Grand Rounds

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Case Presentation

A 24 year-old gentleman was transferred from an outside institution for evaluation of TASER dart in the right lower eyelid.

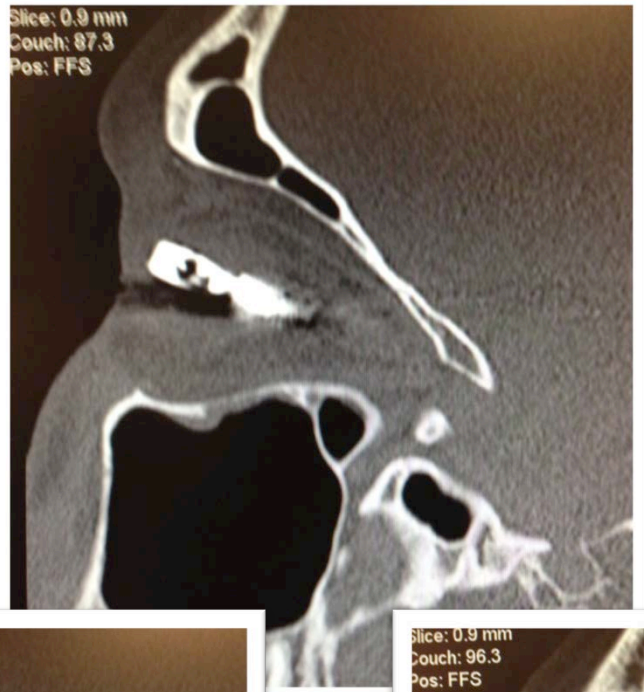
The gentleman sustained multiple TASER wounds elsewhere on the body, but no other medical issues.

The patient was not able to give any reliable history or subjective complaints due to severe psychosis.

Patient Care

NEXT STEP?


