Professor Charles NJ McGhee
PhD, FRCS, FRCOphth, FRANZCO
Maurice Paykel Professor & Chair of Ophthalmology
Infant with an altered light reflex (Oph12)
Gradual deterioration in visual acuity over time (Oph07)
Type 2 diabetes mellitus (Endo11)
6 week check (Paed26)
Family with a genetic disorder (MG02)
Globally, 25 million cataract blind
Requires 36 million procedures to treat <6/12
Basic anatomy: Lens and anterior segment
Subluxated Lens

lens zonules
The eye has two principal focusing structures

a) The cornea 2/3rd – approximately 40 dioptres
b) The crystalline lens 1/3rd – approximately 20 dioptres
c) If a lens cataract is removed the focussing power (20D) needs to be replaced
d) Historically replaced by spectacles, in last 30 years mainly by intraocular lenses
Cataract assessment:
acuity, ophthalmoscope and slit lamp
Describing Cataract Anatomy

Anterior

- Anterior sub-capsular
- Cortical
- Nuclear

Posterior

- Posterior sub-capsular
The global burden of cataract

- 25 million blind (classified as 20/400)
- Additional 2 million new cases per annum
- 110 million severe visual impairment
- 90% of blindness in developing world
- Only 7 million procedures per annum
Cataract - multiple aetiologies

- Congenital
- Inherited
- **Age-related (the majority)**
  - Metabolic – e.g. diabetes
  - Toxic – e.g. corticosteroids
  - Traumatic – e.g. irradiation
  - Secondary – e.g. ant. uveitis
Dehydrational crises: a major risk factor in blinding cataract

D C MINASSIAN,¹ V MEHRA,² AND J-D VERREY¹

From the ¹International Centre for Eye Health, Institute of Ophthalmology, 27–29 Cayton Street, London EC1V 9EJ, and the ²Chattisgarh Eye Hospital, Fafadih, Raipur, MP, India

SUMMARY An earlier case control investigation has indicated a strong relationship between dehydrational crises and risk of presenile cataract. A second methodologically distinct case control study of risk factors in cataract has been carried out in a population very different in terms of environmental and sociocultural characteristics from the population investigated in the earlier study in Central India. The results strongly confirm the findings from the first study and indicate that an estimated 38% of blinding cataract may be attributable to repeated dehydrational crises resulting from severe life threatening diarrhoeal disease and/or heatstroke. The risk of blinding cataract was strongly related to level of exposure to dehydrational crises in a consistent and dose dependent manner, thus indicating a causal association. The findings are discussed in relation to possible sources of bias in the study, confounding in the data, and the steps that were taken to minimise their undesirable effects.
Cataract presentation in a local New Zealand perspective 2000-03
The Auckland Cataract Studies

Provided a prospective snapshot of 500 patients with cataract, cataract services, and state of the art surgical techniques in a public hospital service in the year 2000

Also highlighted public cataract waiting list issues and access to appropriate government funded care in a major metropolitan area (now resolved)

Results published in a series of scientific publications in the British Journal of Ophthalmology and Clinical and Experimental Ophthalmology
Harbour Bridge Study (N=193)

Mean age 77.2 years
Mean wait 18.2+/-11.6
Mean BSCVA 6/36

Outcome

Still waiting 49%
Expedited Rx 4%
Private Surgery 21%
Deceased 12%
Declined Surgery 12%

The Waiting Game: The natural history of a cataract waiting list in New Zealand
### NZ Cataract Prioritization Questionnaire

#### Contralateral Eye

<table>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>6/12</td>
<td>1</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>13</td>
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<td>6/18</td>
<td>2</td>
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<td>15</td>
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<td>36</td>
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<tr>
<td>CF/HM</td>
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<td>12</td>
<td>18</td>
<td>24</td>
<td>36</td>
<td>36</td>
<td>40</td>
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</tbody>
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Clinical modifiers eg. ARMD, Diabetic retinopathy
Work and independence 0 to 10
Non-vision physical disability 0 to 10
Activities of Daily Life questionnaire 0 to 13
Driving 0 to 7

Mrs JW

11
5
0
7
23pts

Image used with patient permission
## Auckland Cataract Project 2: Demographics

<table>
<thead>
<tr>
<th>Demographics</th>
<th>(N=500)</th>
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<tr>
<td>Gender</td>
<td>62%</td>
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<tr>
<td>Female</td>
<td></td>
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<tr>
<td>Mean Age</td>
<td>74.9+/-</td>
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<tr>
<td>9.8yrs</td>
<td></td>
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<tr>
<td>BSCVA</td>
<td>6/48-1</td>
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<tr>
<td>European</td>
<td>85%</td>
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<tr>
<td>Maori</td>
<td>7%</td>
</tr>
<tr>
<td>Indian</td>
<td>3%</td>
</tr>
<tr>
<td>Asian</td>
<td>2%</td>
</tr>
<tr>
<td>Pacific Peoples</td>
<td>2%</td>
</tr>
</tbody>
</table>
The majority of those with significant cataract have General Health issues

