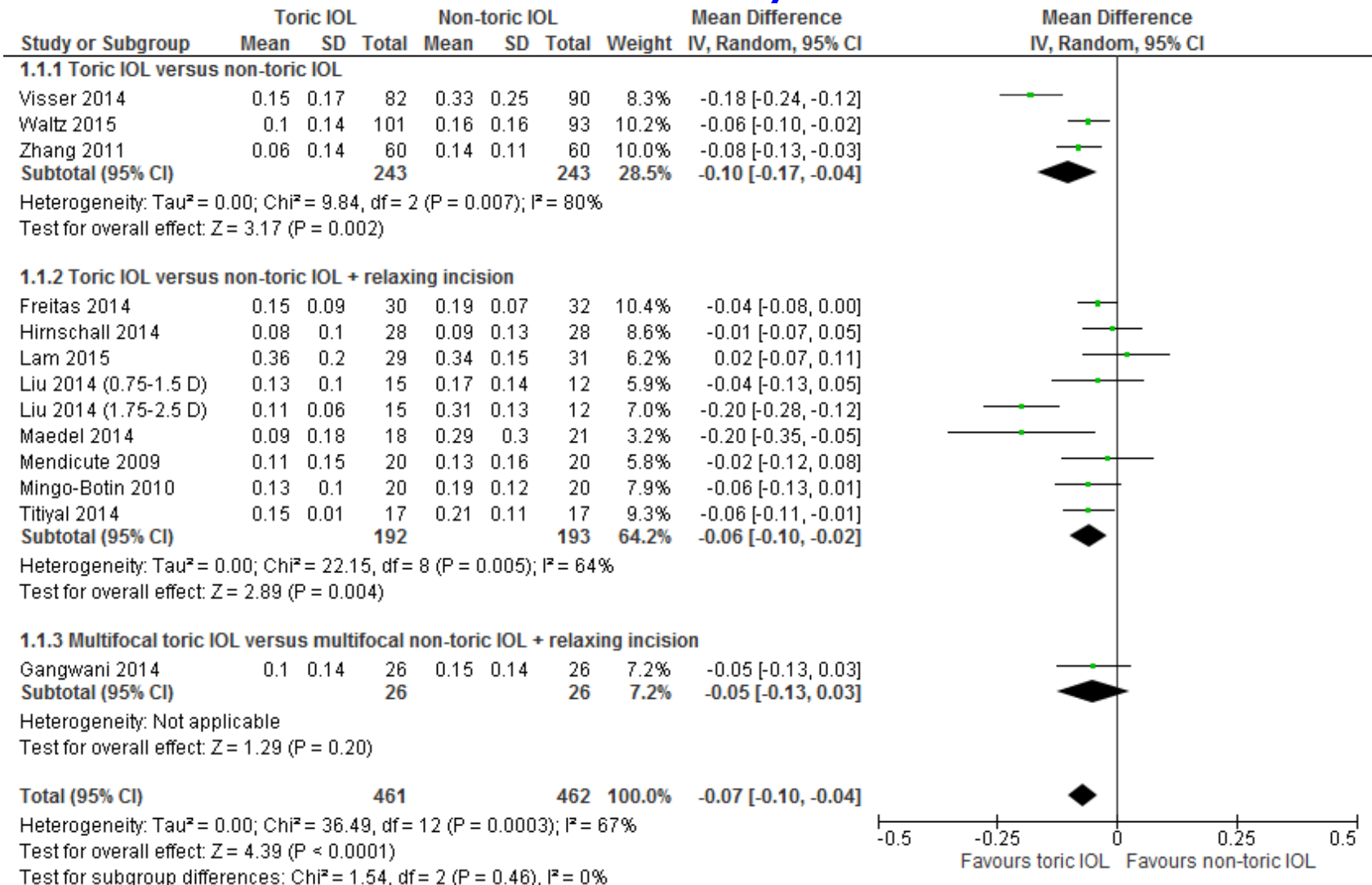
Should toric IOLs be recommended to patients with pre-operative corneal astigmatism?

# Toric IOLs

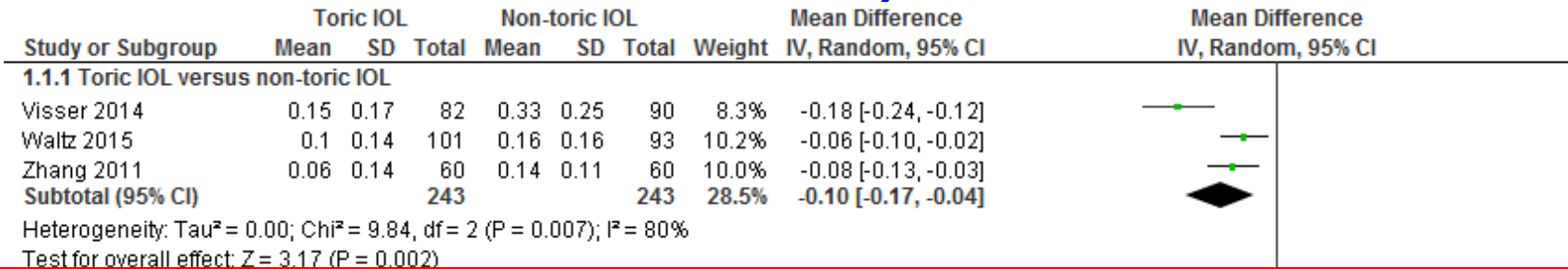
## Included RCTs:

1. Freitas GO, Boteon JE, Carvalho MJ, Pinto RM. Treatment of astigmatism during phacoemulsification. *Arq Bras Oftalmol* 2014;77:40-6.
2. Gangwani V, Hirschall N, Findl O, Maurino V. Multifocal toric intraocular lenses versus multifocal intraocular lenses combined with peripheral corneal relaxing incisions to correct moderate astigmatism. *J Cataract Refract Surg* 2014;40:1625-32.
3. Hirschall N, Gangwani V, Crnej A, et al. Correction of moderate corneal astigmatism during cataract surgery: toric intraocular lens versus peripheral corneal relaxing incisions. *J Cataract Refract Surg* 2014;40:354-61.
4. Holland E, Lane S, Horn JD, et al. The AcrySof Toric intraocular lens in subjects with cataracts and corneal astigmatism: a randomized, subject-masked, parallel-group, 1-year study. *Ophthalmology* 2010;117:2104-11.
5. Maedel S, Hirschall N, Chen YA, Findl O. Rotational performance and corneal astigmatism correction during cataract surgery: aspheric toric intraocular lens versus aspheric nontoric intraocular lens with opposite clear corneal incision. *J Cataract Refract Surg* 2014;40:1355-62.
6. Mendicute J, Irigoyen C, Ruiz M, et al. Toric intraocular lens versus opposite clear corneal incisions to correct astigmatism in eyes having cataract surgery. *J Cataract Refract Surg* 2009;35:451-8.
7. Mingo-Botin D, Munoz-Negrete FJ, Won Kim HR, et al. Comparison of toric intraocular lenses and peripheral corneal relaxing incisions to treat astigmatism during cataract surgery. *J Cataract Refract Surg* 2010;36:1700-8.
8. Titiyal JS, Khatik M, Sharma N, et al. Toric intraocular lens implantation versus astigmatic keratotomy to correct astigmatism during phacoemulsification. *J Cataract Refract Surg* 2014;40:741-7.
9. Visser N, Beckers HJ, Bauer NJ, et al. Toric vs aspherical control intraocular lenses in patients with cataract and corneal astigmatism: a randomized clinical trial. *JAMA Ophthalmol* 2014;132:1462-8.
10. Waltz KL, Featherstone K, Tsai L, Trentacost D. Clinical outcomes of TECNIS toric intraocular lens implantation after cataract removal in patients with corneal astigmatism. *Ophthalmology* 2015;122:39-47.
11. Zhang JS, Zhao JY, Sun Q, Ma LW. Distance vision after bilateral implantation of AcrySof toric intraocular lenses: a randomized, controlled, prospective trial. *Int J Ophthalmol* 2011;4:175-8.
12. Lam DK, Chow VW, Ye C, et al. Comparative evaluation of aspheric toric intraocular lens implantation and limbal relaxing incisions in eyes with cataracts and  $\leq 3$  dioptres of astigmatism. *The British journal of ophthalmology* 2015;2015/06/20.
13. Liu Z, Sha X, Liang X, et al. Toric intraocular lens vs. peripheral corneal relaxing incisions to correct astigmatism in eyes undergoing cataract surgery. *Eye Sci* 2014;29:198-203

# Uncorrected postop logMAR visual acuity



# Uncorrected postop logMAR visual acuity



UCDVA was 5 letters better after toric IOL implantation than non-toric and it was 3 letters better when toric IOL was compared to non-toric + relaxing incision

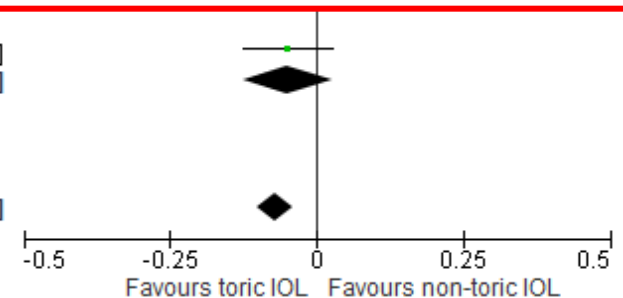
## 1.1.3 Multifocal toric IOL versus multifocal non-toric IOL + relaxing incision

Gangwani 2014	0.1	0.14	26	0.15	0.14	26	7.2%	-0.05 [-0.13, 0.03]	
<b>Subtotal (95% CI)</b>			<b>26</b>			<b>26</b>	<b>7.2%</b>	<b>-0.05 [-0.13, 0.03]</b>	

Heterogeneity: Not applicable  
 Test for overall effect: Z = 1.29 (P = 0.20)