ice: 0.9 mm
ouch: 87.3
os: FFS


Slice: 0.9 mm
Couch: 87.3
Pos: FFS


Slice: 0.9 mm
Couch: 90.9
Pos: FFS


ice: 0.9 mm
ouch: 99
os: FFS
F: YD


Slice: 0.9 mm
Couch: 96.3
Pos: FFS
F: YD
237 mA

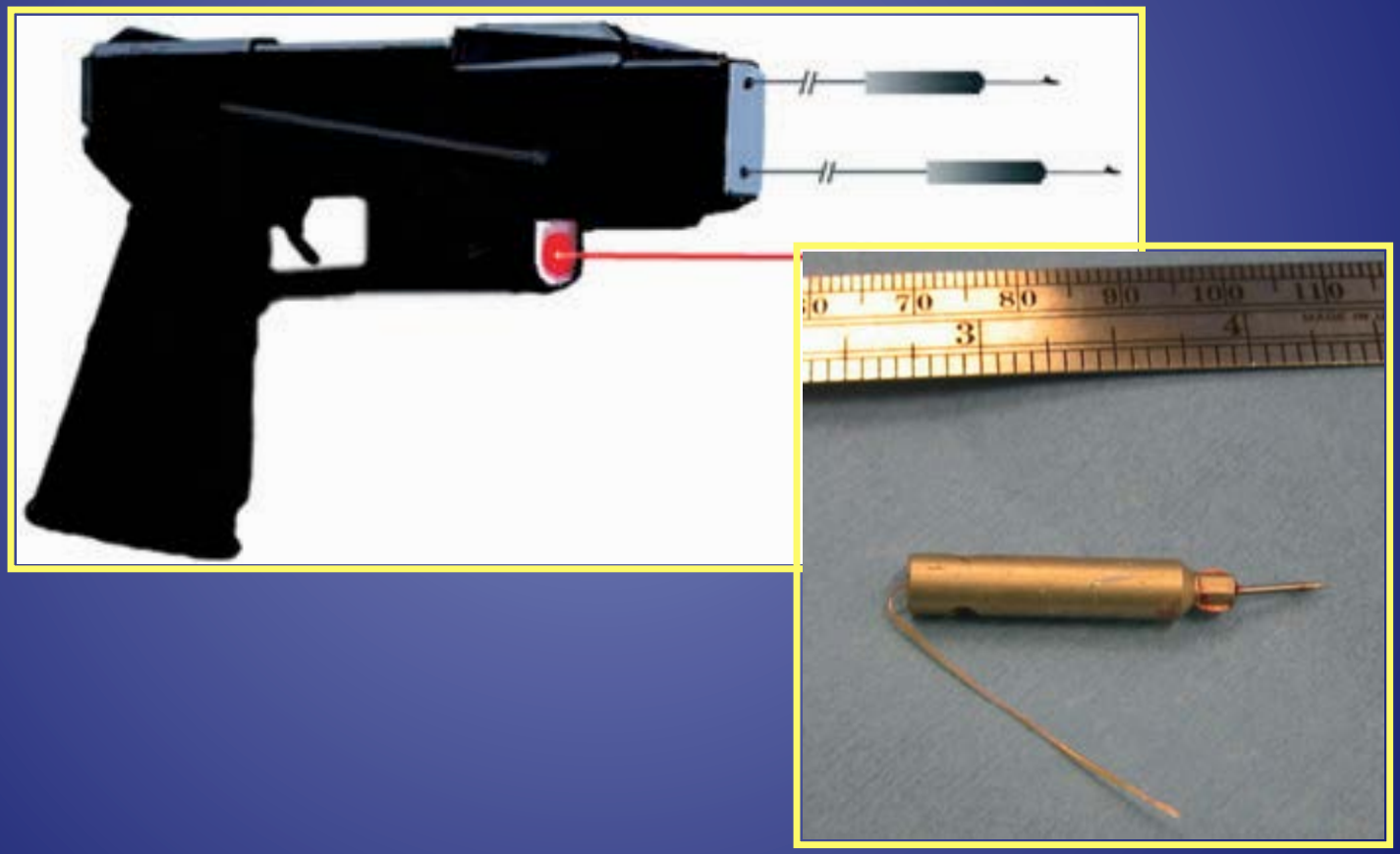

C: 50


C: 5

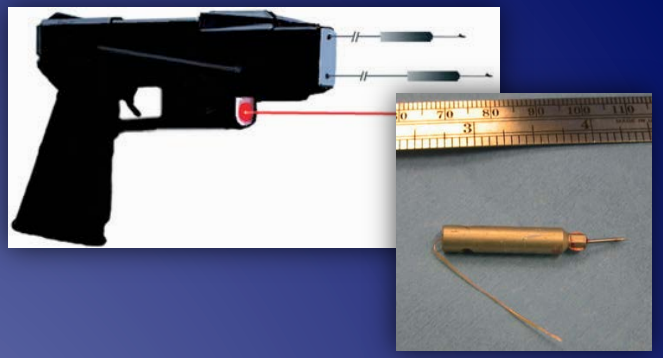
Diagnosis?

Ruptured Globe! Ruptured Globe! Ruptured Globe!

But.. A Simple Ruptured Globe?



The TASER



- Thomas A Swift's Electric Rifle:
  - "A less lethal weapon" (1974)
  - Meant to immobilize violent and threatening individuals in law enforcement.
- Two harpoon-like barbed electrode darts with trailing conductive wires to a target 3–6 m away.
- Wires complete an electrical arc: short-duration (fraction of a millisecond) repetitive pulses (5–30 pulses per second), each of 50 000 V.
- 160 ft/sec, up to 35 ft
- Triggers skeletal muscle contraction and tetany
- 1.4% sustain significant injury (face, groin, neck)

TASER Injuries

- High-voltage, low current stimulation tetanizes skeletal muscle, while leaving smooth and cardiac muscle unaffected.
- Medical attention is usually sought for removal of lodged darts (9.5 mm long)
- Reported sequelae: contusions, abrasions, skin lacerations, mild rhabdomyolysis, testicular torsion and miscarriage.

Taser Penetrating Ocular Injury

Weng Ng, MBBS, and
Mark Chehade, FRANZCO

- 55 year-old man with a Taser to the right lower lid
- Vision: 6/18
- Inferior SCH, microhyphema, vitreous hemorrhage
- Tip of barb visible within the vitreous
- Sclera sutured and cryopexy was applied
- Vision improved post-operatively

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0736-4679/$ - see front matter

