A Historical Overview of Cataract Surgery In Humans and Animals

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From Ancient Times to the Present

Outline
- Anatomy
- Definition
- History
- Ancient Techniques
- Milestones/Developments
- Current Techniques
Definition

"Cataract"

- First/oldest record
- Cairo Museum (Egypt) has the oldest description of a cataract (4500 year-old statue)
- Excavated in 1870
- Sheikh el-Balad

"Principal procedure in Ophthalmology today"
"One of the oldest and most gratifying operations for both surgeon and patient"
"Responsible for Ophthalmology becoming one of the first surgical specialties"

"Evolution of cataract surgery over the centuries: one of the great sagas of medical history"
When did it all start?

- First surgical procedure was mentioned in the Rig-Vedas (~2000 BC)
  - The earliest account of ancient Indian civilization
  - Prosthetic leg was attached to a queen’s leg so that she could walk and even participate in war
- Cataract surgery dates to ancient times
  - Likely born in India
  - Conflicting dates of its first description/invention
  - Era of no documentation, "Upanishads"
  - Mentioned in the "Mahabharata/Bhagavad Gita"

Sushruta/Suśruta

- Indian Sage/Rishi/Physician, 800 BCE
  - "Father of Surgery"; father of brain surgery, cataract surgery, plastic surgery
  - Sushruta Samhita/"Sushruta’s Compendium" – oldest texts in the topics
  - Work of several historical layers, described all basic principles of surgery
  - 184 chapters, 1130 diseases, 700 medicinal plants
  - Practice of mock operations on inanimate objects such as watermelons, cadavers, clay plots and reeds

Sushruta’s definition of an ideal surgeon

“A person who possesses courage and presence of mind, a hand free from perspiration, tremor less grip of sharp and good instruments and who carries his operations to the success and advantage of his patient who has entrusted his life to the surgeon. The surgeon should respect this absolute surrender and treat his patient as his own son.”
Cataractous lens was initially pushed/displaced out of the visual field within the eye.

- Removal of the lens out of the eye, with or without its capsule.
- Different methods in different eras and multiple breakthroughs.

Introducing an era:
- Couching (with or without sectioning/needling)
- Extraction (extracapsular/intracapsular)
- Phacoemulsification

Couching:
- Cataractous lens was initially pushed/displaced out of the visual field within the eye.
From antiquity to the mid-17th century (~3000+ years)
Instruments and techniques (such as entry location) changed with time
Teachings eventually reached many regions due to regional expansions/explorations
i.e. Expedition of Alexander the Great

Archeological sites
Valley of the Kings
56th-11th century BC
Wall paintings depicting various techniques
Couching instruments found in tombs
Collage of an era

- Different paintings/drawings/sculptures depict different practices employed throughout the ages
- Instruments, location (by the window for sunlight), restraint, clothes, accessories, standing vs sitting position

Drawing Analysis

- The surgery is outside, the patient sits close to the ground. Dr sits a little higher
- Assistance in a sitting position
- Dr uses the left hand for the right eye (ambidexterity), thumb opens the eyelid
- telescopes worn by the doctor
Instruments for couching

- Thorns from the gum arabic tree
- Egyptian acacia or thorny acacia

“Jabamukhi Salaka”
Curve needle used for couching
Complications galore

Introducing an era

- Couching (with or without sectioning)
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Extraction - ECCE

- The era of Jacques Daviel
- 4 Steps: corneal section, anterior capsulotomy, expression of the cataract, cortical removal (+/- iridotomy)
- Reported 206 sx, 182 successful
- Started from April 8th 1745
- Lasted from mid-18th until early 20th century (~300 years)

Perhaps the most important date in ophthalmic history
von Graef – Linear extraction

- Upper limbus linear incision
- Von Graefe Knife > 100 years

VIDEO von Graefe Knife
ICCE

- Similar origin timepoint as ECCE
- Samuel Sharp in 1753
- More vitreous loss
- Post-op infection
- High incidence of complications
- From late 19th century until 1970s
  - <100 years

Major Milestones

- 1884 - von Graefe introduced asepsis and antisepsis
  - Knapp described retrobulbar anesthesia
  - Koller discovered topical anesthesia
- 1891 - De Mendoza described suturing techniques
- 1917 - Suction cup developed by Barraquer
ICCE (cont)

- Capsule forceps
- 1957 - Barraquer's son described chemical ablation/zonulolysis
- 1958 - Krawitz introduces cryoextraction
2 heroes from the 20th century

Harold Ridley
- Treated Royal Air Force pilots who suffered from eye injuries
- Noticed the lack of inflammatory response in ocular penetrating injuries with material made of PMMA (Polymethyl methacrylate)
- Found PMMA to be inert, with no signs of rejection
- PMMA was used in the canopies of two planes in the Royal Air Force, the Spitfire and the Hurricane

Charles Kelman
- Performed the first phacoemulsification for cataract in 1967
- Germany launched the air attack known as the Battle of Britain (1940)

The most powerful antigen known to man is a new idea.
Colleagues were highly distrustful
- Including neighbor Duke Elder
- It took until the 1970s for IOLs to be considered standard of care
- If not started in 1949, IOLs might have been discovered for yet another forty years
- Immediately after a war many were accustomed to accepting risk of injury
"Shoemaker's son always goes barefoot?"

- Ridley performed the first surgery at St Thomas Hospital (where 1st Minister Boris Johnson was recently admitted with COVID-19)

- Monumental plaque is has the wrong date!

British Parliament located across the hospital

- Painting made 2 years prior to diagnosis of cataract
Collage of the era

Various types of
Intraocular lens implants ever since

- Multifocal implants
- Various materials
- Implant in various positions (iris-claw, transscleral, sulcus)
- Intraocular implants have chips to measure intraocular pressure 24/7
- Implants for presbiopia
ECCE comeback

- 20 years prior to the next era (phaco)
- Improved success rates, vision, comorbidities
- Improvements in magnification devices, medications

Magnification Sources
Introducing an era

- Couching (with or without sectioning/needling)
- Extraction (extracapsular/intracapsular)
- Phacoemulsification

In 25 years the technique achieves near technical perfection; becomes universally taught in the USA, then the world of medicine and veterinary medicine.
Collage of an era
First phaco took 76 minutes

Persistence

Phacoemulsification is certainly no more effective in restoring vision than our currently practiced technique. The currently practiced extracapsular operation is, in many cases, the only method to be used. 

AAO 2011
A letter from the 1st generation

“Consider yourselves lucky and honored for the scientific advancements in medical surgery, innovations, anesthesia & analgesia, instrumentation, and anti-inflammatory drugs, no matter the case today, there is always room to do better tomorrow.”

“A person with a new idea is a crank until the idea succeeds.”

MARK TWAIN
Novelist and journalist, 1835 – 1910