Walter Reed National Military Medical Center

Eye Injuries: Surgical Management and Outcomes

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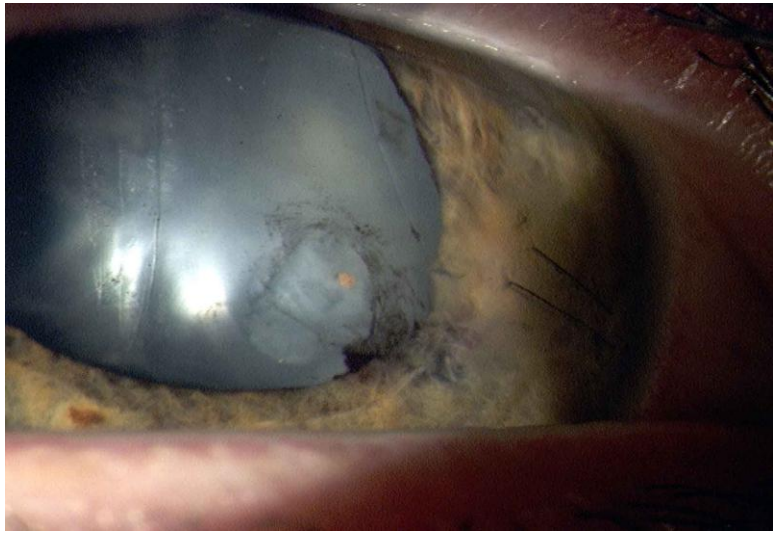
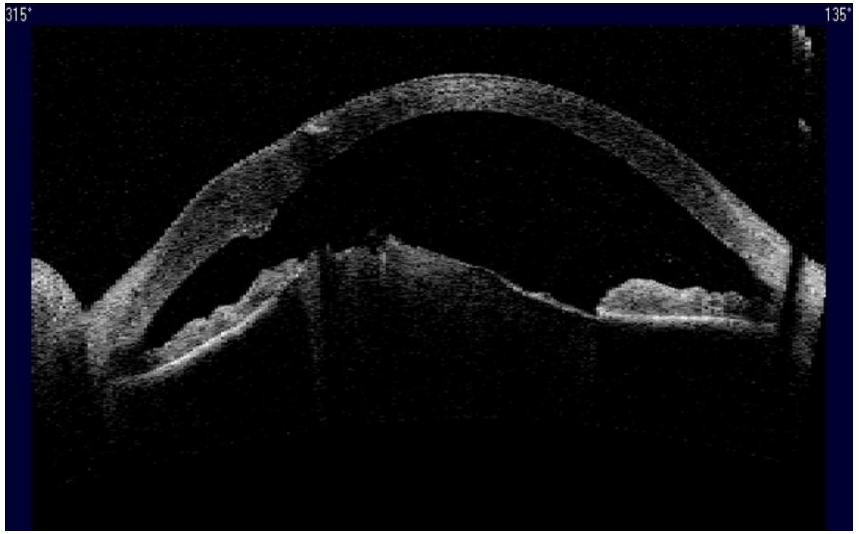
Background

- IRB approved retrospective consecutive case series of all eye trauma cases evaluated at Walter Reed Army Medical Center between 2001-August 2011
- Does not include National Naval Medical Center or Walter Reed National Military Medical Center cases UNLESS patient was evaluated to WRAMC at some point after injury (NNMC has ~350 eye casualties during same interval)
- Does not include “TBI-related Vision loss” or “TBI-related visual dysfunction”. Includes eye injury and/or neurologic injury
- Eye injuries classified according to the Birmingham Eye Trauma terminology





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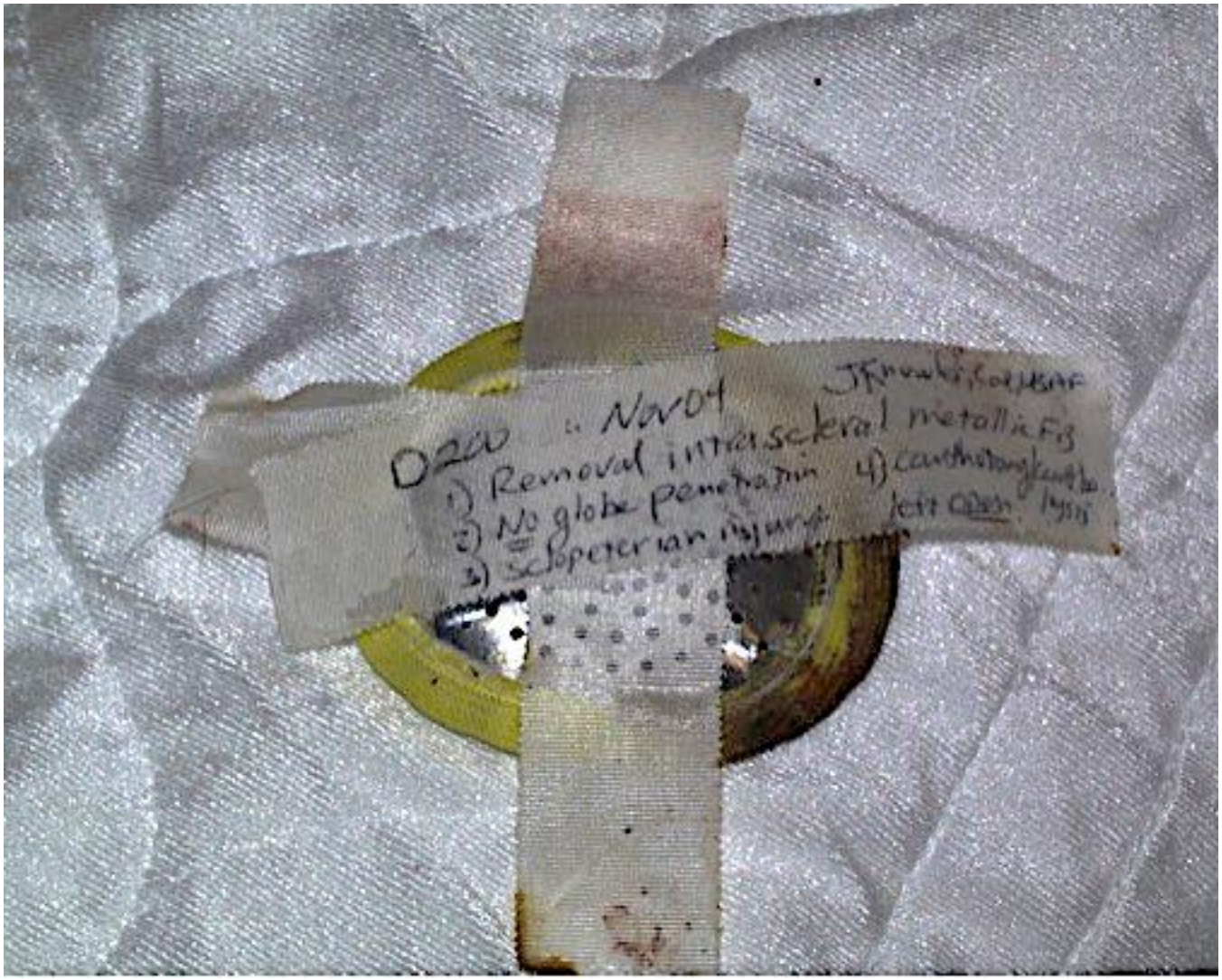
The "Battlefield Ophthalmic Medical Record" (Nov 2004)