CATASTROPHIC GLOBE DISRUPTION AS A RESULT OF A TASER INJURY

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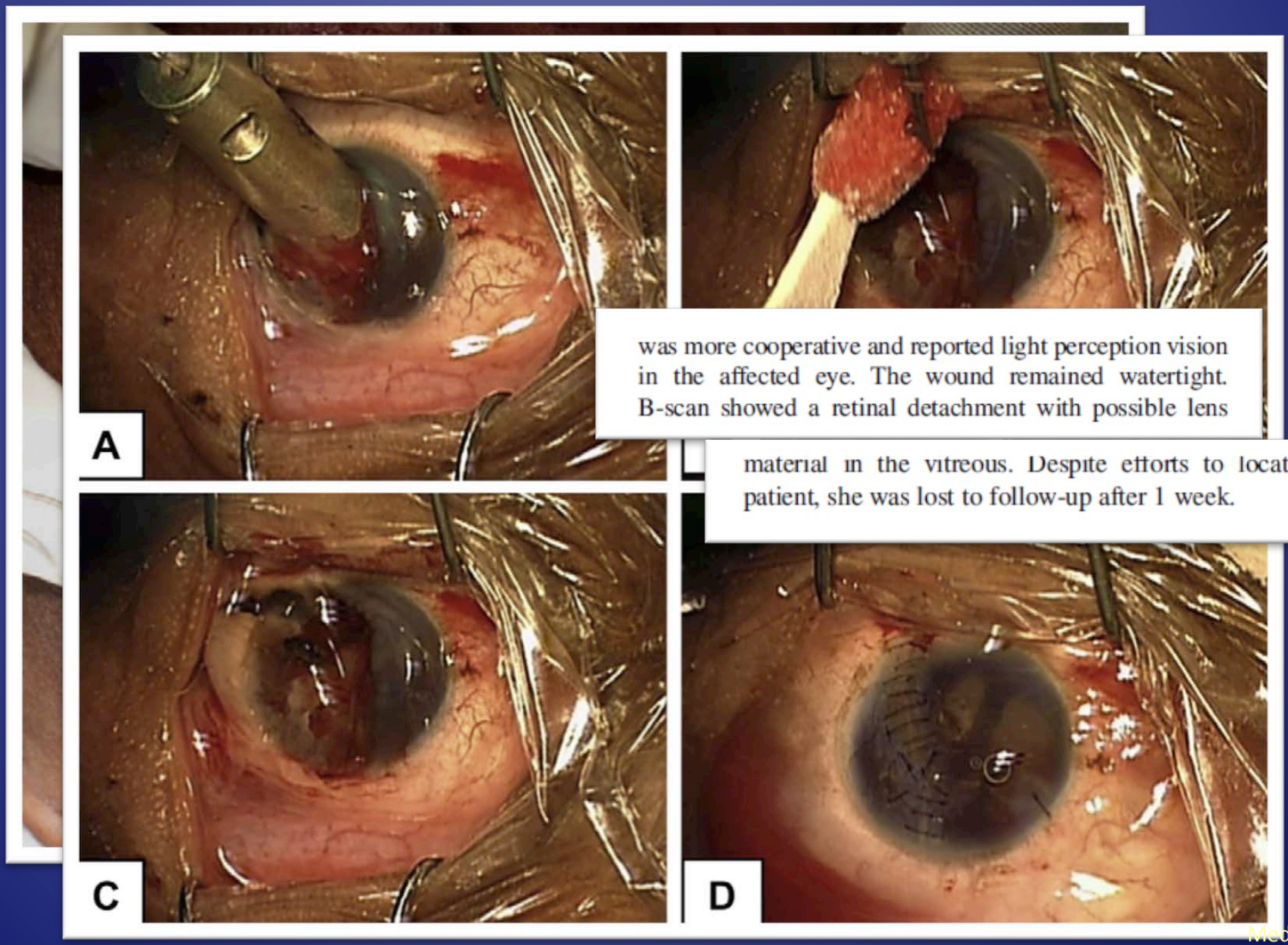


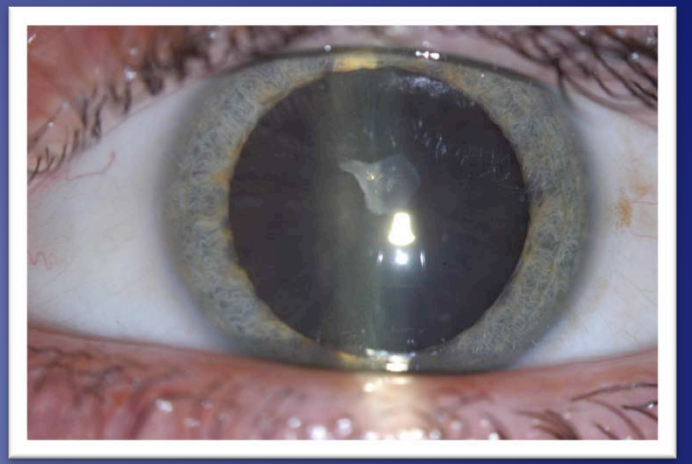
was more cooperative and reported light perception vision in the affected eye. The wound remained watertight. B-scan showed a retinal detachment with possible lens material in the vitreous. Despite efforts to locate the patient, she was lost to follow-up after 1 week.

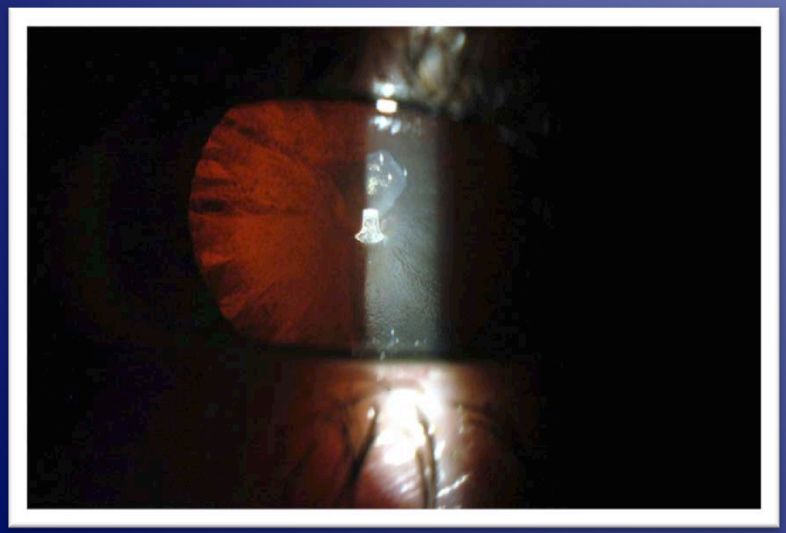
CASE REPORT

Cataract secondary to electrical shock from a Taser gun

Rajeev K. Seth, MD, Gelareh Abedi, MD, MS, Armand J. Daccache, MD, James C. Tsai, MD