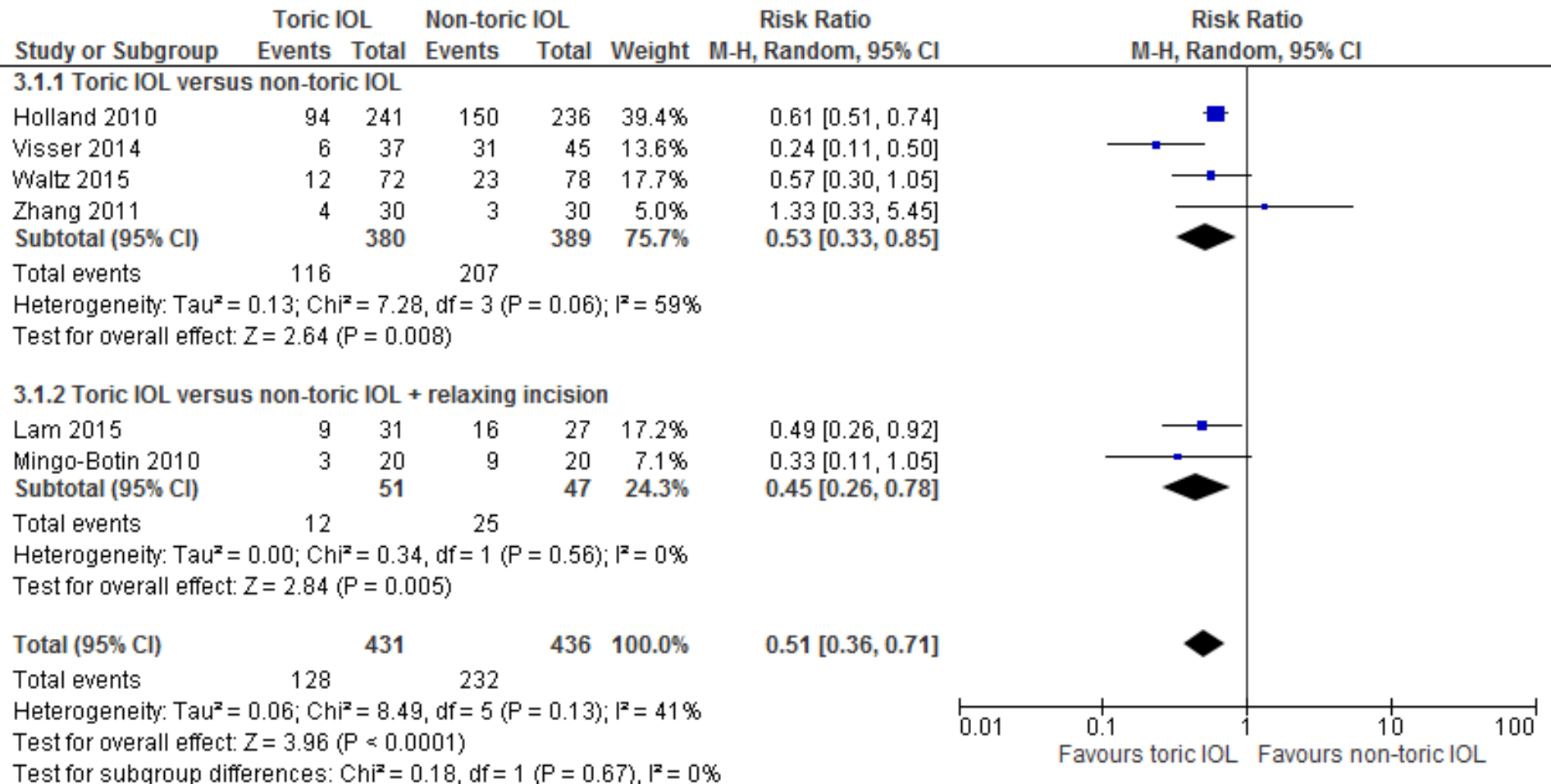
<b>Total (95% CI)</b>			<b>461</b>			<b>462</b>	<b>100.0%</b>	<b>-0.07 [-0.10, -0.04]</b>	
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Heterogeneity: Tau<sup>2</sup> = 0.00; Chi<sup>2</sup> = 36.49, df = 12 (P = 0.00003); I<sup>2</sup> = 67%  
 Test for overall effect: Z = 4.39 (P < 0.00001)  
 Test for subgroup differences: Chi<sup>2</sup> = 1.54, df = 2 (P = 0.46), I<sup>2</sup> = 0%

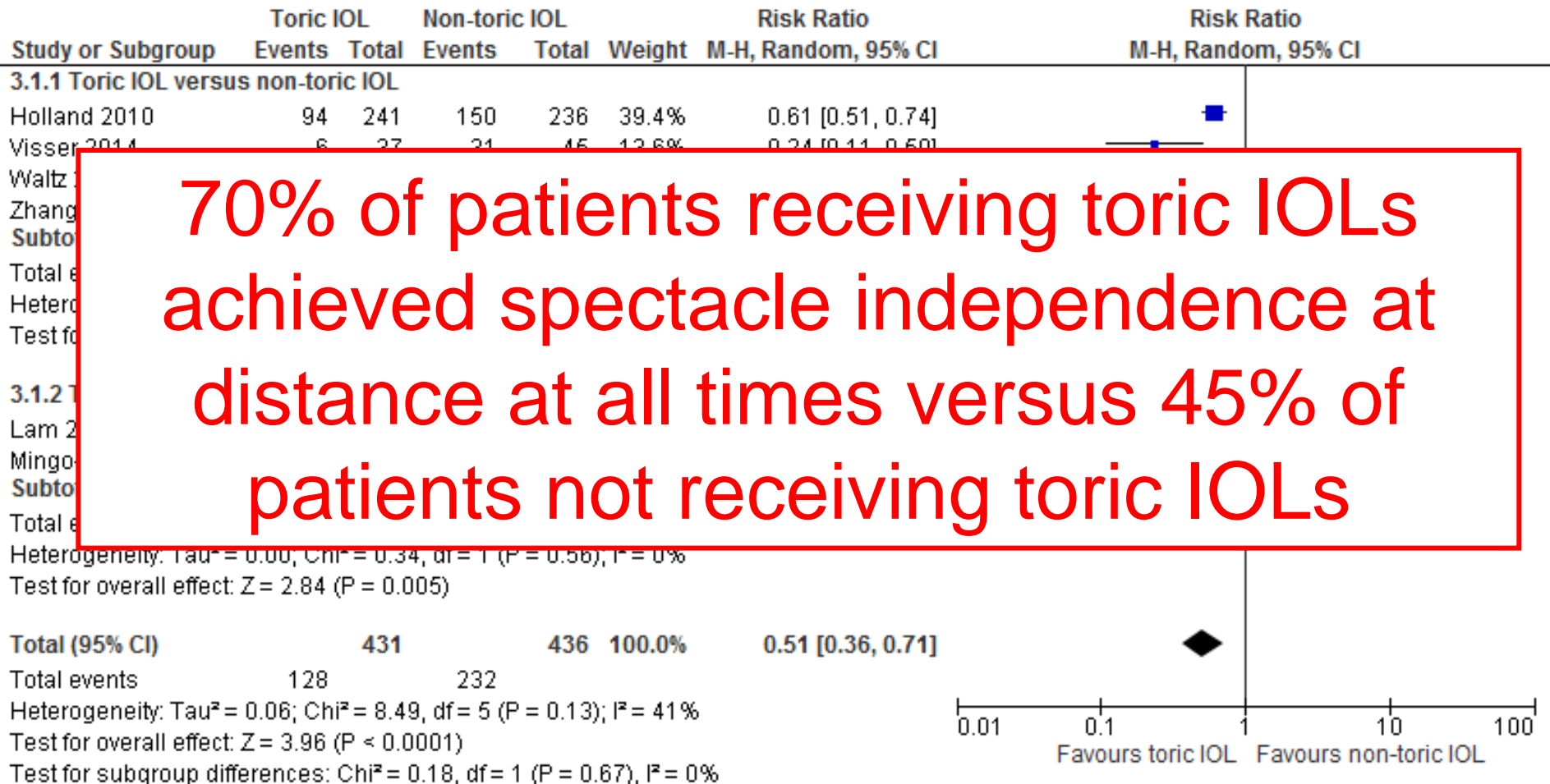




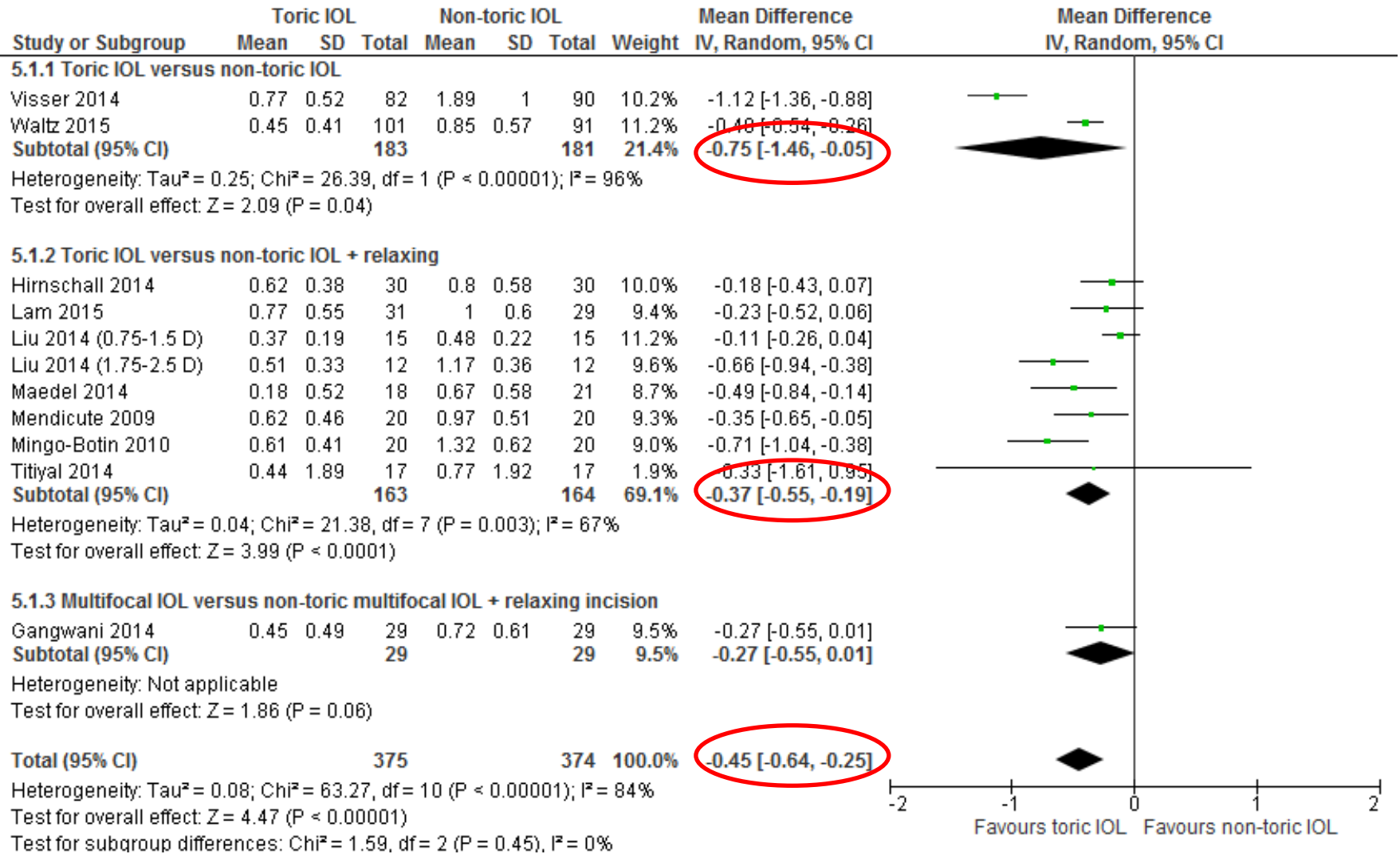
# Spectacle independence at distance at all times



# Spectacle independence at distance at all times



# Residual astigmatism



# Complications and toric IOLs

4.2% of toric IOL patients had a post-operative complication versus 2.3% of non-toric patients (not significant)

# Complications and toric IOLs

- Retinal: Toric group: 1 retinal detachment, 5 retinal tears. Non-toric group: 1 PVD
- Second surgeries: 12 toric patients (toric IOL alignment + treatment for retinal tears or detachment) versus 1 non-toric patient ( $p=0.013$ ).
- Macular edema: 7 toric patients versus 4 non-toric. Non-significant