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Open-Globe Injury

B. OPEN-GLOBE INJURY CLASSIFICATION

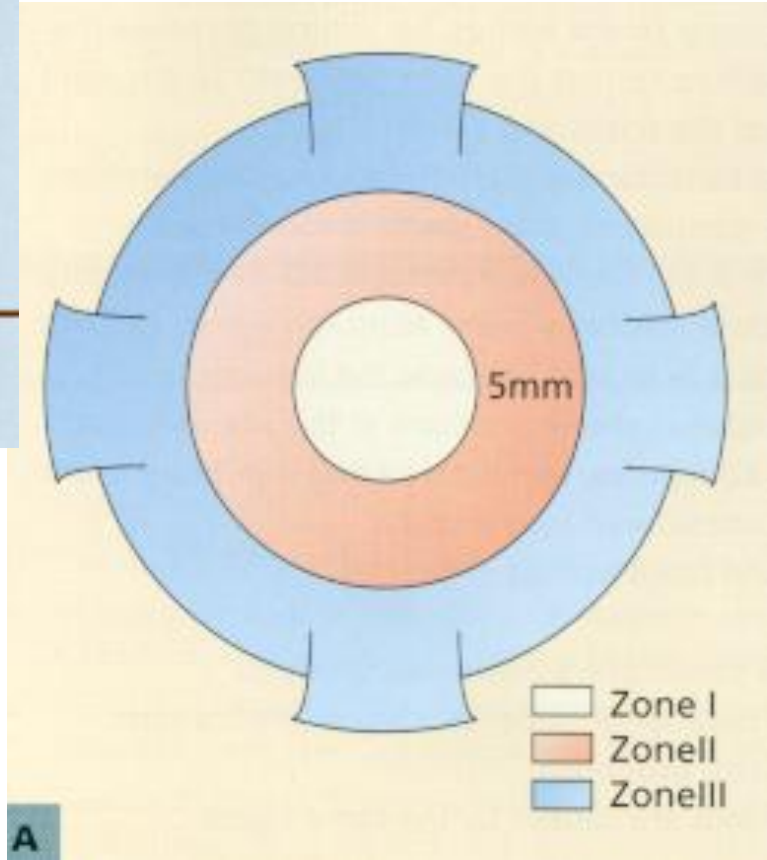
Type
- A. Rupture
- B. Penetrating
- C. Intraocular foreign body
- D. Perforating
- E. Mixed

Grade
- Visual acuity*
  1. ≥ 20/40
  2. 20/50 to 20/100
  3. 19/100 to 5/200
  4. 4/200 to light perception
  5. No light perception†

Pupil
- Positive: relative afferent pupillary defect present in affected eye
- Negative: relative afferent pupillary defect absent in affected eye

Zone
- I. Isolated to cornea (including the corneoscleral limbus)
- II. Corneoscleral limbus to a point 5 mm posterior into the sclera
- III. Posterior to the anterior 5 mm of sclera

*Measured at distance (20 ft or 6 m) using Snellen chart or Rosenbaum near card, with correction and pinhole when appropriate.
†Confirmed with bright light source and fellow eye well occluded.



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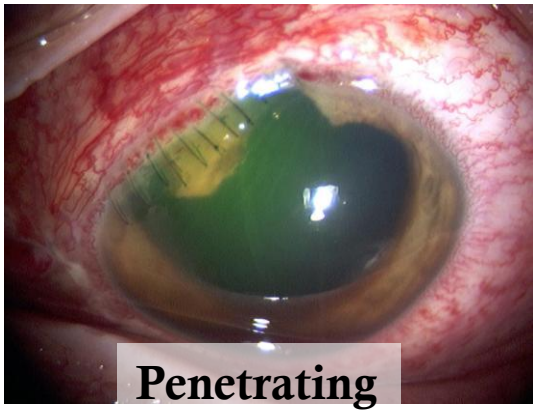
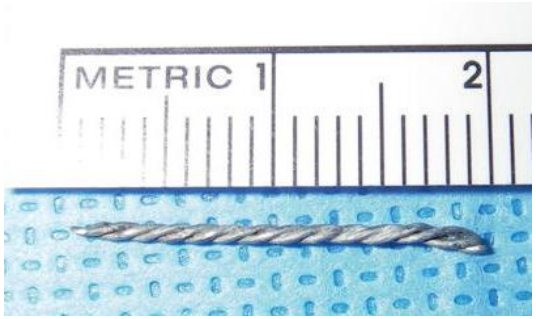
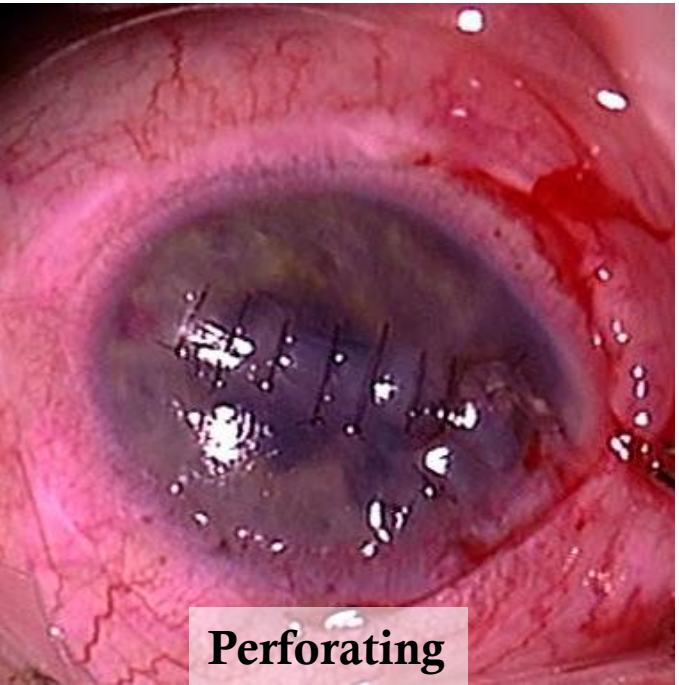
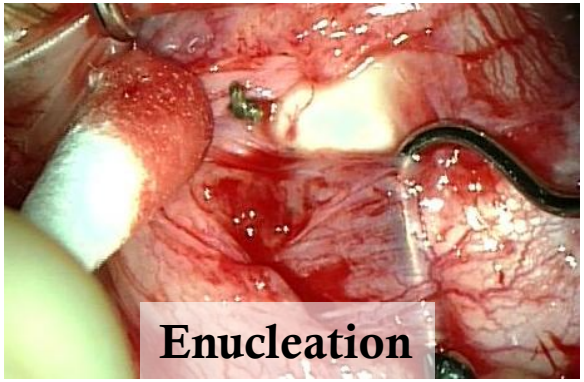
Open Globe Injuries