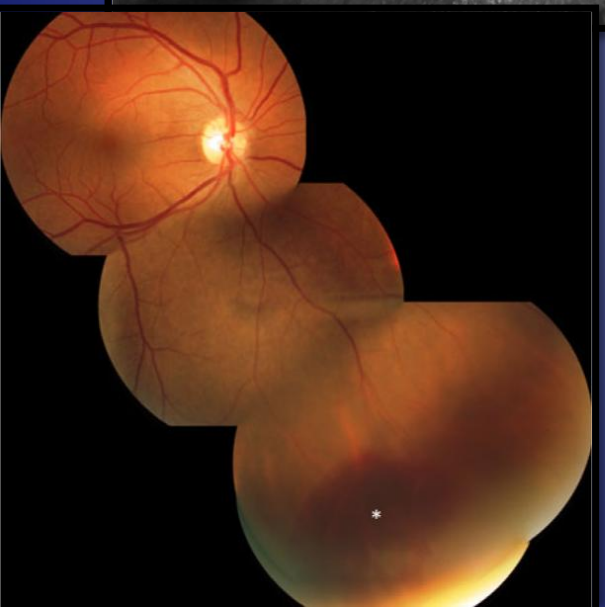
- 35 year-old man six days s/p blunt trauma from a Taser gun in the right eye, complains of decreased vision in *both eyes* since trauma.
- BCVA 20/50, 20/100
- Tapp: 48 OD





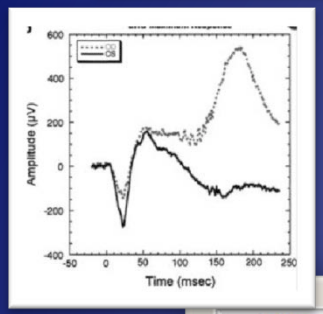
- Subconjunctival hemorrhage, PSC od, angle recession on gonio od, two clock-hours retinal dialysis od, ASC os
- Underwent pneumatic retinopexy and cryotherapy
- Lost to follow up before cataract surgery.

Diffuse retinal injury from a non-penetrating TASER dart



Case report

A 39-year-old man was brought to the emergency department after being subdued with a TASER gun by the police. The TASERing resulted in immediate loss of consciousness. Three TASER prongs were found on the patient's clothing, and a fourth was found firmly embedded medially in his right lower lid (Fig. 1). His visual acuity on presentation was 20/400 in the right eye and 20/20 in the left eye. Pupil reactions and confrontational visual fields were normal. Ocular motility was full, with mild pain on upgaze. The intraocular pressures were 20 and 14 mmHg in the right and left eyes, respectively. A TASER probe was embedded in the right lower eyelid with a corresponding laceration and surrounding ecchymosis. However, no electrical burn was observed on the eyelid skin. A small subconjunctival hemorrhage was noted nasally in the right eye. Corneas and lenses were clear, and irides intact. Anterior chambers were formed without inflammation. Dilated fundus examination of the right eye showed a string of retinal hemorrhages surrounding a large area of subretinal hemorrhage inferonasally, measuring approximately 3 disk-diameters in extent (Fig. 2). No retinal tear was identified. The vitreous was clear with no evidence of cells in the anterior vitreous. A CT scan of the orbits showed intact globes, and localized the prong in the right lower lid, extending into the anterior orbit, with the tip terminating in the right lacrimal fossa. There was no radiographic evidence of rectus muscle involvement (Figs. 3, 4).



Diffuse retinal injury from a non-penetrating TASER dart

The initial area of subretinal hemorrhage progressed into an exudative retinal detachment over the following 3 days. A Ganzfeld electroretinogram (UTAS-E 2000, LKC Technologies, Inc, Gaithersburg, MD), following the ISCEV standard for clinical electrophysiology [3], was performed on our patient at this time and showed a 63–70% decrease in a- and b-wave amplitudes for rods when compared to the fellow normal eye, but only a 10% reduction in cone amplitudes. Cone responses were also delayed by 1–2 ms (Fig. 5). Over the next 2 months, the retinal detachment gradually resolved, leaving a few residual intraretinal hemorrhages and some hyperpigmented scars. Visual acuity progressively improved over 2 months time to 20/25. No new complications developed over this period of time. Unfortunately, the patient was lost to follow-up, and we were unable to assess for late sequelae of the injury.

Exudative RD: Thermal vs mechanical

ERG changes: Electrical (lightning strike)

EMA
Emergency Medicine Australasia

Review article: Emergency department implications of the TASER

Megan Robb, Benjamin Close, Jeremy Furyk and Peter Aitken
Emergency Department, The Townsville Hospital, Townsville, Queensland, Australia

Cardiovascular

Several studies have examined electrocardiogr
(ECG) changes in healthy volunteers with
TASER exposures.[23,24,31] They found a sig
increase in heart rate, decrease in PR interv

One study conducted on pigs[12] obser
cardium either directly through a thora
echocardiography, which demonstrate