# Recommendations – toric IOLs

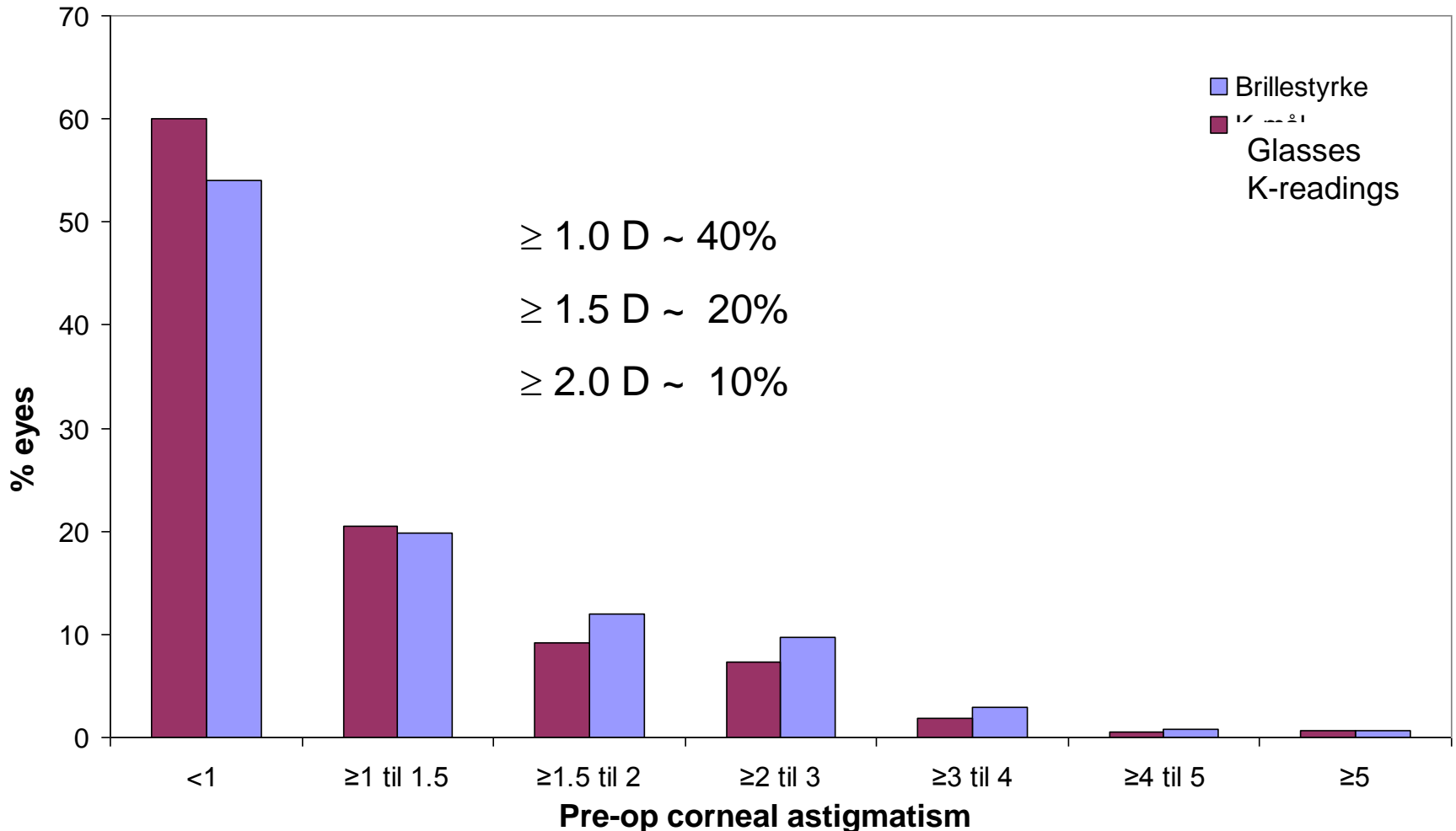
We found high quality evidence that implantation of toric IOLs resulted in higher rates of spectacle independence and that a greater number of patients achieved post-op visual acuity 20/25 or greater.

There is moderate quality of evidence that toric IOLs are associated with more complications than non-toric IOLs

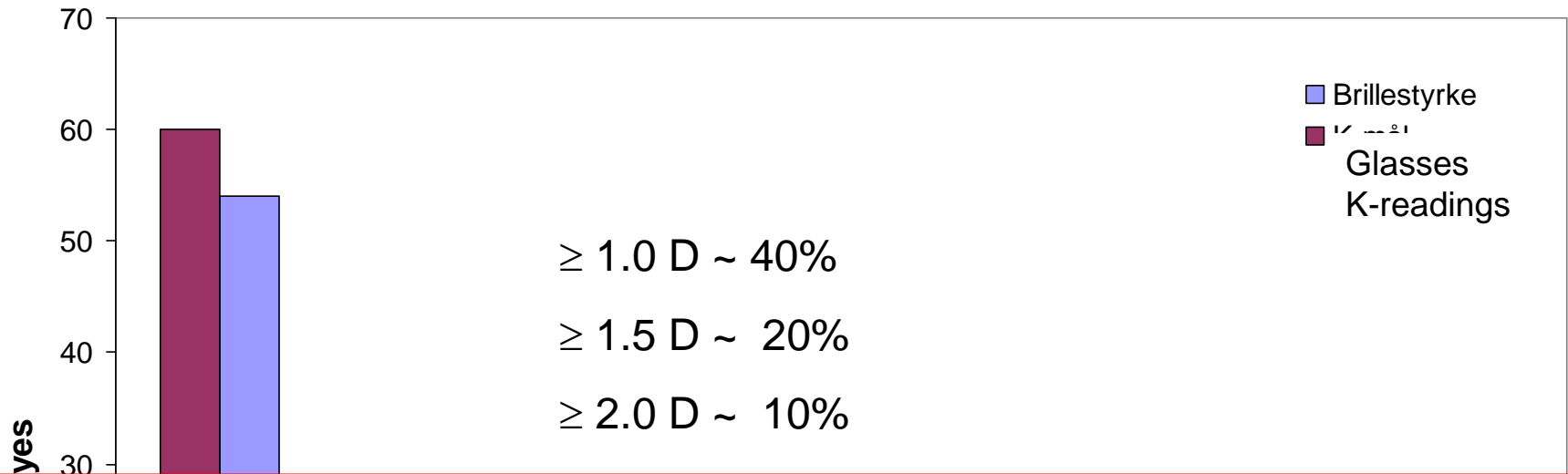


We recommend implanting toric IOLs in patients with pre-op corneal astigmatism ( $\oplus\oplus\bigcirc\bigcirc$ )

# How many patients will need toric IOL implantation?



# How many patients will need toric IOL implantation?



**2 diopter pre-op corneal astigmatism was chosen as cut-off value for implantation of toric IOLs in reimbursed surgeries**

<1       $\geq 1$  til 1.5       $\geq 1.5$  til 2       $\geq 2$  til 3       $\geq 3$  til 4       $\geq 4$  til 5       $\geq 5$   
**Pre-op corneal astigmatism**



# **Toric intraocular lenses in the correction of astigmatism during cataract surgery - a systematic review and meta-analysis**

*Line Kessel, Jens Andresen, Britta Tendal, Ditte Erngaard, Per Flesner, Jesper Hjortdal*

*Accepted by Ophthalmology, October 2015*

# Antibiotic prevention of post-cataract endophthalmitis



# Intracameral antibiotics

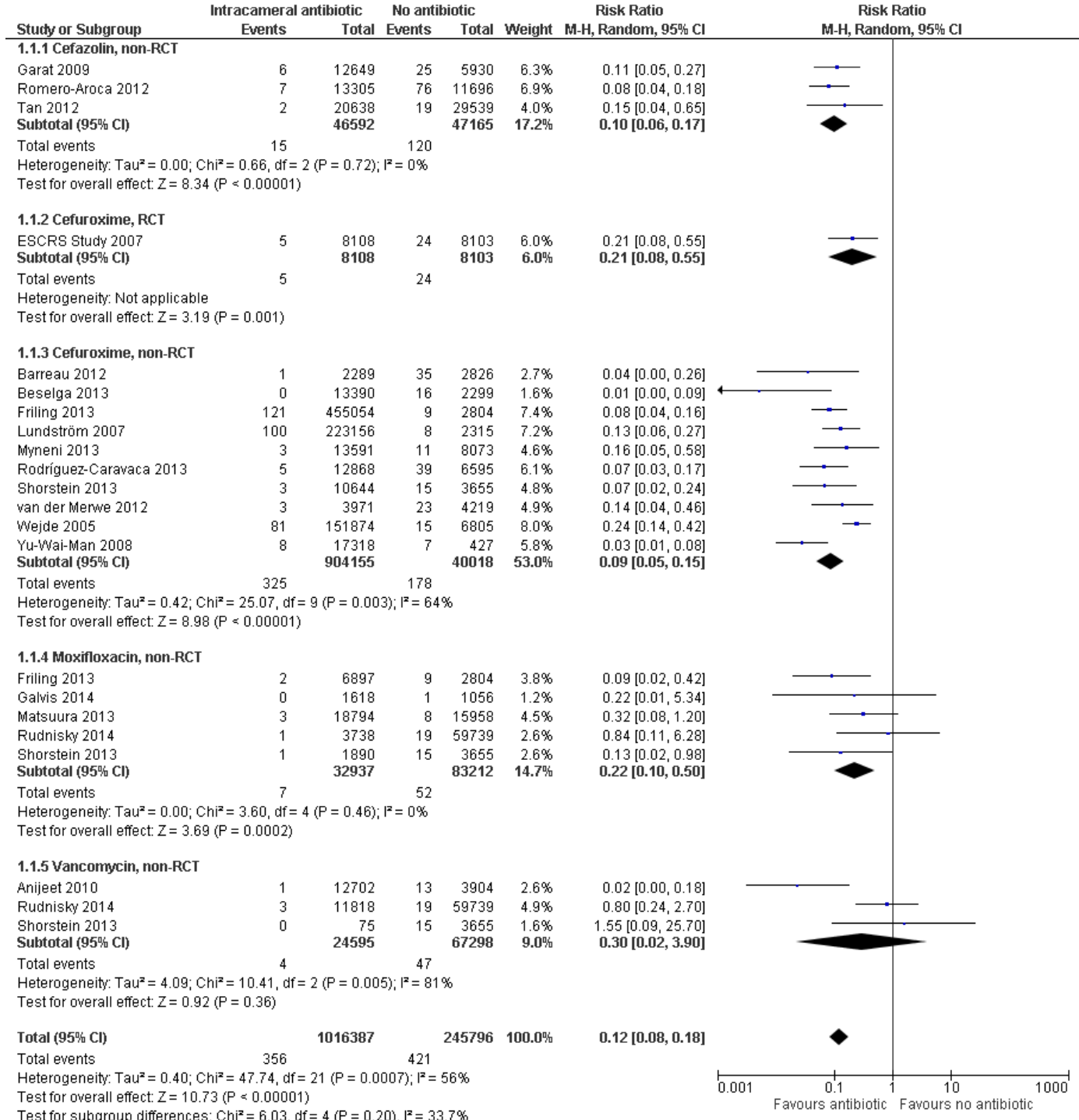
- Bacteria are found in 5-15% of samples from the anterior chamber at the conclusion of surgery
- Bacteria are found in 50% of samples of irrigation fluids
- Bacteria causing endophthalmitis are the same as those found on the conjunctival surface
- Intracameral cefuroxime is well-tolerated
- An approved product (Aprokam) is available in Europe