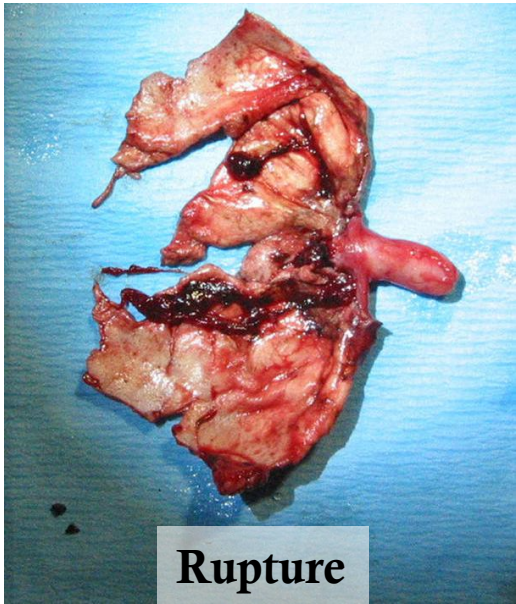

Penetrating




IOFB


Perforating


Enucleation


Rupture

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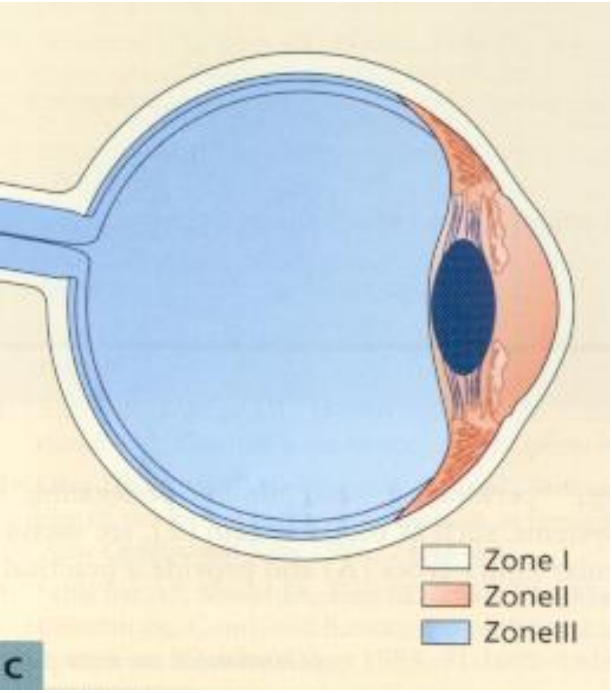
Closed-Globe Injury



D. CLOSED-GLOBE INJURY CLASSIFICATION

Type
- A. Contusion
- B. Lamellar laceration
- C. Superficial foreign body
- D. Mixed

Grade

Visual acuity*
1. ≥ 20/40
2. 20/50 to 20/100
3. 19/100 to 5/200
4. 4/200 to light perception†
5. No light perception†

Pupil

Positive: relative afferent pupillary defect present in affected eye

Negative: relative afferent pupillary defect absent in affected eye

Zone‡
- I. External (limited to bulbar conjunctiva, sclera, cornea)
- II. Anterior segment (involving structures in anterior segment internal to the cornea and including the posterior lens capsule; also includes pars plicata but not pars plana)
- III. Posterior segment (all internal structures posterior to the posterior lens capsule)

*Measured at distance (20 ft or 6 m) using Snellen chart or Rosenbaum near card, with correction and pinhole when appropriate.

†Confirmed with bright light source and fellow eye well occluded.

‡Requires B-scan ultrasonography when media opacity precludes assessment of more posterior structures.

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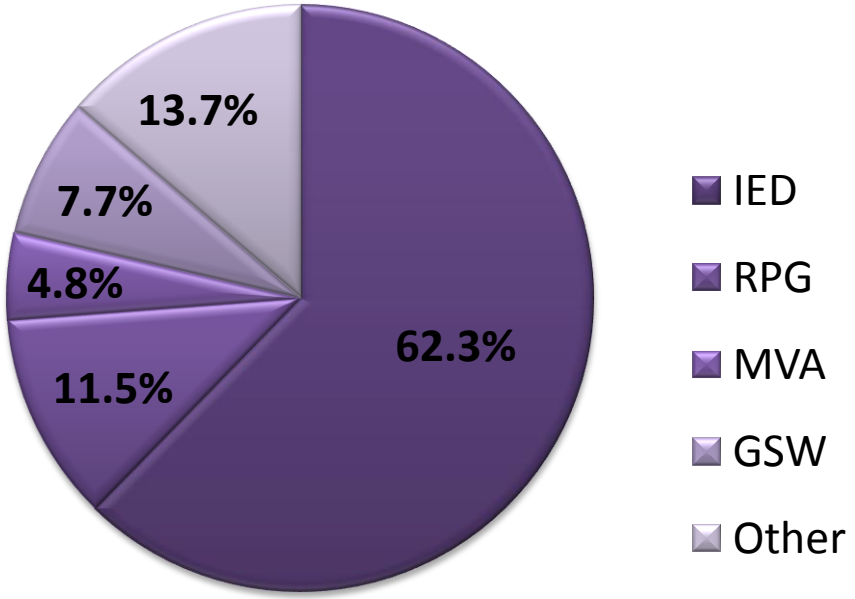
Demographics

Number of patients	651
Number of patients with bilateral eye injury	240
Age (yrs)	27.14 ± 7.24 (18-53)
Gender	96.5 % male/3.5% female
Eye protection	28.9 % yes/23.7 % no/ 47.4 % unknown
Location of injury	Iraq 83.4%/ Afghanistan 16.6%*

Mechanism of injury



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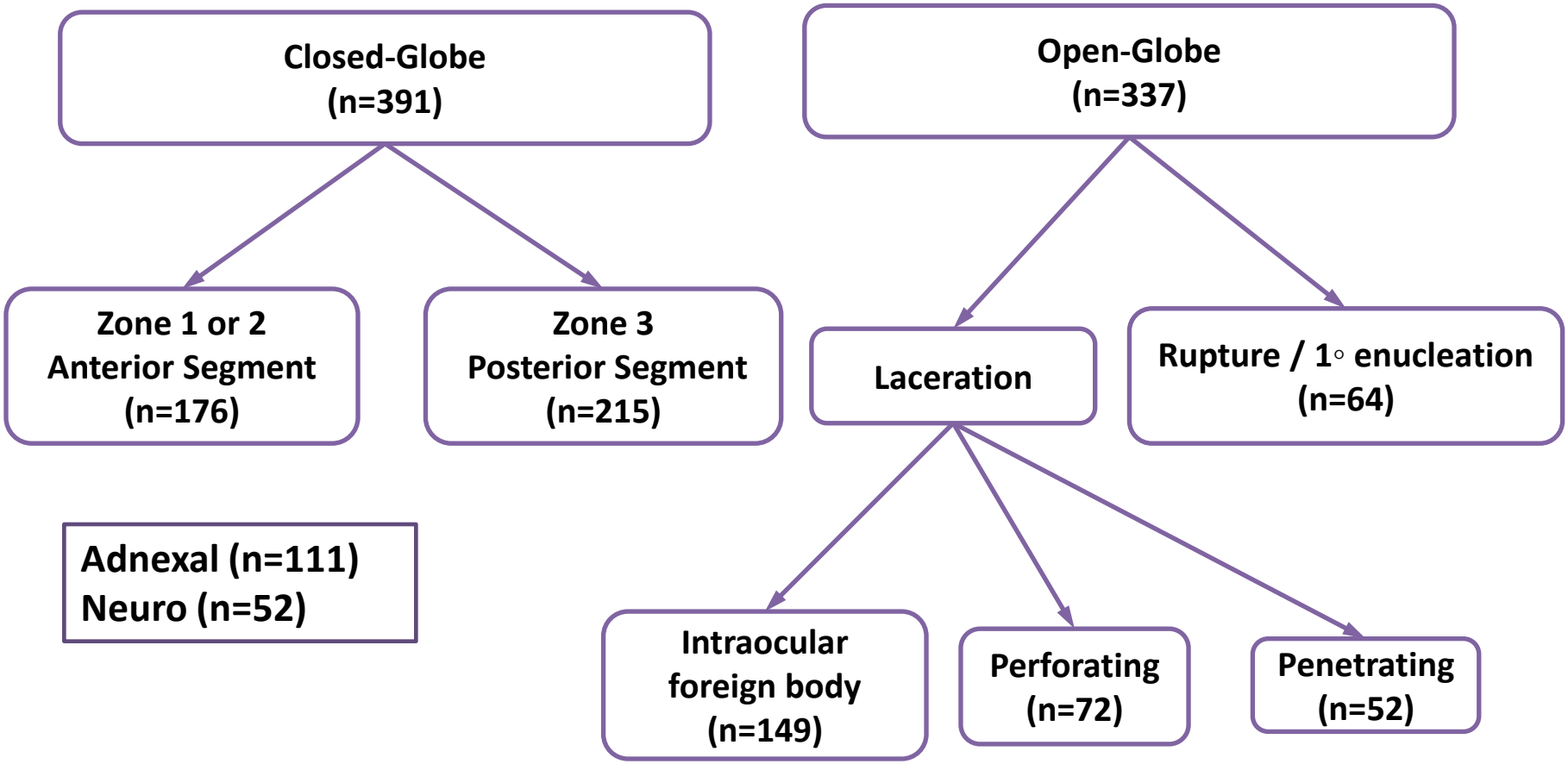
General injury pattern