Other variables might impact on the risk of
ing a ventricular arrhythmia after a TASER e
such as the presence of drugs and the barb
distance. A study conducted on anaesthetize
found that ventricular tachycardia and VF cou
induced, but only when adrenaline had been given firs
to simulate stress.[17] A similar pig study found tha
cocaine reduced the VF threshold and hence increase
the vulnerability to VF.[33] The distance from the TASE
barb to the heart has also been investigated in pigs, an
applied to human models. In theory, VF would be mor
likely when electrodes are closest to the heart and, fo
this reason, people with a low body mass index migh
be at higher risk.[34]

Sudden death

There has also been concern about whether or not
TASER is the cause of death of patients in some
cumstances. Amnesty International (2006) has p
lished an article that suggests that death can
attributed to the use of TASER in over 150 patient
However, many of the patients who have died a
exposure to the TASER had illicit drugs in their syste
Coronial reports into the cause of deaths in many
these patients did not attribute death directly
TASER, but associated it with the death. TASER Int
national acknowledges that drug use increases the r
of death following TASER use.[7]

Pregnancy

There is a theoretical risk of the TASER causing adverse effects to the foetus and there is one case report describing the miscarriage of an 8–10 week gestation pregnancy following TASER exposure.[47] A barb lodged in the patients' abdomen above the uterus and the following day she experienced vaginal bleeding and subsequently miscarried 7 days later. The author suggests a link between the TASER and the miscarriage as the uterus and amniotic fluids act as excellent conductors of electrical current. Foetal death might have occurred as a result of a cardiac arrest or thermal injury to the placenta resulting in uteroplacental insufficiency. However, in this case a causal relationship was not able to be established.

report,[55] an intracranial penetration of a barb occurred in a 16-year-old boy. CT demonstrated possible dural perforation. He was neurologically intact. It was removed in the operating theatre. A recent case of pharyngeal perforation from a barb penetrating the neck has also been reported.[56]

TASER International describes a case of a pneumothorax caused by a barb penetrating the left upper anterior chest of a slim-built man.[7] In another case

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Review article: Emergency department implications of the TASER

Megan Robb, Benjamin Close, Jeremy Furyk and Peter Aitken
Emergency Department, The Townsville Hospital, Townsville, Queensland, Australia

All patients exposed to TASER should have

1. ABC – airway, breathing, circulation and vital signs
2. Secondary survey – look for other injuries
3. Treat injuries – lacerations, burns as per departmental guidelines
4. Remove barbs – unless risk that has penetrated body cavity, joint, eye, cranium
5. Assess tetanus status – ADT as required
6. Baseline investigations – consider BSL, ECG and venous blood gas as screening test

- If the patient is not high risk and baseline investigation normal then can be discharged.
- If the patient has an abnormal ECG (arrhythmia) or chest pain, admit as per hospital protocols.
- If patient has an ICD or pacemaker – Normal ECG – Pacemaker check
  – Abnormal ECG – admit cardiology
- If patient >24/40 pregnant – refer to Obstetrics for CTG monitoring.
- If patient has a barb embedded in eye – refer ophthalmology.
- If suspicion barb has penetrated body cavity (cranium, peritoneum, joint), manage or refer as per usual practice.
  If suspicion barb has penetrated chest, ensure that patient has chest x-ray and pneumothorax excluded.
- If initial baseline investigations normal – treat coexisting conditions as per local protocols (i.e. drug intoxication, psychiatric condition, traumatic injuries)

High-risk groups

- drug-or alcohol-intoxicated patients
- mental health patients
- patients with pre-existing cardiovascular disease, pacemaker or ICD's
- multiple TASER exposures
- low BMI
- obstetric patients >24/40
- patients considered to have 'excited delirium'