# Included studies

1. Beselga D, Campos A, Castro M, Fernandes C, Carvalheira F, Campos S et al. Postcataract surgery endophthalmitis after introduction of the ESCRS protocol: a 5-year study. *Eur.J Ophthalmol* 2013;0.
2. Prophylaxis of postoperative endophthalmitis following cataract surgery: results of the ESCRS multicenter study and identification of risk factors. *J Cataract Refract.Surg.* 2007;**33**:978-88.
3. Friling E, Lundstrom M, Stenevi U, Montan P. Six-year incidence of endophthalmitis after cataract surgery: Swedish national study. *J Cataract Refract.Surg.* 2013;**39**:15-21.
4. Galvis V, Tello A, Sanchez MA, Camacho PA. Cohort study of intracameral moxifloxacin in postoperative endophthalmitis prophylaxis. *Ophthalmol.Eye Dis.* 2014;**6**:1-4.
5. Garat M, Moser CL, Martin-Baranera M, Alonso-Tarres C, Alvarez-Rubio L. Prophylactic intracameral cefazolin after cataract surgery: endophthalmitis risk reduction and safety results in a 6-year study. *J Cataract Refract.Surg.* 2009;**35**:637-42.
6. Lundstrom M, Wejde G, Stenevi U, Thorburn W, Montan P. Endophthalmitis after cataract surgery: a nationwide prospective study evaluating incidence in relation to incision type and location. *Ophthalmology* 2007;**114**:866-70.
7. Matsuura K, Miyoshi T, Suto C, Akura J, Inoue Y. Efficacy and safety of prophylactic intracameral moxifloxacin injection in Japan. *J Cataract Refract.Surg.* 2013;**39**:1702-6.
8. Myneni J, Desai SP, Jayamanne DG. Reduction in postoperative endophthalmitis with intracameral cefuroxime. *J.Hosp.Infect.* 2013;**84**:326-8.
9. Rodriguez-Caravaca G, Garcia-Saenz MC, Villar-Del-Campo MC, Andres-Alba Y, Arias-Puente A. Incidence of endophthalmitis and impact of prophylaxis with cefuroxime on cataract surgery. *J Cataract Refract.Surg.* 2013;**39**:1399-403.
10. Romero-Aroca P, Mendez-Marin I, Salvat-Serra M, Fernandez-Ballart J, Almena-Garcia M, Reyes-Torres J. Results at seven years after the use of intracameral cefazolin as an endophthalmitis prophylaxis in cataract surgery. *BMC.Ophthalmol* 2012;**12**:2.
11. Rudnisky CJ, Wan D, Weis E. Antibiotic choice for the prophylaxis of post-cataract extraction endophthalmitis. *Ophthalmology* 2014;**121**:835-41.
12. Shorstein NH, Winthrop KL, Herrinton LJ. Decreased postoperative endophthalmitis rate after institution of intracameral antibiotics in a Northern California eye department. *J Cataract Refract.Surg.* 2013;**39**:8-14.
13. Tan CS, Wong HK, Yang FP. Epidemiology of postoperative endophthalmitis in an Asian population: 11-year incidence and effect of intracameral antibiotic agents. *J Cataract Refract.Surg.* 2012;**38**:425-30.
14. van der Merwe J, Mustak H, Cook C. Endophthalmitis prophylaxis with intracameral cefuroxime in South Africa. *J Cataract Refract.Surg.* 2012;**38**:2054.
15. Wejde G, Montan P, Lundstrom M, Stenevi U, Thorburn W. Endophthalmitis following cataract surgery in Sweden: national prospective survey 1999-2001. *Acta Ophthalmol Scand.* 2005;**83**:7-10.
16. Yu-Wai-Man P, Morgan SJ, Hildreth AJ, Steel DH, Allen D. Efficacy of intracameral and subconjunctival cefuroxime in preventing endophthalmitis after cataract surgery. *J Cataract Refract.Surg.* 2008;**34**:447-51.
17. Anijeet DR, Palimar P, Peckar CO. Intracameral vancomycin following cataract surgery: An eleven-year study. *Clin Ophthalmol* 2010;**4**:321-6.
18. Barreau G, Mounier M, Marin B, Adenis JP, Robert PY. Intracameral cefuroxime injection at the end of cataract surgery to reduce the incidence of endophthalmitis: French study. *J Cataract Refract.Surg.* 2012;**38**:1370-5.
19. Barry P, Seal DV, Gettinby G, Lees F, Peterson M, Revie CW. ESCRS study of prophylaxis of postoperative endophthalmitis after cataract surgery: Preliminary report of principal results from a European multicenter study. *J Cataract Refract.Surg.* 2006;**32**:407-10.
20. Råen M, Sandvik GF, Drolsum L. Endophthalmitis following cataract surgery: the role of prophylactic postoperative chloramphenicol eye drops. *Acta Ophthalmol* 2013;**91**:118-22.

# Included studies

1. Beselga D, Campos A, Castro M, Fernandes C, Carvalheira F, Campos S et al. Postcataract surgery endophthalmitis after introduction of the ESCRS protocol: a 5-year study. *Eur.J Ophthalmol* 2013;0.
2. Prophylaxis of postoperative endophthalmitis following cataract surgery: results of the ESCRS multicenter study and identification of risk factors. *J Cataract Refract.Surg.* 2007;**33**:978-88.
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20. Råen M, Sandvik GF, Drolsum L. Endophthalmitis following cataract surgery: the role of prophylactic postoperative chloramphenicol eye drops. *Acta Ophthalmol* 2013;**91**:118-22.



Study or Subgroup	Intracameral antibiotic		No antibiotic		Weight	Risk Ratio	M-H, Random, 95% CI
	Events	Total	Events	Total		M-H, Random, 95% CI	
<b>1.1.1 Cefazolin, non-RCT</b>							
Garat 2009	6	12649	25	5930	6.3%	0.11 [0.05, 0.27]	
Romero-Aroca 2012	7	13305	76	11696	6.9%	0.08 [0.04, 0.18]	
Tan 2012	2	20638	19	29539	4.0%	0.15 [0.04, 0.65]	
<b>Subtotal (95% CI)</b>		<b>46592</b>		<b>47165</b>	<b>17.2%</b>	<b>0.10 [0.06, 0.17]</b>	
Total events	15		120				
Heterogeneity: Tau <sup>2</sup> = 0.00; Chi <sup>2</sup> = 0.66, df = 2 (P = 0.72); I <sup>2</sup> = 0%							
Test for overall effect: Z = 8.34 (P < 0.00001)							
<b>1.1.2 Cefuroxime, RCT</b>							
ESCRS Study 2007	5	8108	24	8103	6.0%	0.21 [0.08, 0.55]	
<b>Subtotal (95% CI)</b>		<b>8108</b>		<b>8103</b>	<b>6.0%</b>	<b>0.21 [0.08, 0.55]</b>	
Total events	5		24				
Heterogeneity: Not applicable							
Test for overall effect: Z = 3.19 (P = 0.001)							

**Endophthalmitis occurred in one out of 2855 surgeries when intracameral antibiotics were used compared to one out of 485 surgeries when intracameral antibiotics were not used**

Heterogeneity: Tau<sup>2</sup> = 0.00; Chi<sup>2</sup> = 3.60, df = 4 (P = 0.46); I<sup>2</sup> = 0%  
 Test for overall effect: Z = 3.69 (P = 0.0002)

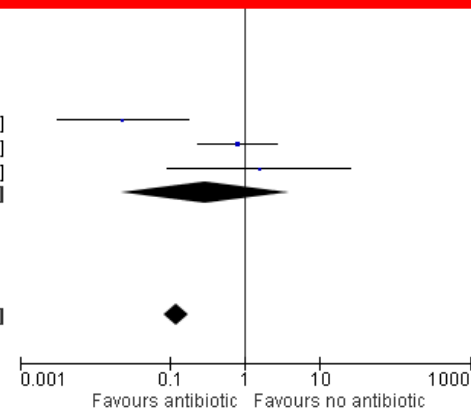
**1.1.5 Vancomycin, non-RCT**

Anijeet 2010	1	12702	13	3904	2.6%	0.02 [0.00, 0.18]	
Rudnisky 2014	3	11818	19	59739	4.9%	0.80 [0.24, 2.70]	
Shorstein 2013	0	75	15	3655	1.6%	1.55 [0.09, 25.70]	
<b>Subtotal (95% CI)</b>		<b>24595</b>		<b>67298</b>	<b>9.0%</b>	<b>0.30 [0.02, 3.90]</b>	

Total events 4 47  
 Heterogeneity: Tau<sup>2</sup> = 4.09; Chi<sup>2</sup> = 10.41, df = 2 (P = 0.005); I<sup>2</sup> = 81%  
 Test for overall effect: Z = 0.92 (P = 0.36)

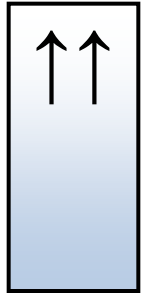
**Total (95% CI)** 1016387 245796 100.0% 0.12 [0.08, 0.18]

Total events 356 421  
 Heterogeneity: Tau<sup>2</sup> = 0.40; Chi<sup>2</sup> = 47.74, df = 21 (P = 0.00007); I<sup>2</sup> = 56%  
 Test for overall effect: Z = 10.73 (P < 0.00001)  
 Test for subgroup differences: Chi<sup>2</sup> = 6.03, df = 4 (P = 0.20), I<sup>2</sup> = 33.7%



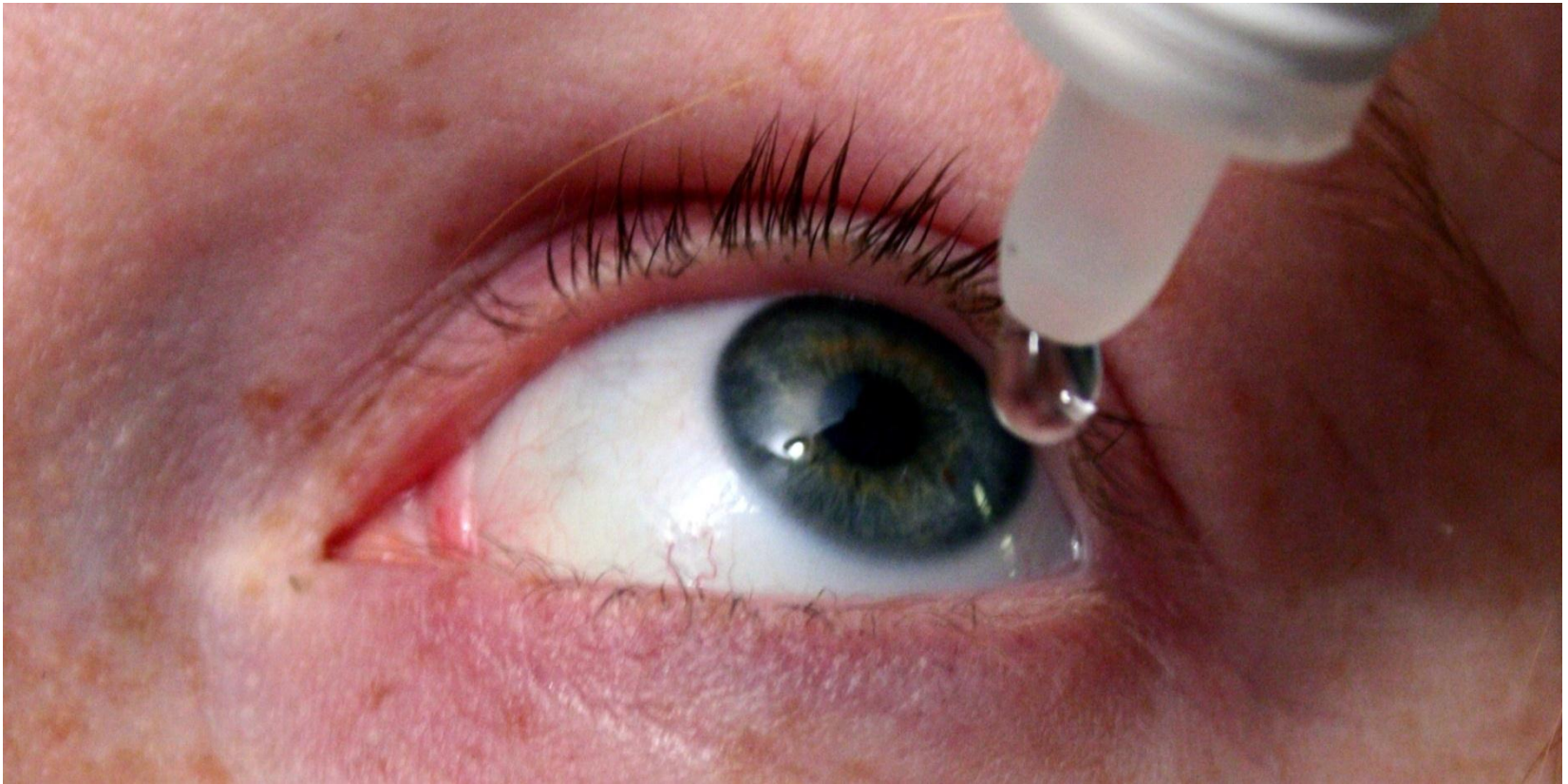
# Recommendation – intracameral cefuroxime

We found high quality evidence that intracameral cefuroxime prevents post-cataract endophthalmitis

 We recommend using 1.0 mg cefuroxime in 0.1 ml isotonic saline at the conclusion of surgery (⊕⊕⊕⊕)



# Topical antibiotics



# Topical antibiotic prevention of post-cataract endophthalmitis

Reduced risk of peri-operative contamination of the anterior chamber

Reduced risk of post-operative contamination of the anterior chamber via wound dehiscence