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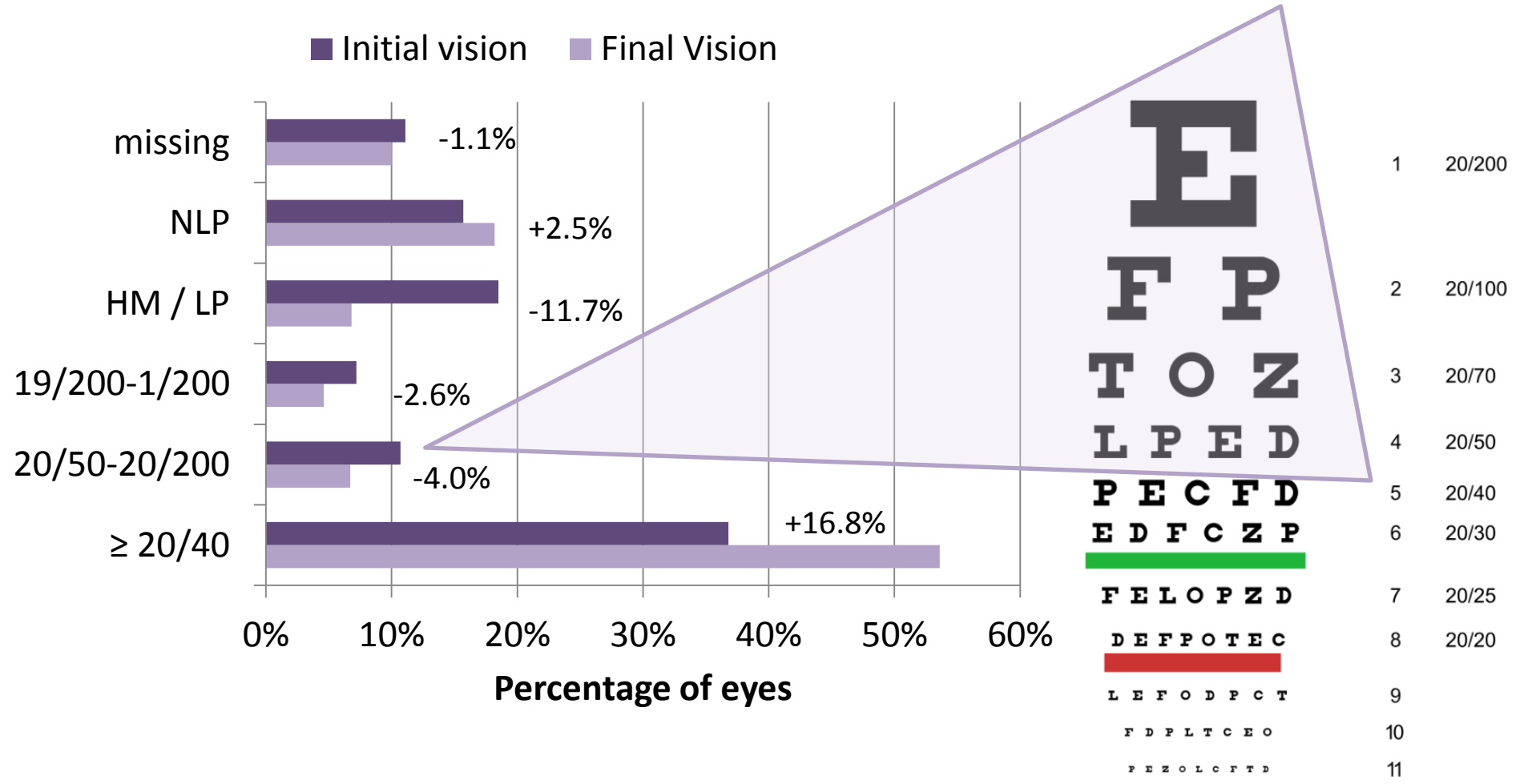
Visual Outcomes



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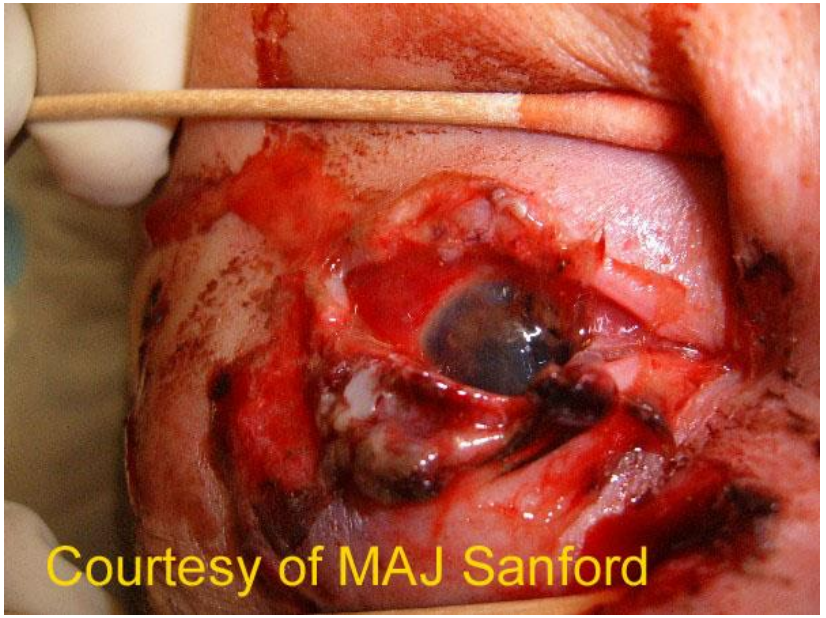
Ocular Trauma Score (OTS)

Range 0 to 100 for **prognosis** of final visual acuity—initial exam

- Only used for globe trauma (NOT oculoplastics/neuro)

• Initial Vision	
– NLP	60 pts
– LP/HM	70 pts
– 1/200-19/200	80 pts
– 20/200-20/50	90 pts
– >20/40	100 pts
• Rupture	-23 pts
• Endophthalmitis	-17 pts
• Perforating	-14 pts
• Retinal Detachment	-11 pts
• APD	-10 pts



Kuhn F, Maisiak R, Mann L, Mester V, Morris, R, Witherspoon CD. The Ocular Trauma Score (OTS). Ophthalmol Clin North Am 2002;15:163-5.