The Classification and Regression Tree

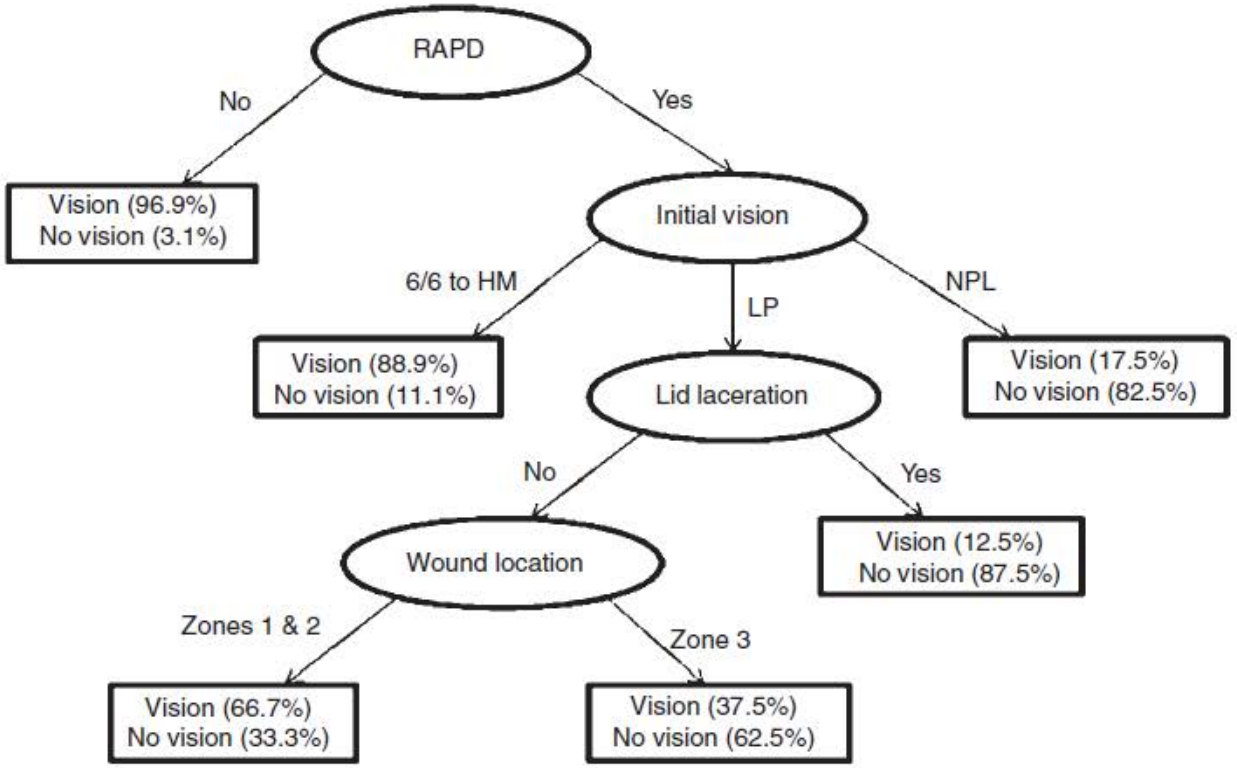


Figure 1 The classification and regression tree (CART) model for open globe injuries: visual survival (LP or better) *vs* no vision (NP or enucleation).

Ocular Trauma Score

Initial Visual Factor	Raw Points
A. Initial visual acuity category	No light perception = 60 Light perception to HM = 70 1/200 to 19/200 = 80 20/200 to 20/50 = 90 ≥ 20/40 = 100
B. Globe rupture	-23
C. Endophthalmitis	-17
D. Perforating injury	-14
E. Retinal detachment	-11
F. Afferent pupillary defect (Marcus Gunn pupil)	-10

Raw score sum = sum of raw points
HM = hand motion vision

Raw Score Sum	Ocular Trauma Score	No Light Perception	Light Perception/ HM	1/200–19/200	20/200–20/50	≥ 20/40
0–44	1	73%	17%	7%	2%	1%
45–65	2	28%	26%	18%	13%	15%
66–80	3	2%	11%	15%	28%	44%
81–91	4	1%	2%	2%	21%	74%
92–100	5	0%	1%	2%	5%	92%

HM = hand motion vision

Visual outcome after open globe injury: a comparison of two prognostic models—the Ocular Trauma Score and the Classification and Regression Tree

Eve (2010) 24, 84–89

Table 2 Correlation between patient characteristics and visual outcome

	Vision survival (n=77)	*No vision* (n=23)	*Odds ratio*	*P-value*
Gender				
Male	58 (75.3%)	16 (69.6%)		
Female	19 (24.7%)	7 (30.4%)	1.34	0.5953
Age				
0–16	21 (27.3%)	3 (13.0%)		0.5692
17–39	26 (33.8%)	9 (39.1%)		
40–59	20 (26.0%)	7 (30.4%)		
⩾60	10 (13.0%)	4 (17.4%)		
Cause of injury				
Assault	11 (14.3%)	8 (34.8%)	3.2	0.037
Accident	66 (85.7%)	15 (65.2%)		
Initial VA				
NPL	1 (1.3%)	14 (60.9%)		<0.0001
Lid laceration				
Yes	11 (14.3%)	13 (56.5%)	7.8	0.0001
No	66 (85.7%)	10 (43.5%)		