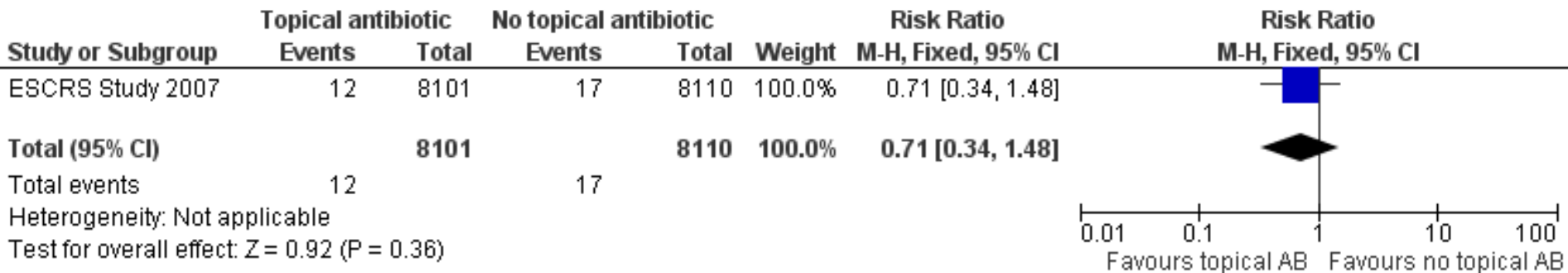
Bacteriocidal concentration in the anterior chamber

# Topical antibiotics

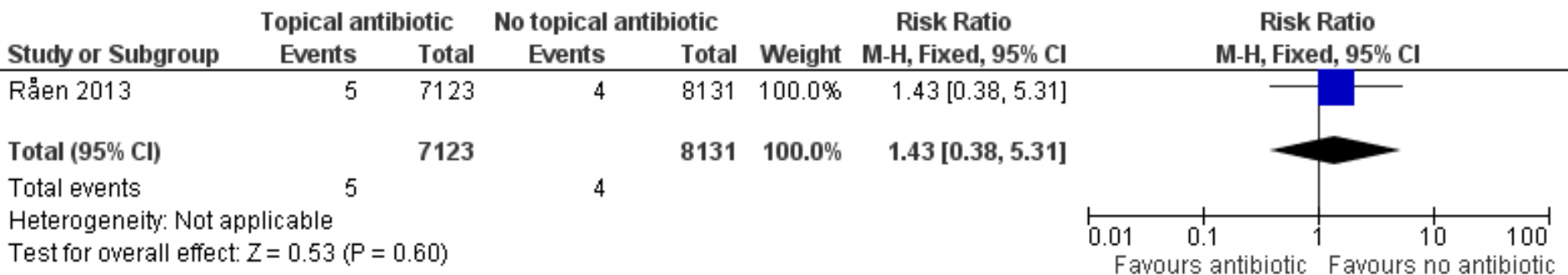
- 1 hour intense treatment with topical antibiotics (fluoroquinolons) reduces the number of positive conjunctival samples by 31.6%. After 1 and 3 days treatment, the number is reduced by 54.3% and 56.0%, respectively
- Intensive treatment (4 x per hour) with levo- and moxifloxacin results in bacteriocidal concentrations in the anterior chamber whereas other treatment modalities have failed to reach bacteriocidal concentrations

# Topical antibiotics and endophthalmitis

**Levofloxacin 0.5% 1 drop 60 + 30 min pre-op, 3 drops every 5 min postop  
All patients received levofloxacin for 6 days post-op**

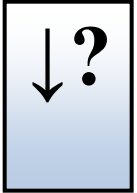


## Postoperative use of chloramphenicol



# Recommendation – topical antibiotics

We found moderate to low quality evidence that topical antibiotics do not prevent endophthalmitis

 We do not recommend using topical antibiotics routinely after cataract surgery

## Review Article

# Antibiotic prevention of postcataract endophthalmitis: a systematic review and meta-analysis

Line Kessel,<sup>1,2</sup> Per Flesner,<sup>3</sup> Jens Andresen,<sup>4</sup> Ditte Erngaard,<sup>5</sup> Britta Tendal<sup>2</sup> and Jesper Hjortdal<sup>6</sup><sup>1</sup>Department of Ophthalmology, Copenhagen University Hospital Glostrup, Glostrup, Denmark<sup>2</sup>Danish Health and Medicines Authorities, Copenhagen, Denmark<sup>3</sup>Odense Eye Clinic, Odense, Denmark<sup>4</sup>Skanderborg Eye Clinic, Skanderborg, Denmark<sup>5</sup>Department of Ophthalmology, Næstved Hospital, Næstved, Denmark<sup>6</sup>Department of Ophthalmology, Aarhus University Hospital NBG, Aarhus, Denmark**ABSTRACT.**

Endophthalmitis is one of the most feared complications after cataract surgery. The aim of this systematic review was to evaluate the effect of intracameral and topical antibiotics on the prevention of endophthalmitis after cataract surgery. A systematic literature review in the MEDLINE, CINAHL, Cochrane Library and EMBASE databases revealed one randomized trial and 17 observational studies concerning the prophylactic effect of intracameral antibiotic administration on the rate of endophthalmitis after cataract surgery. The effect of topical antibiotics on endophthalmitis rate was reported by one randomized trial and one observational study. The quality and design of the included studies were analysed using the Cochrane risk of bias tool. The quality of the evidence was evaluated using the GRADE approach. We found high-to-moderate quality evidence for a marked reduction in the risk of endophthalmitis with the use of intracameral antibiotic administration of cefazolin, cefuroxime and moxifloxacin, whereas no effect was found with the use of topical antibiotics or intracameral vancomycin. Endophthalmitis occurred on average in one of 2855 surgeries when intracameral antibiotics were used compared to one of 485 surgeries when intracameral antibiotics were not used. The relative risk (95% CI) of endophthalmitis was reduced to 0.12 (0.08; 0.18) when intracameral antibiotics were used. The difference was highly significant ( $p < 0.00001$ ). Intracameral antibiotic therapy is the best choice for preventing endophthalmitis after cataract surgery. We did not find evidence to conclude that topical antibiotic therapy prevents endophthalmitis.

**Key words:** antibiotic therapy – cataract surgery – cefuroxime – endophthalmitis – prevention

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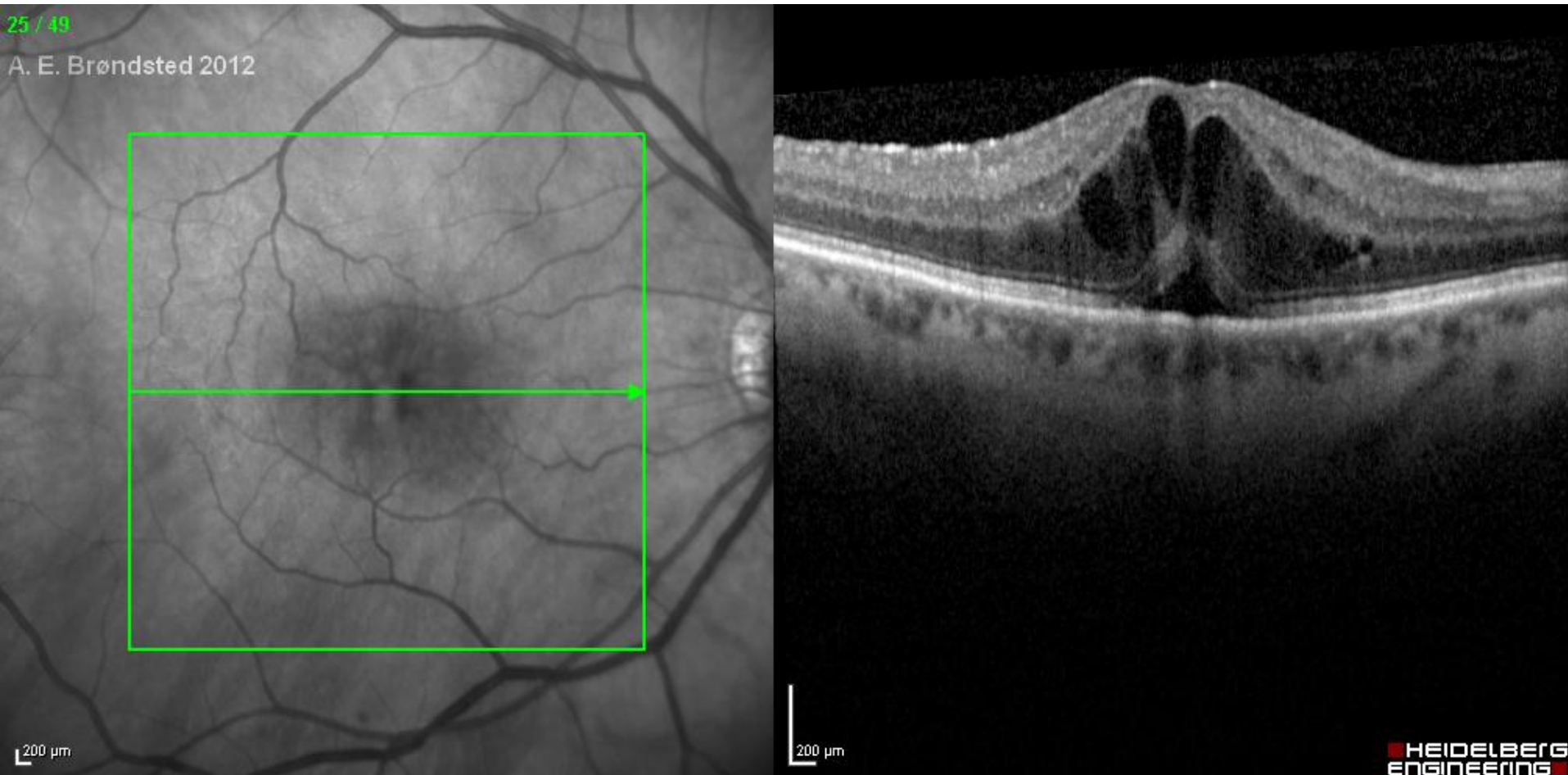
doi: 10.1111/aos.12684

**Introduction**

Cataract surgery is the most frequently performed elective surgical procedure in many Westernized countries. Although cataract surgery is generally considered a safe procedure resulting in a favourable visual outcome, surgical complications do occur. The most feared complication is postoperative endophthalmitis which is an infectious condition caused by micro-organisms introduced to the interior of the eye during or after the surgical procedure. The visual outcome after endophthalmitis is often very poor. Seventeen per cent of patients in the European Society of Cataract and Refractive Surgeons (ESCRS) study had a final visual acuity  $\leq 20/200$  and 48.3% had a final visual acuity  $\leq 20/40$  (Barry et al. 2009). Treatment of endophthalmitis often requires further surgery and hospitalization; thus, every case of endophthalmitis puts a heavy burden on the healthcare system (Fongere et al. 2004; Schmier et al. 2007), not to mention the distress and loss of quality of life experienced by the patient (Clark et al. 2008).