- Hypertension: 25%
- Cerebral vascular disease: 12%
- Diabetes Mellitus: 11%
- Ischaemic Heart disease: 10%

**Rx**
- Aspirin: 42%
- Warfarin: 6%

Pre-proliferative diabetic retinopathy
Auckland Cataract Study:
commonly associated ocular disease

Ocular co-morbidities in cataract patients

- Open-angle glaucoma: 10%
- Diabetic retinopathy: 6%
- Vein occlusion: 2%
- Advanced AMD: 1%

Advanced Optic disc cupping in glaucoma

The Auckland Cataract Study: Demographic, Corneal Topographic and Ocular Biometric Parameters.
4. (R)evolution of cataract surgery
Cataract surgery

Ancient Techniques

Couching

Current cataract extraction techniques

1. Intra-capsular – now mainly in developing world
2. Extra-capsular – some use in developed world
3. Phacoemulsification – most popular technique
Couching of cataract has ancient origins in India
Origin of modern Cataract Surgery: 
1750’s Extra-capsular cataract (ECCE) surgery

Dr Jacques Daviel described the ECCE technique in 1752
Intra-capsular cataract extraction (ICCE)

- Still successfully performed in parts of developing world
Extra-capsular Cataract Surgery
Intra-ocular lenses 1949

Sir Harold Ridley

Invented intra-ocular lenses (IOLs) and performed the first successful Surgery in Moorfields Eye Hospital, London, in 1949
1970’s Iris-clip intra-ocular lenses
1980’s Intra-ocular lenses: three piece posterior chamber IOL
1990’s widespread acceptance of small incision phacoemulsification

Use of high frequency ultrasound to emulsify cataract performed through a smaller incision (6mm verses traditional 10mm incision of ECCE procedures)
Phacoemulsification hand piece

- Piezoelectric crystal vibrates ultrasonically
- Driven electrically
- Frequency 25,000 – 60,000 Hz
- Phaco “needle” is hollow (0.9mm diam) with central aspiration port
- Needle surrounded by soft irrigation sleeve with two ports which maintains fluid in ant. chamber
Classic superior scleral tunnel approach to phacoemulsification
Late 1990’s Intra-ocular lenses: small incision phacoemulsification and the evolution of foldable and injectable Intraocular lenses

Folding or injecting the 6mm diameter IOL enables the incision size to be reduced to 3mm width for no suture phaco with incisions moving from largely scleral to corneal based
Corneal Incision structure

One and two step corneal incisions

- Quick
- Single instrument
- No suture
- Enables topical anaesthetic approach
- Popular
Injecting a single piece IOL through a corneal incision
Complexity of phacoemulsification technology
Cataract Surgery – varied global rates 2006
Cataract outcomes in public healthcare systems

I was originally down for cataracts, but I’ve been standing in a queue so long, I now need a hip replacement and pile surgery...

Tom Scott..
488 consecutive cataract operations

Moderately advanced cataracts with mean BSCVA of 6/48 (20/160)

Mean pre-op refraction -0.49 +/- 1.03D

99.8% local anaesthesia (95% subtenons)

97.5% small incision phacoemulsification

Typically less than 30 minute procedure
Unselected, consecutive, moderately advanced cataracts treated in a tertiary public hospital by residents / consultants

Outcome:

Mean BSCVA = 6/7.5 (20/25)
Majority (88%) ≥ 6/12 (20/40)
Mean SphEq = -0.46+/-.89D

Complications:

4.9% capsular tears
3.7% cystoid macular oedema
0.2% endophthalmitis
1.5% of eyes red’n in potential BSCVA due to surgery
What’s new in IOL design?

Considering

- PCO and square edge
- Correction of spherical aberration
- Multifocal / accommodative IOLs
- Coloured IOLs & macular protection
- Specialised IOLs for reconstruction
In a public health system, a predominantly elderly, female population, frequently with significant systemic illness and co-existing ocular diseases, relatively advanced cataracts and poor visual acuity, presented for cataract surgery.

The majority of subjects (97.5%) underwent small incision, phacoemulsification, local anaesthetic, day-case surgery. The remaining 2.5% underwent extra-capsular cataract surgery.
Despite co-existing eye disease, almost 90% of patients achieved best spectacle corrected vision (BSCVA) of 6/12 [20/40] or better which meets the NZ & UK driver’s licence standard.

Although approximately 5% of eyes sustained an adverse intra-operative event only 1.5% of eyes exhibited poorer post-operative BSCVA than anticipated.
Thank you
The End

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