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Incidence of Blindness

- **Different ways of assessing:**
  1. Per Eye
     a) Worse than 20/200
        - 264/891 (29.6% of eyes injured)
     b) NLP or enucleated
        - 162/891 (18.2% of eyes)
  2. Per Patient
     a) 20/200 or worse OU
        - 50/651 patients (7.7%)
     b) NLP or enucleated OU
        - 16/651 patients (2.5%)
  3. DoD Retention standards
        - 20/800 in poorer seeing eye
        - 20/20 in better eye
- **Important metric to layperson**

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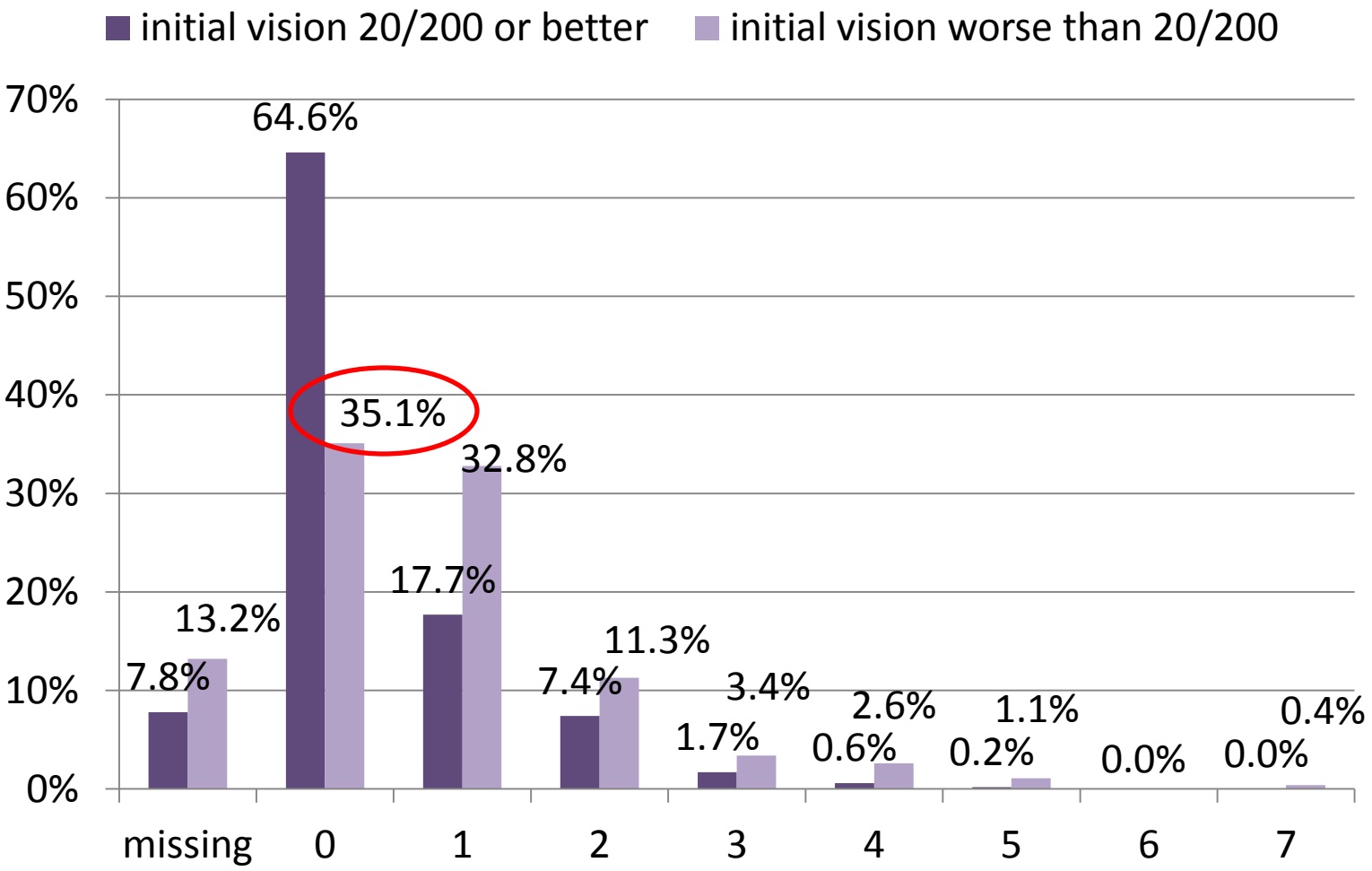
Total number of surgeries performed



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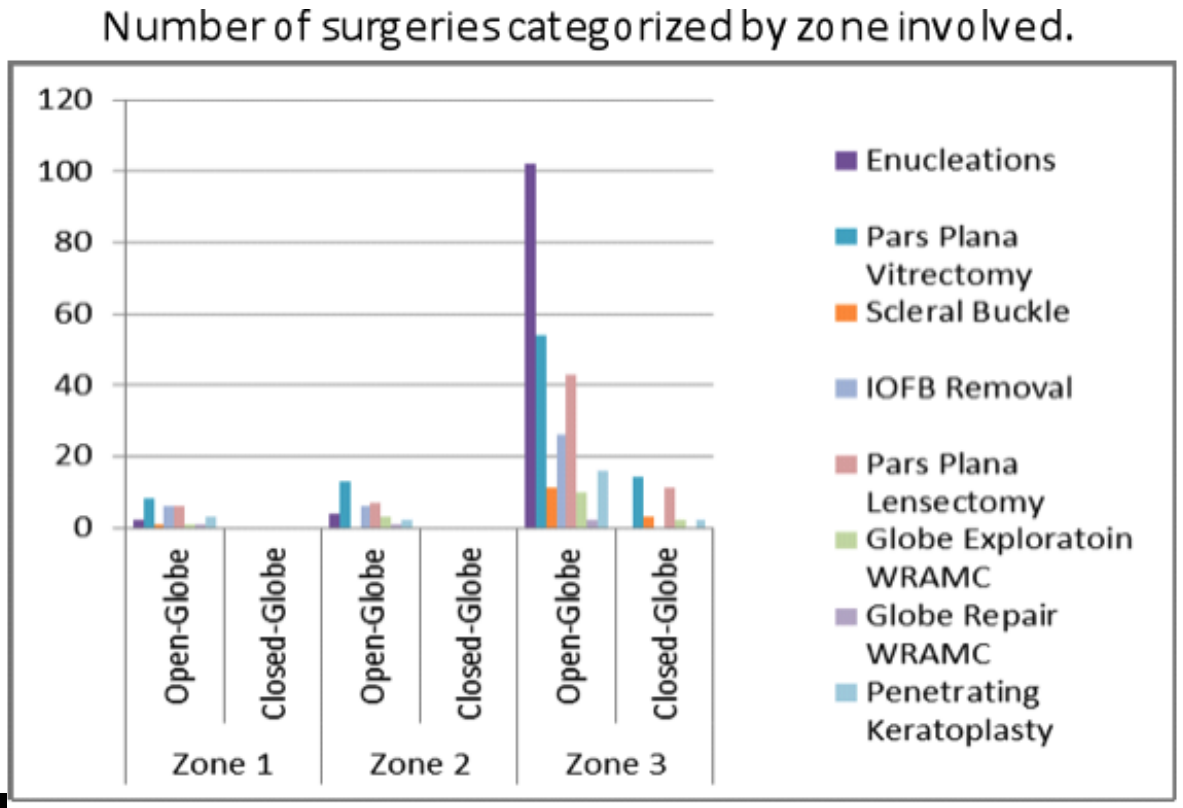
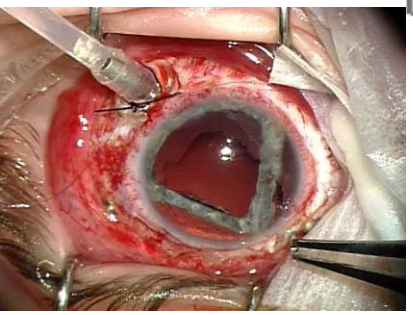
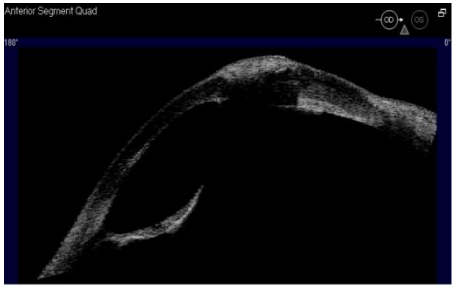
Interventions in the subset of eyes with final vision worse than 20/200*







**Vlasov et al. Causes of Combat Ocular Trauma Related Blindness From Operation Iraqi Freedom and Enduring Freedom. Journal of Trauma and Acute Care Surgery. 2015; In press.*