During cataract surgery, an incision is made in the anterior segment of the eye to remove the cataractous lens. Corneal incisions may allow inflow of ocular surface fluid even after hydro-sealing (Herretes et al. 2005). The use

# Control of inflammation and prevention of macular edema



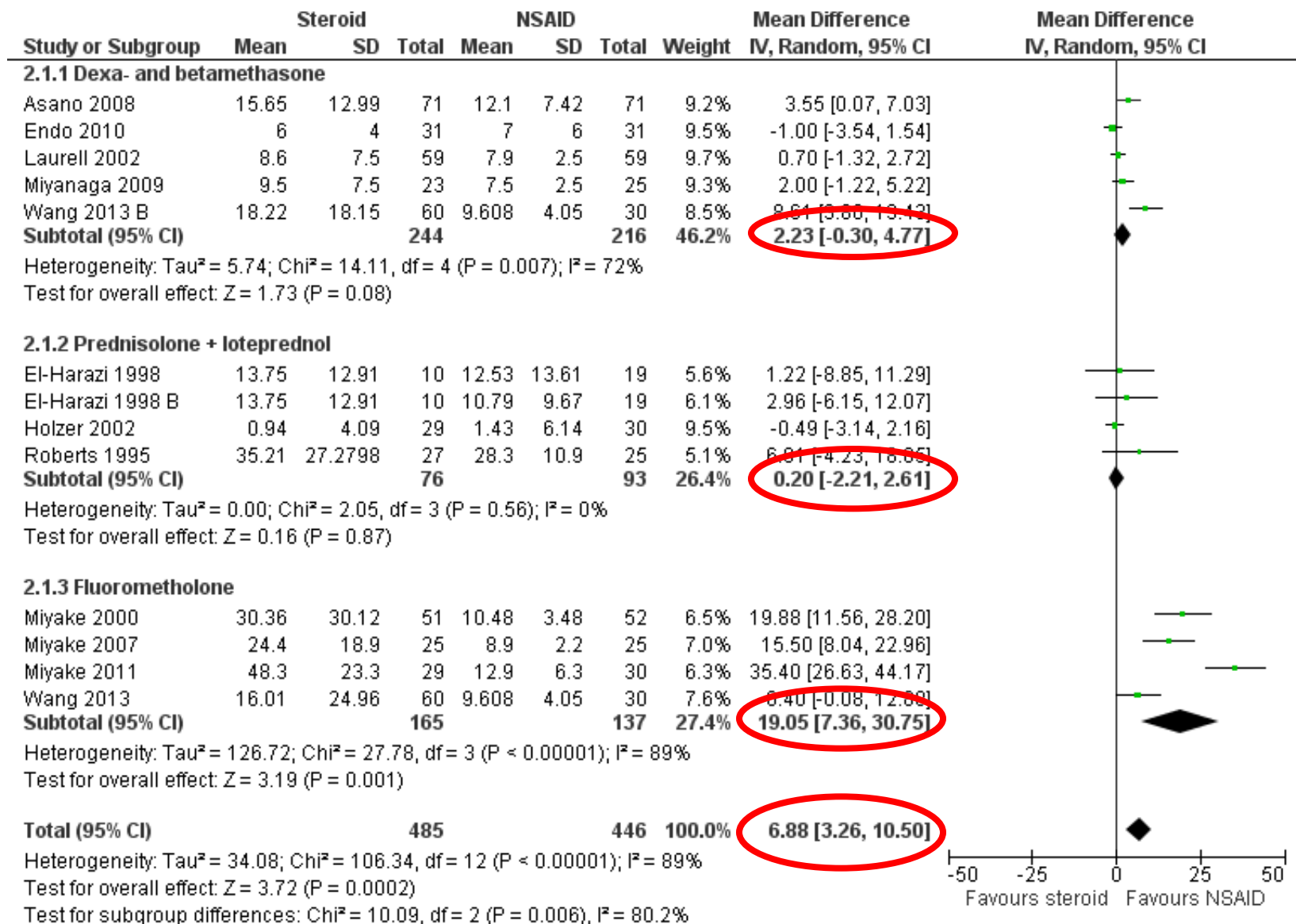
Are steroids or non-steroidal anti-inflammatory eye drops better at preventing post-op inflammation and cystoid macular edema?



# Included RCTs

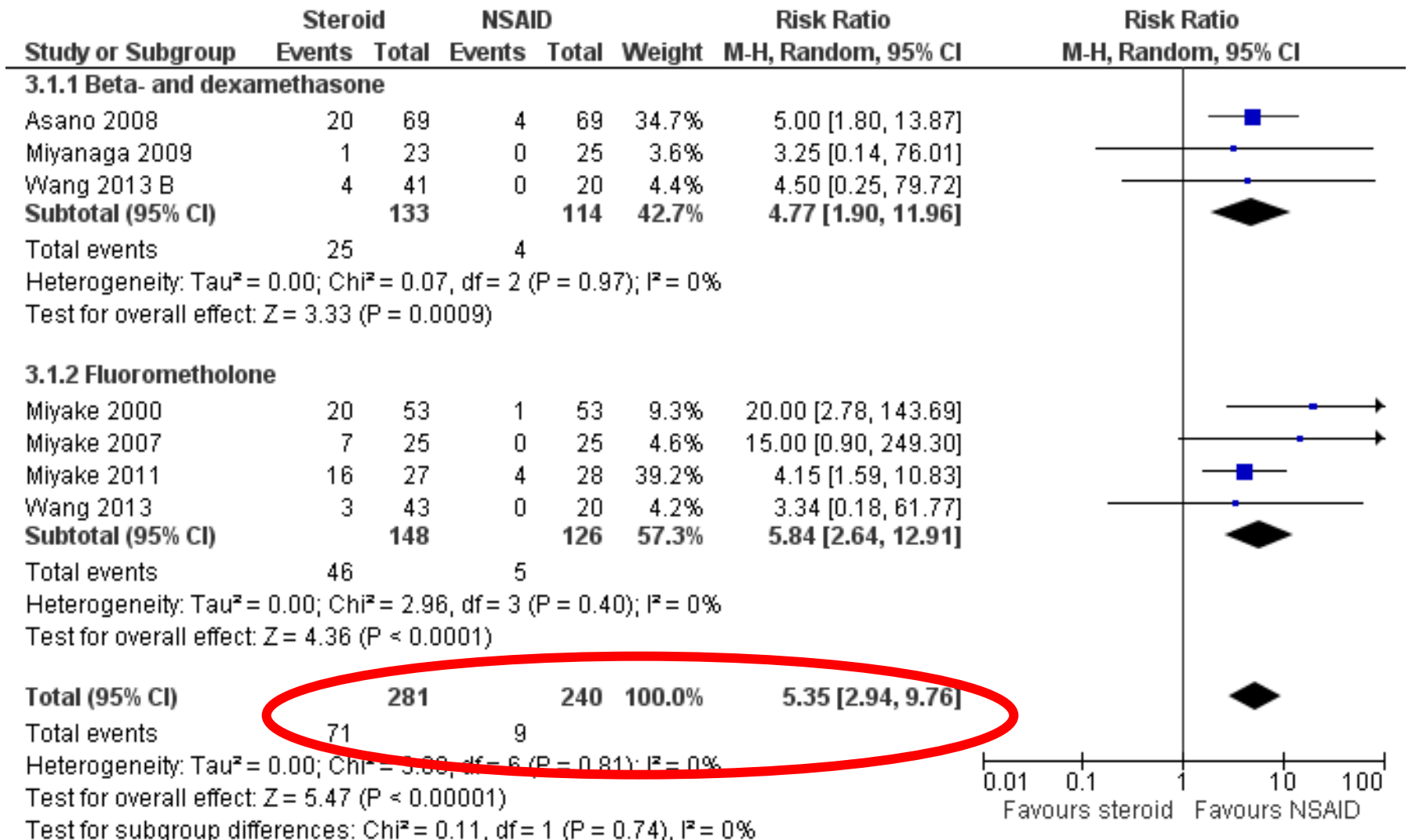
1. Asano 2008, J Cataract Refract Surg; 34: 57-63
2. Demco 1997, Eur J Ophthalmol; 7(3): 236-240
3. El-Harazi 1998, Ophthalmic Surg Lasers; 29 (7): 539-544
4. Endo 2010, Acta Ophthalmol; 88: 896-900
5. Hirneiss 2005, Graefes Arch Clin Exp Ophtholmol; 243: 768-773
6. Holzer 2002, J Cataract Refract Surg; 28: 93-99
7. Laurell 2002, Br J Ophthalmol; 86 (12): 53-58
8. Missotten 2001, Ophthalmologica; 215 (1): 43-50
9. Miyake 2000, Jpn J Ophthalmol; 44 (1): 58-67
10. Miyake 2007, Invest Ophthalmol Vis Sci; 48: 5647-5652
11. Miyake 2011, J Cataract Refract Surg; 37: 1581-1588
12. Miyanaga 2009, Acta Ophthalmol; 87: 300-305
13. Roberts 1995, Arch Ophthalmol; 113 (6): 725-7
14. Solomon 2001, J Cataract Refract Surg, 27: 1232-1237
15. Wang 2013, Ophthalmologica; DOI: 10.1159/000346847

# Control of inflammation, laser flaremeter 1 week post-op



# Prevention of macular edema

## 1 month post-op (fluorescein angiogram or OCT)

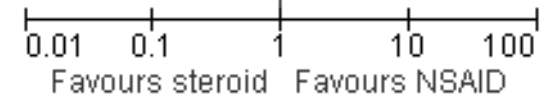


# Prevention of macular edema

Study or Subgroup	Steroid		NSAID		Weight	Risk Ratio M-H, Random, 95% CI	Risk Ratio M-H, Random, 95% CI
	Events	Total	Events	Total			
<b>3.1.1 Beta- and dexamethasone</b>							
Asano 2008	20	69	4	69	34.7%	5.00 [1.80, 13.87]	
Miyanaga 2009	1	23	0	25	3.6%	3.25 [0.14, 76.01]	
Wang 2013 B	4	41	0	20	4.4%	4.50 [0.25, 79.72]	
<b>Subtotal (95% CI)</b>		<b>133</b>		<b>114</b>	<b>42.7%</b>	<b>4.77 [1.90, 11.96]</b>	
Total events	25		4				

25 % of patients receiving steroids had cystoid macular edema on fluorescein angiography 1 month post-op versus 4 % in the NSAID group

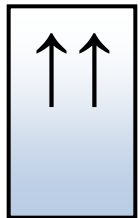
<b>Subtotal (95% CI)</b>		<b>178</b>		<b>128</b>	<b>100.0%</b>	<b>5.35 [2.94, 9.76]</b>	
Total events	46		5				
Heterogeneity: Tau <sup>2</sup> = 0.00; Chi <sup>2</sup> = 2.96, df = 3 (P = 0.40); I <sup>2</sup> = 0%							
Test for overall effect: Z = 4.36 (P < 0.0001)							
<b>Total (95% CI)</b>		<b>281</b>		<b>240</b>	<b>100.0%</b>	<b>5.35 [2.94, 9.76]</b>	
Total events	71		9				
Heterogeneity: Tau <sup>2</sup> = 0.00; Chi <sup>2</sup> = 3.00, df = 6 (P = 0.81); I <sup>2</sup> = 0%							
Test for overall effect: Z = 5.47 (P < 0.00001)							
Test for subgroup differences: Chi <sup>2</sup> = 0.11, df = 1 (P = 0.74), I <sup>2</sup> = 0%							



# Recommendation – inflammation and edema

We found high quality evidence that topical NSAID was more effective than topical steroid in preventing post-op macular edema.

We found low quality evidence that topical NSAID was more effective than topical steroid in controlling post-op inflammation



We recommend using topical NSAID post-phaco to control inflammation and prevent cystoid macular edema(⊕⊕⊕⊕)

# NSAID versus steroid

- PREMED: ESCRS multicenter RCT comparing bromfenac and dexamethason versus dexamethason alone
- 1000 "normal" cataract patients
- 300 diabetics
- Results expected 2014/2015

# Post-cataract Prevention of Inflammation and Macular Edema by Steroid and Nonsteroidal Anti-inflammatory Eye Drops

## A Systematic Review

Line Kessel, MD, PhD,<sup>1,2</sup> Britta Tendal, PhD,<sup>2</sup> Karsten Juhl Jørgensen, MD, DrMedSci,<sup>2,3</sup> Ditte Emgaard, MD,<sup>4</sup> Per Flesner, MD, PhD,<sup>5</sup> Jens Lundgaard Andersen, MD, PhD,<sup>6</sup> Jesper Hjortdal, MD, DrMedSci<sup>7</sup>

**Purpose:** Favorable outcome after cataract surgery depends on proper control of the inflammatory response induced by cataract surgery. Pseudophakic cystoid macular edema is an important cause of visual decline after uncomplicated cataract surgery.

**Design:** We compared the efficacy of topical steroids with topical nonsteroidal anti-inflammatory drugs (NSAIDs) in controlling inflammation and preventing pseudophakic cystoid macular edema (PCME) after uncomplicated cataract surgery.