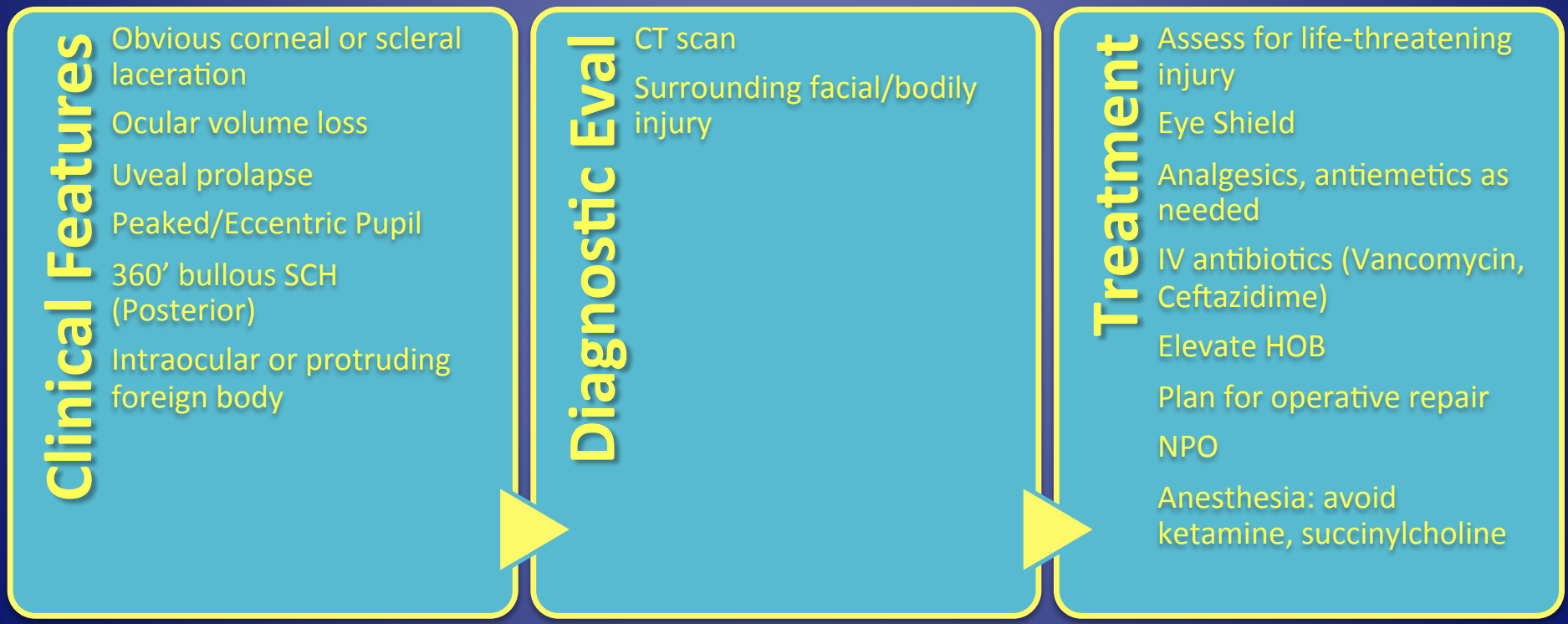
Table 3 The classification and regression tree (CART) analysis predictions compared with the actual visual outcomes

	Actual outcome	
	Visual survival	*No vision*
CART predicts visual survival (LP or better)	72	6
CART predicts no vision (NPL/enucleation)	5	17
	Minimal to severe visual loss	*Profound visual loss*
CART predicts minimal to severe visual loss (6/6–3/60)	48	8
CART predicts profound visual loss (worse than 3/60)	8	36

Table 4 The ocular trauma score (OTS) predictions compared with the actual visual outcomes

	Actual outcome	
	Visual survival	*No vision*
OTS predicts visual survival (LP or better)	75	0
OTS predicts no vision (NPL/enucleation)	2	23
	Minimal to severe visual loss	*Profound visual loss*
OTS predicts minimal to severe visual loss (6/6/–3/60)	50	0
OTS predicts profound visual loss (worse than 3/60)	5	45

Management of Open Globe Injury



Patient Care, Practice-Based Learning and Improvement

PRIMARY REPAIR OF THE POSTERIOR SEGMENT: PENETRATING, PERFORATING, AND BLUNT RUPTURE INJURIES

GORDON A. BYRNES, MD*

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Surgical Goals

- identify the extent of
- rule out an IOFB if p
- close the open globe
- limit reconstruction a and
- guard against infecti thalmia, and tissue d