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Systemic Factors Affecting Ophthalmic Care

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Associated Injuries

- Patients may be intubated and sedated with an inability to assess visual acuity upon arrival
- Traumatic brain injury (**38.2**%) affects patient compliance with use of eye medications and follow up appointments
  - Did not screen for TBI until August 2004
  - **51%** TBI rate in soldiers injury Aug 04-Oct 06
- Injuries may prevent post-operative positioning [extremity injury (**45.8%**) and traumatic limb amputation (**13.7%**)]

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Assessing Visual Function in Intubated / Brain Injured Patients

- **Pre-2006**
  - Deferred intervention until patient awake enough to cooperate with exam
- **2006-Present**
  - Recognized the chronicity of TBI
  - Surgical intervention can be considered in severely traumatized eyes sooner for high risk cases
  - Still no ideal means of quantifying subjective visual symptoms of TBI patients

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Traumatic Brain Injury (38.2-51%)

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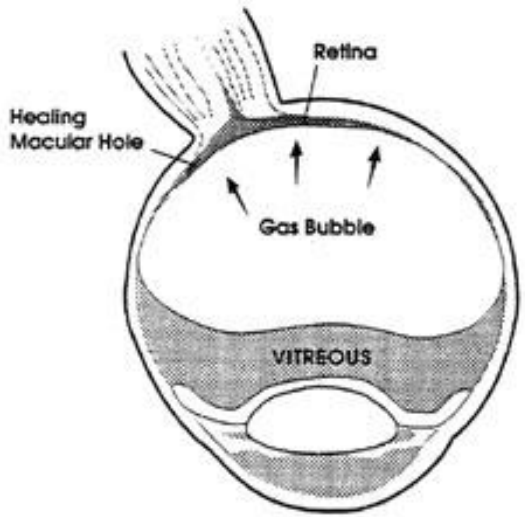
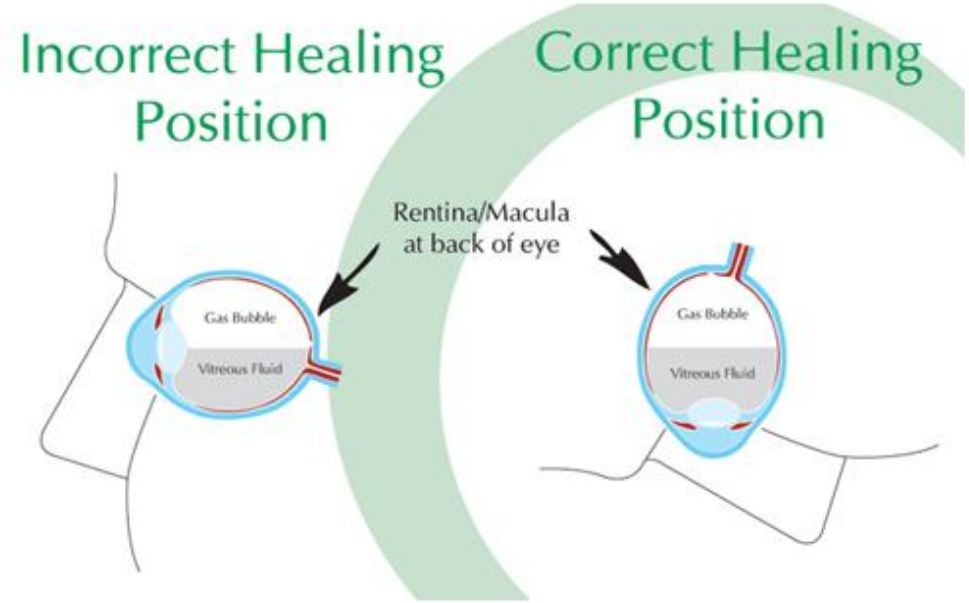
Postoperative Positioning for Retinal Procedures

- Necessary for macular hole repair, retinal detachment repair
- May be limited by systemic issues





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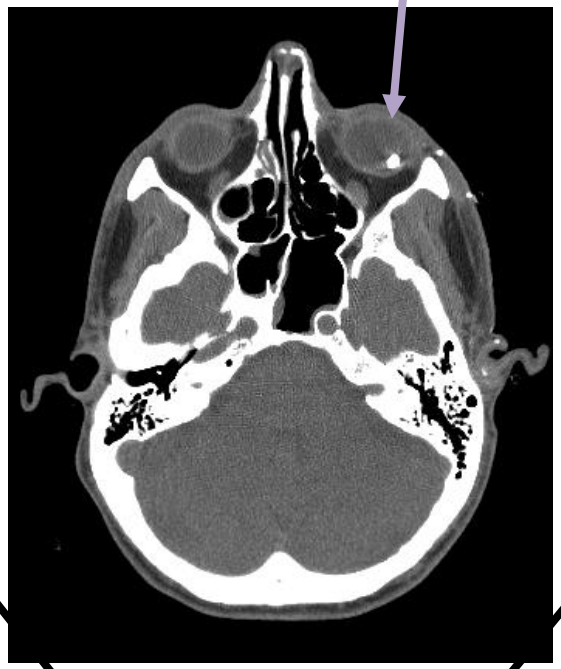
Extremity Injury: Muscle Flap

Unable to Position following Vitrectomy



Groin Flap

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Eye and Extremity Injuries

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Associated Injuries

- Face: 355/651= 54.5%
- Traumatic Brain Injury: 249/651= 38.2%
- Abdomen: 48/651= 7.4%
- Thorax: 53/651= 8.1%
- Pelvis: 34/651= 5.2%
- Neck: 29/651= 4.5%
- Amputee 89/651 = 13.7%

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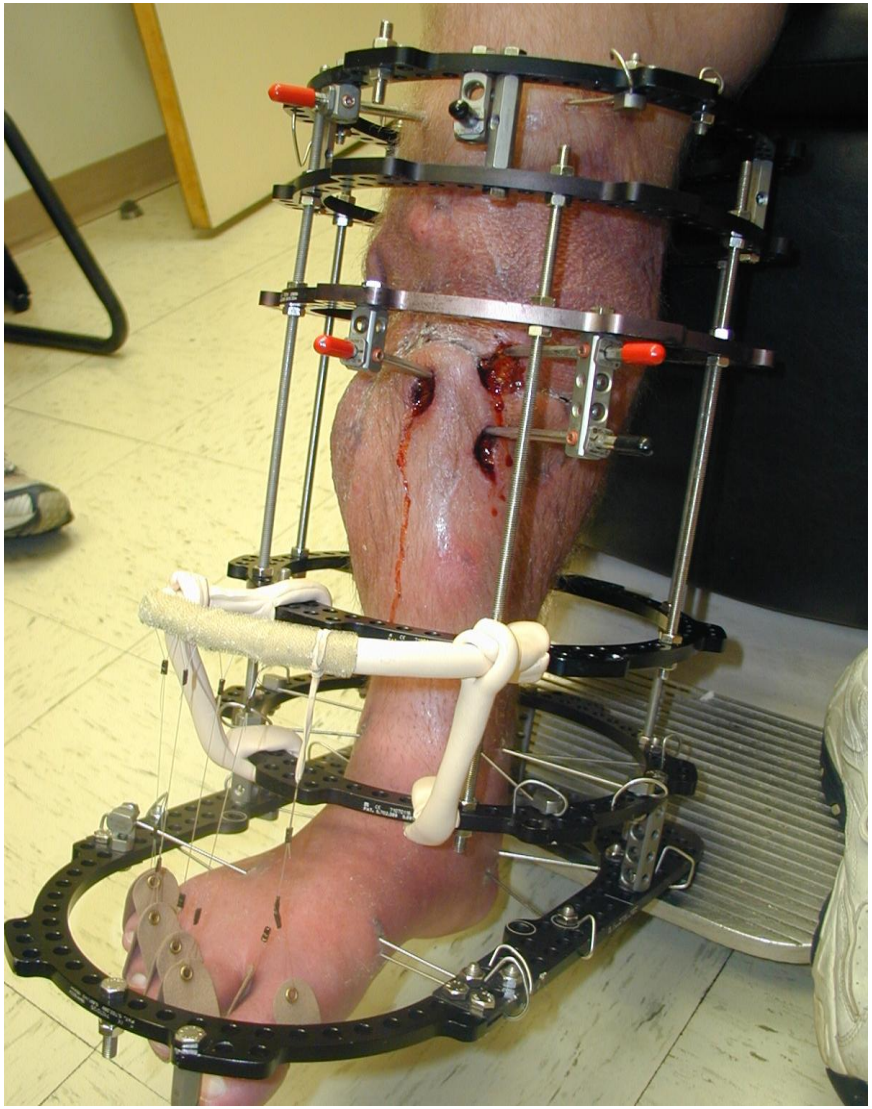
Extremity Injuries (45.8%)