**Participants:** Patients undergoing uncomplicated surgery for age-related cataract.

**Methods:** We performed a systematic literature search in Medline, CINAHL, Cochrane, and EMBASE databases to identify randomized trials published from 1996 onward comparing topical steroids with topical NSAIDs in controlling inflammation and preventing PCME in patients undergoing phacoemulsification with posterior chamber intraocular lens implantation for age-related cataract.

**Main Outcome Measures:** Postoperative inflammation and pseudophakic cystoid macular edema.

**Results:** Fifteen randomized trials were identified. Postoperative inflammation was less in patients randomized to NSAIDs. The prevalence of PCME was significantly higher in the steroid group than in the NSAID group: 3.8% versus 25.3% of patients, risk ratio 5.35 (95% confidence interval, 2.94–9.76). There was no statistically significant difference in the number of adverse events in the 2 treatment groups.

**Conclusions:** We found low to moderate quality of evidence that topical NSAIDs are more effective in controlling postoperative inflammation after cataract surgery. We found high-quality evidence that topical NSAIDs are more effective than topical steroids in preventing PCME. The use of topical NSAIDs was not associated with an increased events. We recommend using topical NSAIDs to prevent inflammation and PCME after routine cataract surgery. *Ophthalmology* 2014;121:1915-1924 © 2014 by the American Academy of Ophthalmology.



Supplemental material is available at [www.aaojournal.org](http://www.aaojournal.org).

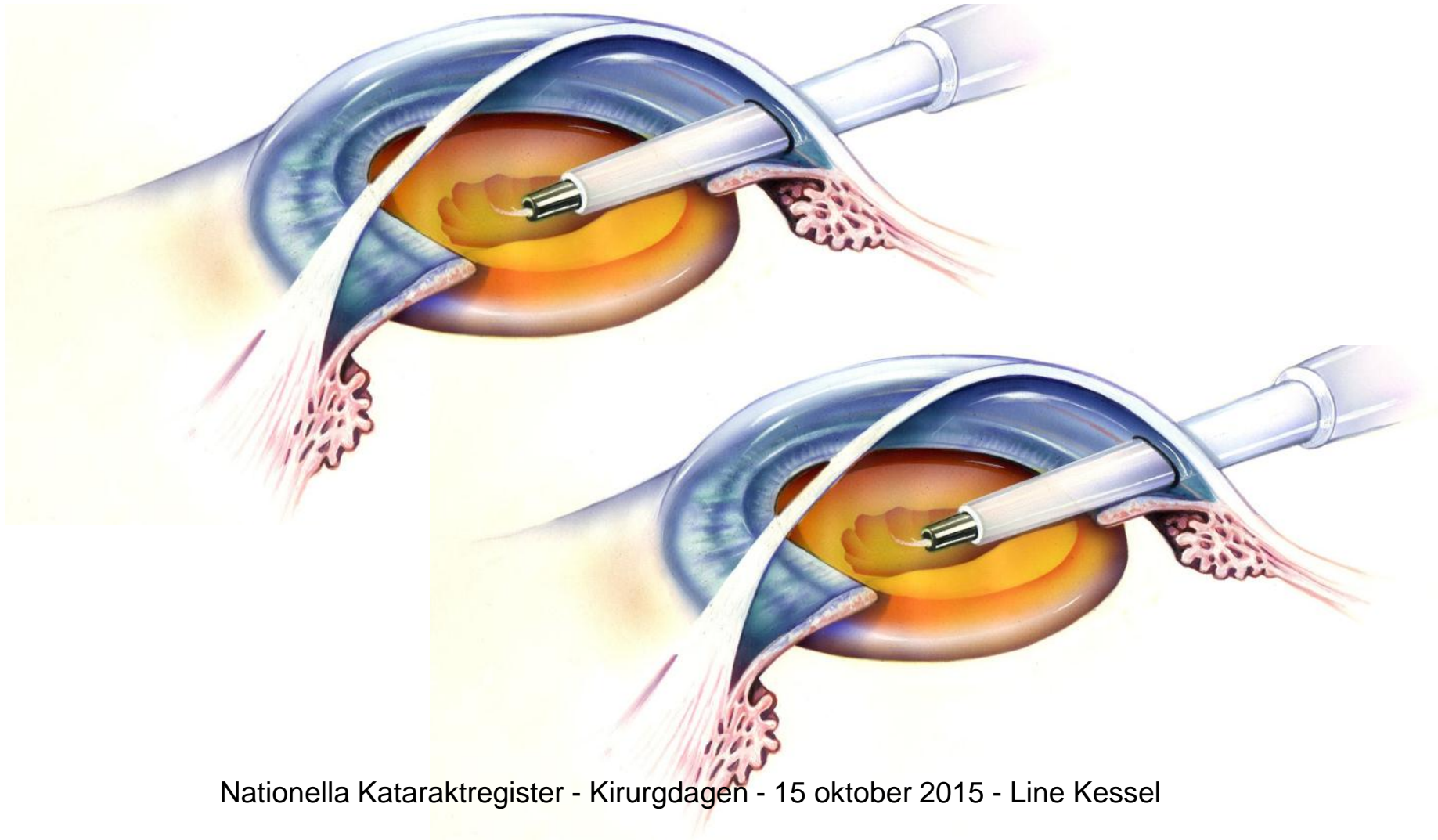
Cataract surgery is one of the most frequently performed elective surgical procedures in developed countries. The surgical methods have improved significantly over the years, thus lowering the risk of complications and raising patients' and surgeons' expectations of a successful visual outcome. In patients without other eye diseases, 20/20 visual outcome is a realistic expectation.

Like other types of surgery, cataract surgery induces a surgical inflammatory response. Uncontrolled inflammation may lead to serious side effects, such as posterior synechia, uveitis, and secondary glaucoma. Management of inflammation is thus a mainstay in modern cataract surgery. Currently, 2 drug groups are available to control ocular inflammation: steroids and nonsteroidal anti-inflammatory drugs (NSAIDs). Steroids are potent anti-inflammatory agents that work by acting on a number of intercellular

inflammatory mediators, and NSAIDs work by inhibiting the cyclooxygenase enzymes. The cyclooxygenase enzymes catalyze the formation of prostaglandins and thromboxanes. Prostaglandins mediate inflammatory reactions. Preventing the formation of prostaglandins reduces the inflammatory process.

Pseudophakic cystoid macular edema (PCME, also termed "Irvine–Gass syndrome") is a swelling of the fovea due to fluid accumulation occurring a few weeks to months after cataract surgery. It is the most common cause of visual decline after cataract surgery. The prevalence of PCME varies from study to study depending on how PCME is defined. By using fluorescein angiography, a prevalence of PCME of up to 20% has been reported,<sup>1,2</sup> whereas only 2% were diagnosed with PCME when loss of visual acuity was required to establish the diagnosis.<sup>1,3</sup> Usually, PCME is

# Immediate sequential bilateral cataract surgery





# Immediate sequential bilateral cataract surgery

## Pros:

Faster rehabilitation, cheaper (fewer visits to hospital and by district nurses)

## Cons:

Risk of bilateral sight threatening complications (endophthalmitis, corneal edema)

10% of surgeries in Sweden, only very few surgeries in Denmark and usually only patients undergoing general anaesthesia

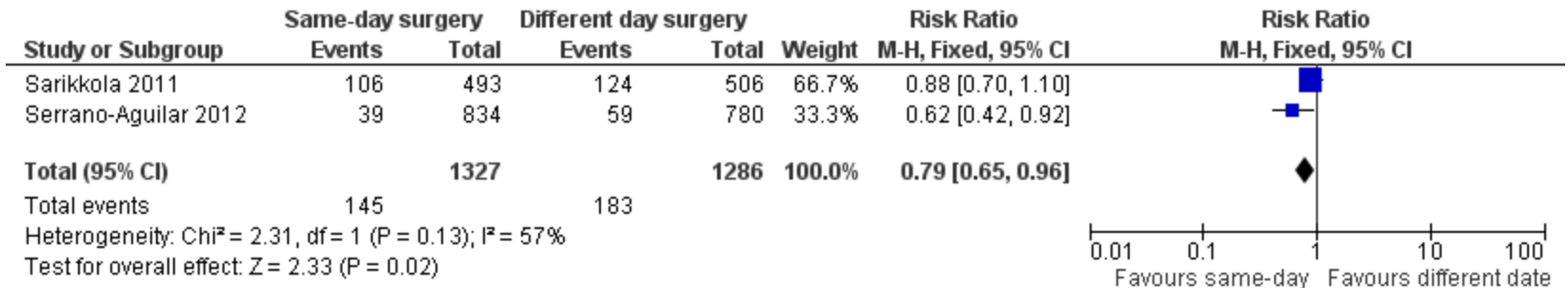
# Immediate sequential bilateral

## Included RCTs:

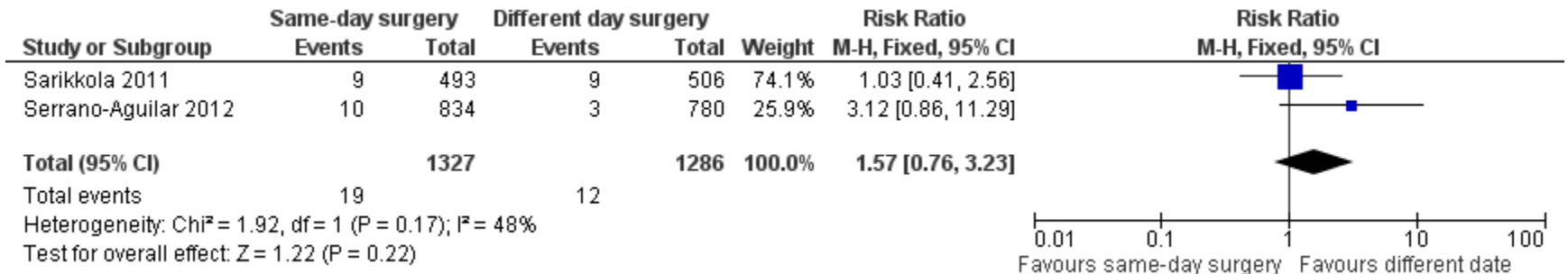
1. Lundström 2006, J Cataract Refract Surg; 32: 826-830
2. Sarikkola 2011, J Cataract Refract Surg 2011; 37: 992-1002
3. Serrano-Aguilar 2012, J Cataract Refract Surg; 2012: 1734-1742

# Immediate sequential surgery

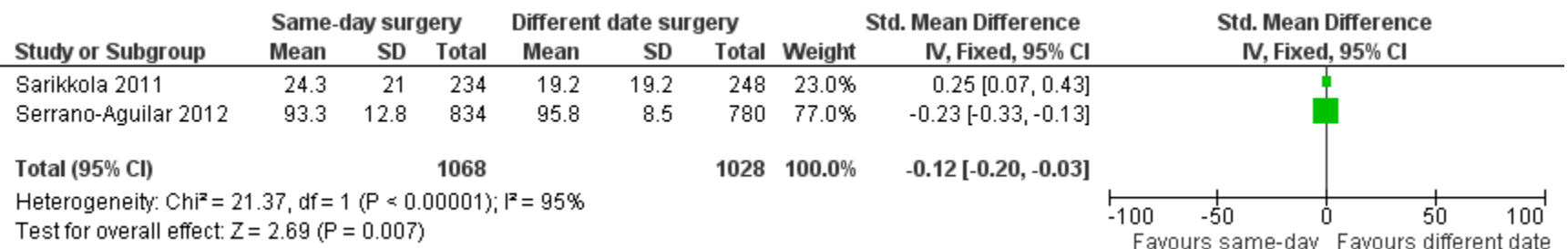
## Any complications



## Serious complications (iris prolaps, persistent corneal edema, leakage)



## Self-rated visual improvement



# Recommendations – Immediate sequential bilateral surgery

We found low to moderate quality evidence that immediate sequential bilateral cataract surgery can be performed without compromising patient safety and visual outcome

 The surgeon may consider to operate both eyes on the same date if bilateral surgery is indicated (⊕⊕○○)