Step-by-Step Repair

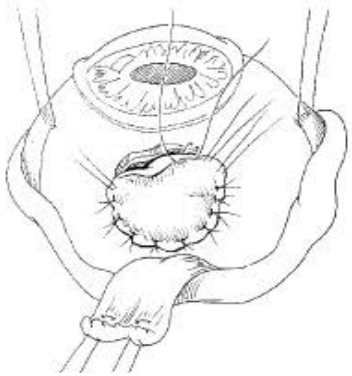
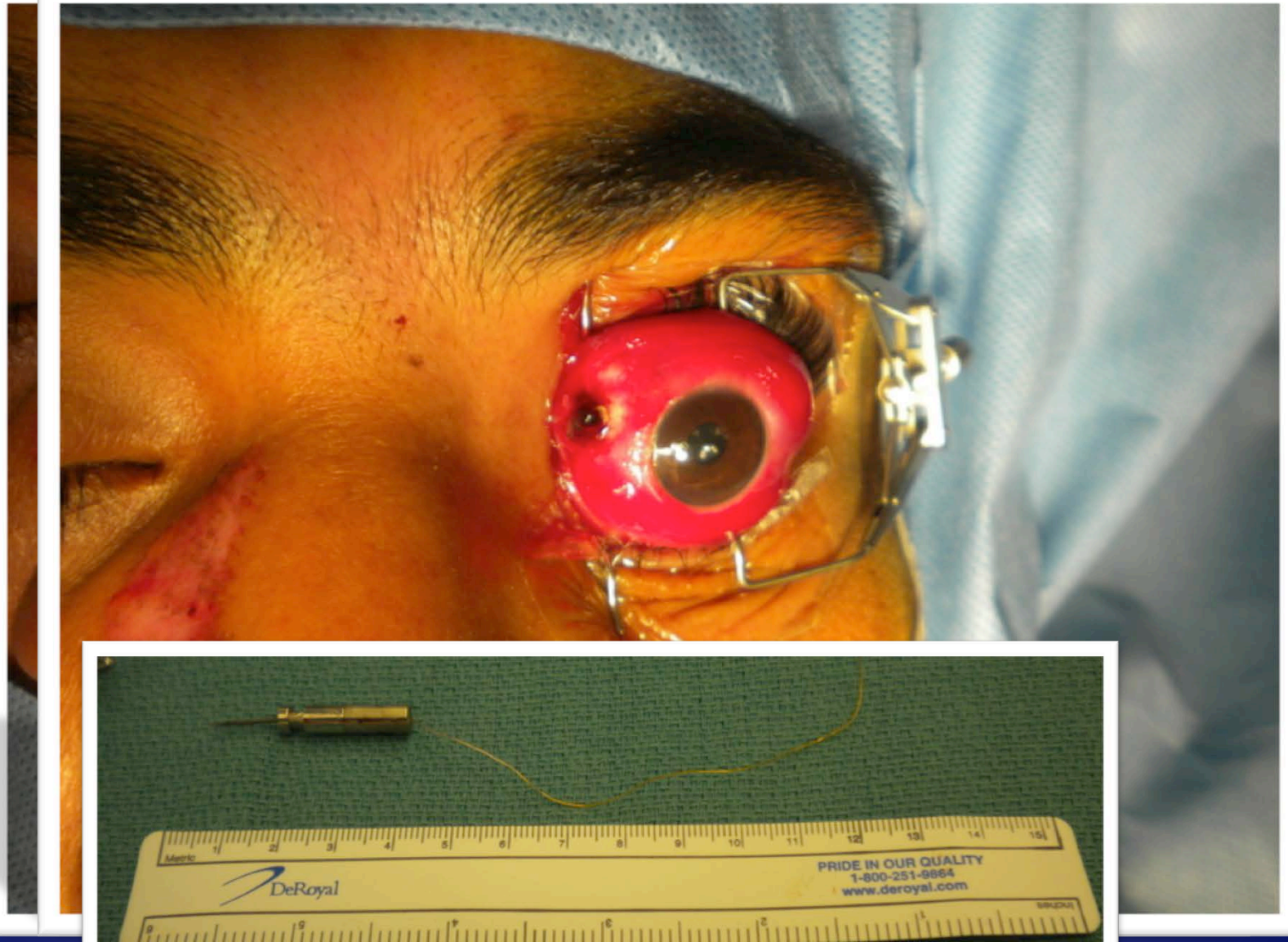


Fig. 13-14. When, owing to missing tissue, a scleral wound cannot be sealed, a patch graft can be fashioned from banked sclera, fascia lata, preserved pericardium, or scleral buckle material, and used to oversew the wound. By using interrupted horizontal mattress sutures through the graft and globe, the wound is compressed and a watertight seal can be obtained. Drawing prepared for this textbook by Gary Wind, MD, Uniformed Services University of the Health Sciences, Bethesda, Md.

The surgeon should never enucleate an eye primarily unless restoration of the globe is impossible. No light perception (NLP) vision should *not* be used as an early enucleation criterion, because several reports of patients with initial NLP indicate that they later recovered some level of vision.[26] Methodical repair can reconstruct many eyes that initially appear unsalvageable.

Patient Care, Practice-Based Learning and Improvement

Back to our patient…



Operative Findings

- Under general anesthesia, the orbit was inspected thoroughly
- The metallic foreign body was found to have penetrated the globe medially
- Using gentle traction, the foreign body was removed. Caught with the barb of the dart was retina and uveal tissue.
- Primary enucleation was performed once repair was not deemed possible.
- The patient was transferred to a psychiatric facility elsewhere for long-term care.

Reflective Practice

This was an excellent case that combined medical and surgical ophthalmological diagnosis and management, as well as general medical and mental issues. I learned the value of teamwork between ophthalmology, emergency medicine, psychiatry, and anesthesiology. The patient was unable to facilitate his own care, so the decisions to make were difficult but necessary. The patient received the best care we could offer, and the team was satisfied with the result.

Patient Care, Practice-Based Learning and Improvement

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Core Competencies

Patient Care- Took care to provide patient care that was compassionate and appropriate, and effective

Medical Knowledge- Recognized the signs and symptoms of ocular trauma, evaluated for associated defects and medical issues, and treated patients using standardized and a well-thought out plan of care.

Practice-based Learning and Improvement- demonstrate the ability to investigate and evaluate the care of our patients, including improving our methods of management of TASER eye injuries and ocular trauma with regard to literature.

Interpersonal and Communication Skills- demonstrate interpersonal and communication skills with a difficult and problematic patient that will result in the effective exchange of information

Professionalism- demonstrate a commitment to carry out professional responsibilities and an adherence to ethical principles despite many obstacles

Systems-based Practice- demonstrate the ability to call effectively on other resources, such as primary care and ancillary staff in the system to provide optimal health care.

Thank You

- Dr. Shinder
- Dr. Shrier
- Psychiatry
- Anesthesia
- Bellevue medical
  and ophtho teams
- Our Patient