- Long recovery period with physical therapy and occupational therapy
- External fixation ring: bone growth at 1 mm per day



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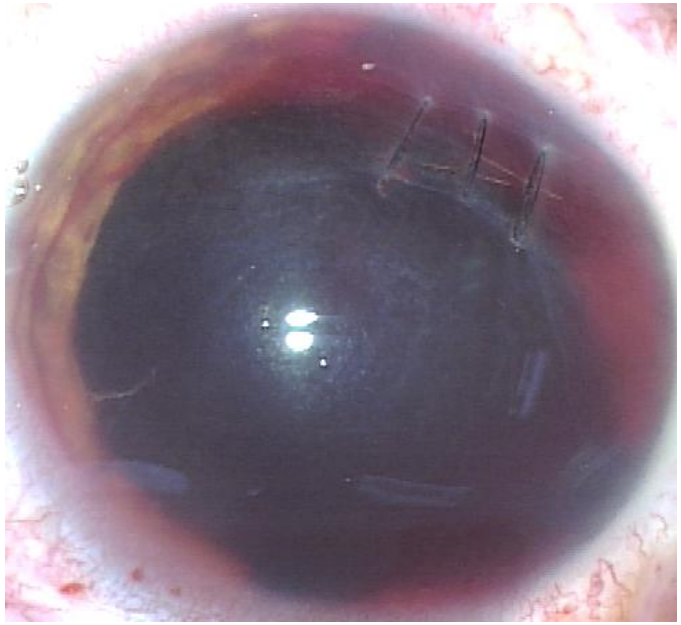
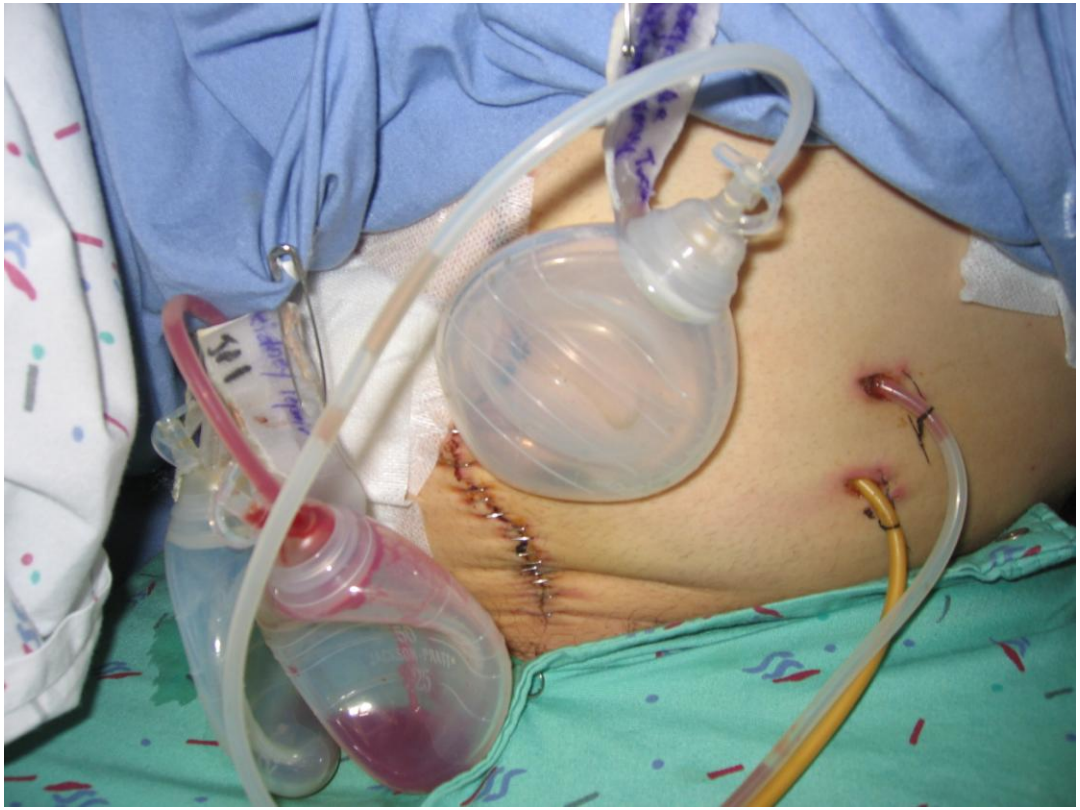
Abdominal Injury (7.4%)