The full-text version of the guideline should be consulted before immediate sequential bilateral cataract surgery is considered

## Review Article

# Immediate Sequential Bilateral Cataract Surgery: A Systematic Review and Meta-Analysis

Line Kessel,<sup>1,2</sup> Jens Andresen,<sup>3</sup> Ditte Erngaard,<sup>4</sup> Per Flesner,<sup>5</sup>  
Britta Tendal,<sup>2</sup> and Jesper Hjortdal<sup>6</sup>

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<sup>2</sup>Danish Health and Medicines Authority, 2300 Copenhagen S, Denmark

<sup>3</sup>Skanderborg Eye Clinic, 8660 Skanderborg, Denmark

<sup>4</sup>Department of Ophthalmology, Næstved Hospital, 4700 Næstved, Denmark

<sup>5</sup>Odense Eye Clinic, 5000 Odense C, Denmark

<sup>6</sup>Department of Ophthalmology, Aarhus University Hospital NBG, 8000 Aarhus, Denmark

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The aim of the present systematic review was to examine the benefits and harms associated with immediate sequential bilateral cataract surgery (ISBCS) with specific emphasis on the rate of complications, postoperative anisometropia, and subjective visual function in order to formulate evidence-based national Danish guidelines for cataract surgery. A systematic literature review in PubMed, Embase, and Cochrane central databases identified three randomized controlled trials that compared outcome in patients randomized to ISBCS or bilateral cataract surgery on two different dates. Meta-analyses were performed using the Cochrane Review Manager software. The quality of the evidence was assessed using the GRADE method (Grading of Recommendation, Assessment, Development, and Evaluation). We did not find any difference in the risk of complications or visual outcome in patients randomized to ISBCS or surgery on two different dates. The quality of evidence was rated as low to very low. None of the studies reported the prevalence of postoperative anisometropia. In conclusion, we cannot provide evidence-based recommendations on the use of ISBCS due to the lack of high quality evidence. Therefore, the decision to perform ISBCS should be taken after careful discussion between the surgeon and the patient.

## 1. Introduction

Cataract surgery is one of the most commonly performed elective surgical procedures in most Westernized countries. In the US Medicare system, cataract is the second most expensive procedure after intravitreal injections of anti-VEGF [1]. With the growing number of older citizens, the need for eye care is expected to rise [2]. The need for cataract surgery alone is expected to double within the next 20 years [3]. We need to prioritize resources to be able to provide service to those most in need.

Immediate sequential bilateral cataract surgery (ISBCS), that is, surgery performed on both eyes on the same day but as separate procedures, has caused some controversy.

Those in favor of the procedure argue that the postoperative visual rehabilitation period is faster and that fewer visits to the clinic or hospital are needed, which saves money and time for both health professionals and patients [4–6]. Those, who object to the procedure, argue that the risk of bilateral sight-threatening complications and the risk of postoperative refractive surprises outweigh any potential benefits that the procedure may have [7, 8]. If the two surgeries are performed independently with strict hygienic precautions (e.g., rescrubbing of lids, redraping, regowning, and separate batches of surgical devices), the risk of bilateral endophthalmitis is small [9]. Reimbursement practices may also affect the likelihood of a surgeon considering ISBCS or bilateral cataract surgery on two separate days [10].

# Postoperative controls



# Postoperative controls

What is the most appropriate timing of post-op controls?

Are routine first-day controls necessary?

# Postoperative controls

What is the most important control for post-op

**No references could be identified**

Are routine first-day controls necessary?



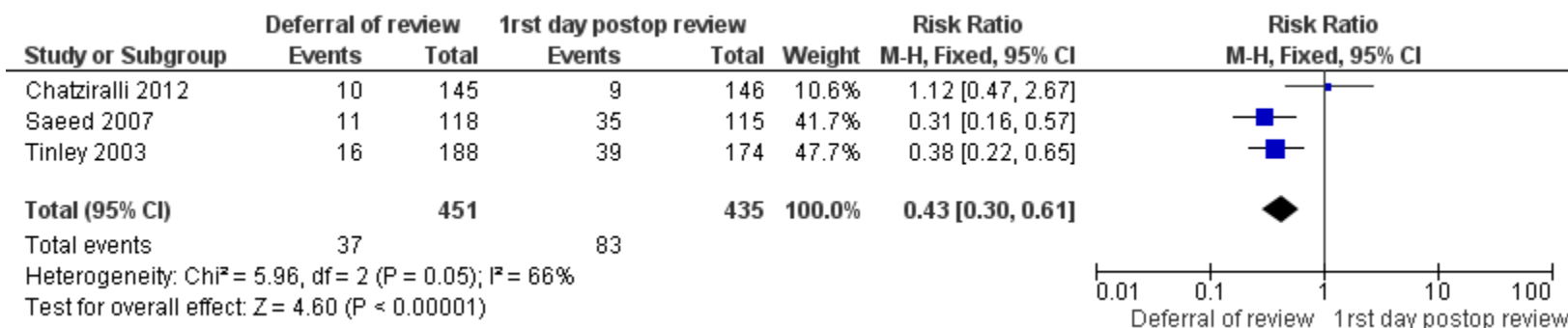
# Are routine first-day controls necessary?

## Included RCTs:

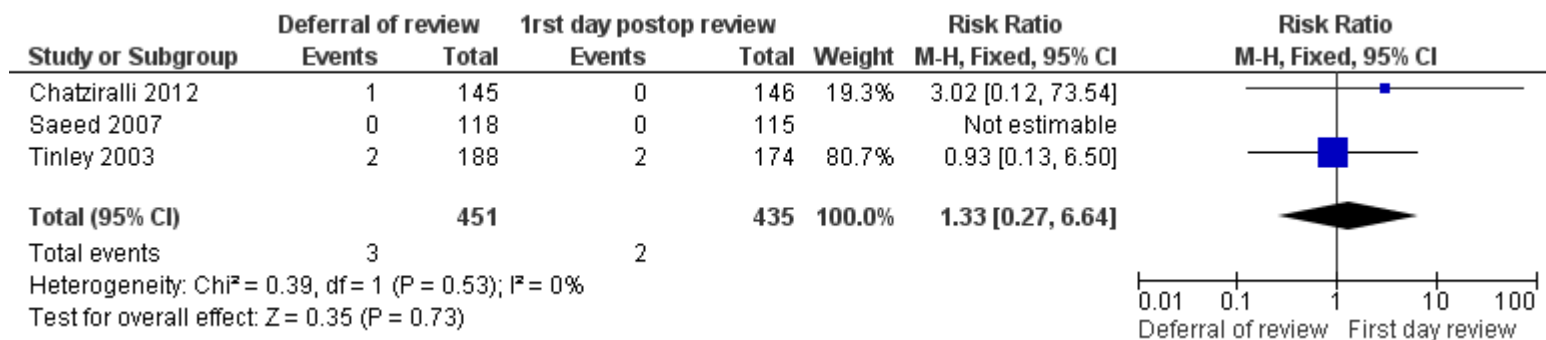
- Chatziralli 2012, BMC Research Notes; 5: 333  
Examination first-day post-op + day 14 and 28 post-op versus examination day 14 and 28 post-op
- Saeed 2007, J Cataract Refract Surg; 33: 1591-1596  
Examination at 2 hours and 2 weeks post-op versus 2 weeks post-op
- Tinley 2003, Br J Ophthalmol; 87: 1350-1355  
Examination first-day + 2 weeks post-op versus 2 weeks post-op

# Post-op controls

## All complications detected within the first 2 weeks post-op

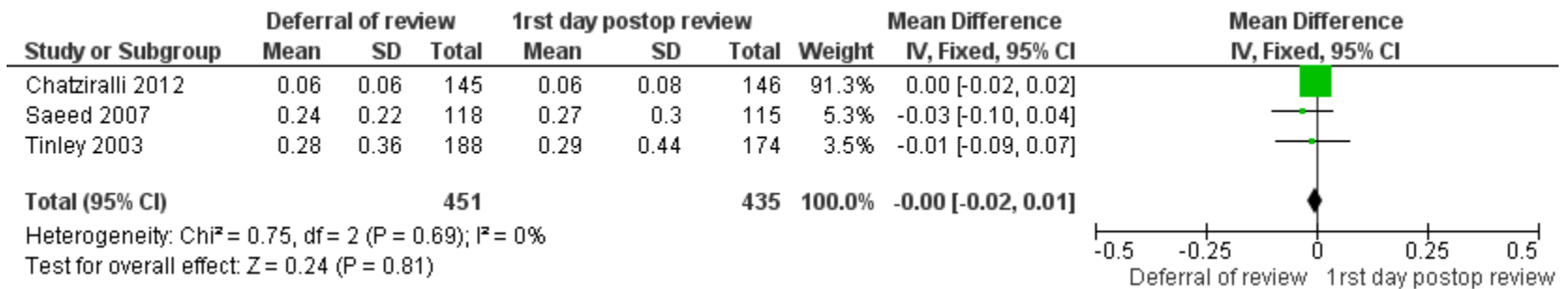


## Serious complications at 2 weeks post-op

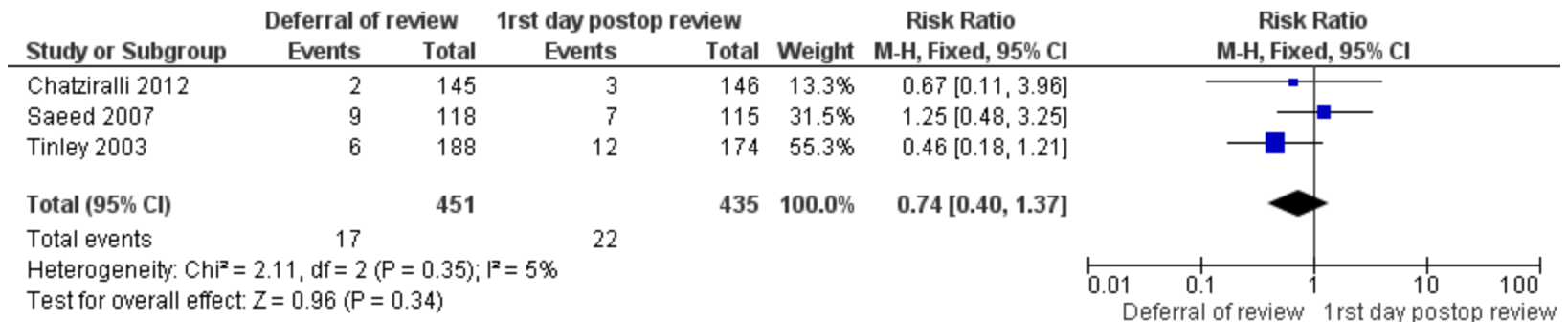


# Post-op controls

## Visual acuity (logMAR), 2 weeks post-op

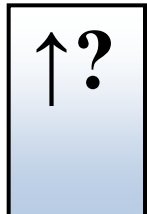


## Unplanned visits



# Recommendations – post-operative controls

We found low to moderate quality evidence that first-day post-operative controls can be omitted without compromising patient safety or visual outcome. We could not find any evidence to evaluate if patient satisfaction is affected by omitting first-day controls

 We recommend considering not to perform routine first-day controls in low-risk patients after uncomplicated surgery (⊕⊕⊕○).

# **Can review after uneventful cataract surgery safely be deferred until 2 weeks postoperatively? A systematic review**

*Line Kessel, Jens Andresen, Ditte Erngaard,  
Per Flesner, Britta Tendal, Jesper Hjortdal*

*Accepted by Journal of Cataract and  
Refractive Surgery*

# What we didn't learn from the clinical guideline

We were unable to find strong scientific evidence for important topics, e.g. indication for surgery, surgery in patients with AMD and timing of post-op controls

# Will the clinical guideline for cataract surgery change clinical decision making?

- Prevention of post-cataract endophthalmitis should be by intracameral antibiotics.
- Topical antibiotics should no longer be used routinely
- NSAIDs are better at controlling post-op inflammation and preventing edema
- Post-op treatment should change from combined antibiotics/steroids to NSAIDs alone