Newer methods for measuring Intraocular Pressure

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Financial Disclosures

I have no financial interest in any of the products discussed.

No unlabeled drugs will be discussed.
What is Intraocular Pressure?

“Tension” of the eye

Determined by balance b/w aqueous production & outflow

Expressed in millimeters of mercury (mm Hg)
Elevated IOP induces strain on the optic nerve as it exits the eye
Strain affects the blood supply and astrocytes in the laminar beams
The end result is glaucoma

Normal

Glaucoma
Applanation tonometry is the current standard for IOP measurement

Measures force necessary to flatten 3.06 mm$^2$ of cornea

Goldmann applanator is slit-lamp mounted

Hand-held version: Perkins
Even Goldmann tonometry has limitations

Deviations in thick or thin clear corneas

Error in swollen/scarred corneas unknown

Real gold standard for IOP is cannulation of the anterior chamber
Goldmann tonometer pushes cornea with adjustable force until it flattens
A beam splitter in the tonometer tip indicates when the force is correct.

Force adjusted with dial

Endpoint = touching semicircles created by split beam

Touching semicircles $\rightarrow$ correct amount of flattened cornea
Handheld applanators use the same principle

Patient need not be sitting

No need for slit lamp

Still need fluorescein
Applanation tonometry is not suitable for some patients

Irregular corneal surface

Blinkers/squeezers

Eyelid swelling/sensitivity
Several alternatives to traditional applanation tonometry

Noncontact tonometry

Tonopen

Pneumotonometer

Rebound tonometry
Non-contact tonometry relies on an “air puff”

No chance of spreading infection

No need for skilled operator

Eliminates the needs for cleaning/disposables
Limitations to non-contact tonometry

Can be some patient discomfort

Prone to errors at extremes of IOP

Does not solve many of the issues with Goldmann tonometry
Tonopen is also an applanation

Applanates a very small section of the cornea

“Works” in corneal irregularity

Averages several readings

Portable
Tonopen still has limitations

Need to poke the eye at least 5 times

Requires anesthesia

Accuracy unknown

Shared instruments often work poorly
Rebound tonometry works by a different mechanism

Lightweight probe bounced against cornea

Faster probe with higher IOP

Shorter probe/cornea contact time with higher IOP
Rebound tonometer now available for clinic and research use

iCare Tonometer
Several distinct advantages to iCare

No need for anesthetic drop

No need to touch eye or head

High success of getting clinic IOP in children
iCare incorporation presents new challenges

Can avoid IOP portion of EUAs, but.....

Need to document ON appearance outside OR

Need to refract/check axial lengths outside OR

.....Not everyone is spared an EUA
iCare accuracy isn’t perfect

About 15% in whom IOP is off by 3 mm Hg

Validation studies only in simple patients

Doesn’t work well in supine patients