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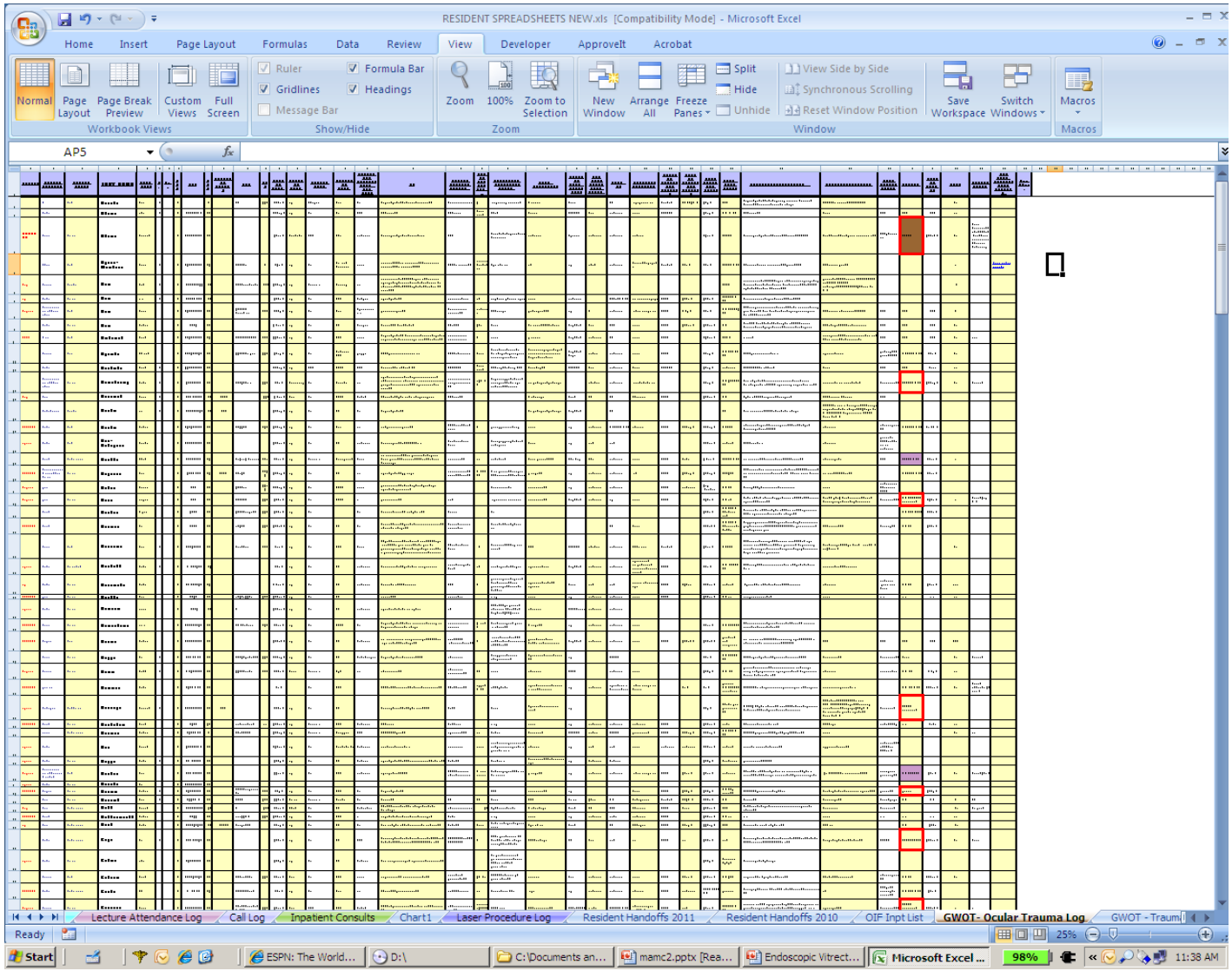
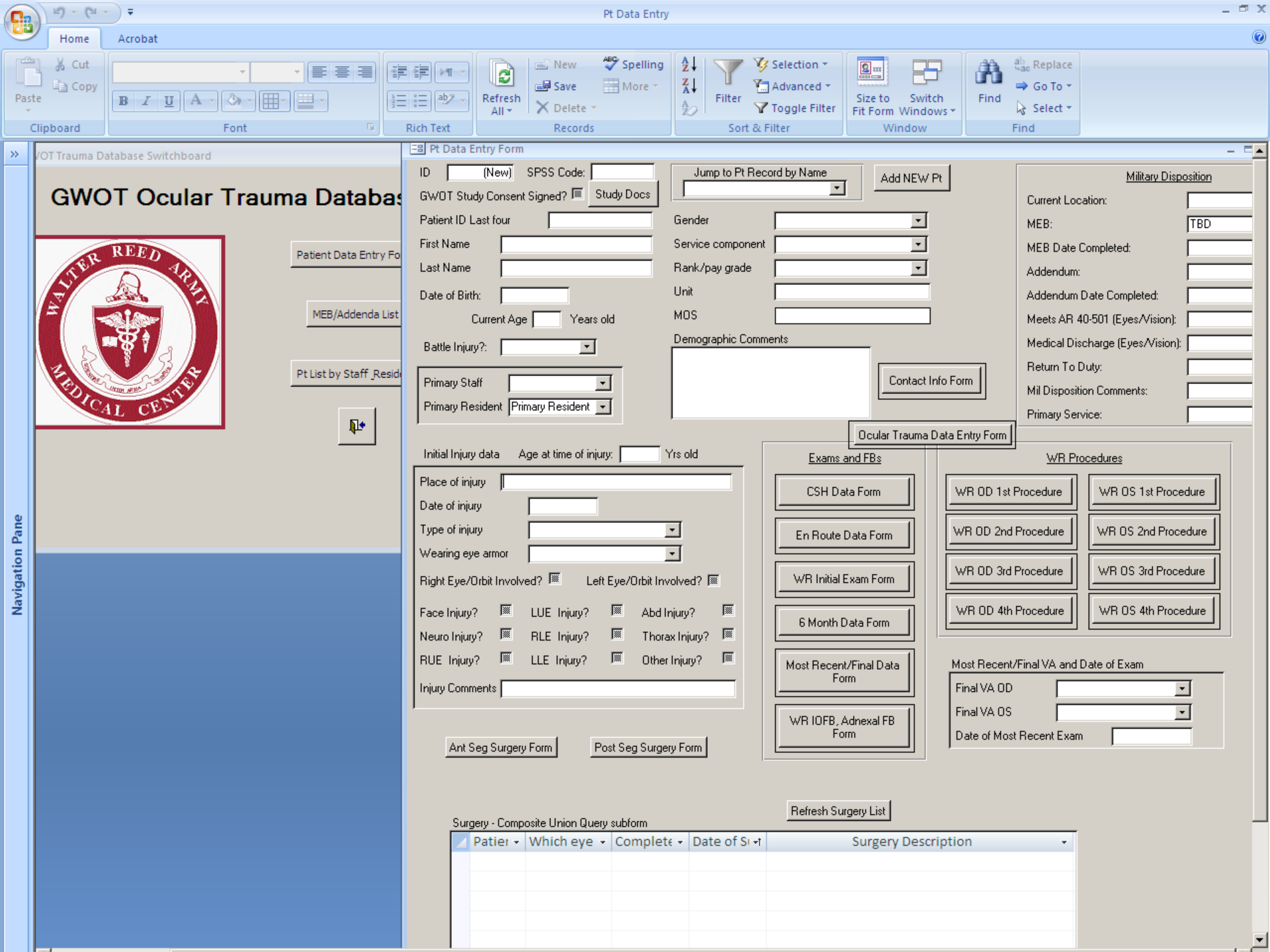
DATA



- Original Patient Database at Walter Reed was a Spreadsheet
- Follow up data recorded on spreadsheet
- No capability to document outcomes over time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Advanced
Toggle Filter
Sort & Filter
Size to Fit Form
Switch Windows
Window
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Replace
Go To
Select
Find
Navigation Pane
OT Trauma Database Switchboard
GWOT Ocular Trauma Databas
WALTER REED ARMY MEDICAL CENTER
Patient Data Entry Fo
MEB/Addenda List
Pt List by Staff _Resid
Pt Data Entry Form
ID
(New)
SPSS Code:
GWOT Study Consent Signed?
Study Docs
Patient ID Last four
First Name
Last Name
Date of Birth:
Current Age
Years old
Battle Injury?:
Primary Staff
Primary Resident
Primary Resident
Jump to Pt Record by Name
Add NEW Pt
Gender
Service component
Rank/pay grade
Unit
MOS
Demographic Comments
Contact Info Form
Military Disposition
Current Location:
MEB:
TBD
MEB Date Completed:
Addendum:
Addendum Date Completed:
Meets AR 40-501 (Eyes/Vision):
Medical Discharge (Eyes/Vision):
Return To Duty:
Mil Disposition Comments:
Primary Service:
Ocular Trauma Data Entry Form
Initial Injury data
Age at time of injury:
Yrs old
Place of injury
Date of injury
Type of injury
Wearing eye armor
Right Eye/Orbit Involved?
Left Eye/Orbit Involved?
Face Injury?
LUE Injury?
Abd Injury?
Neuro Injury?
RLE Injury?
Thorax Injury?
RUE Injury?
LLE Injury?
Other Injury?
Injury Comments
Exams and FBs
CSH Data Form
En Route Data Form
WR Initial Exam Form
6 Month Data Form
Most Recent/Final Data Form
WR IOFB, Adnexal FB Form
WR Procedures
WR OD 1st Procedure
WR OS 1st Procedure
WR OD 2nd Procedure
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File Edit View Data Transform Analyze Graphs Utilities Add-ons Window Help

12 : Injury | 3 | Visible: 215 of 215 Variables

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1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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32	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	.	0	0	0	.	0	1	0	-9	0	0	0	.	0	0	0	0	0	0	0	0	0	1	0	1	-9	0
44	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9
45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Walter Reed National Military Medical Center

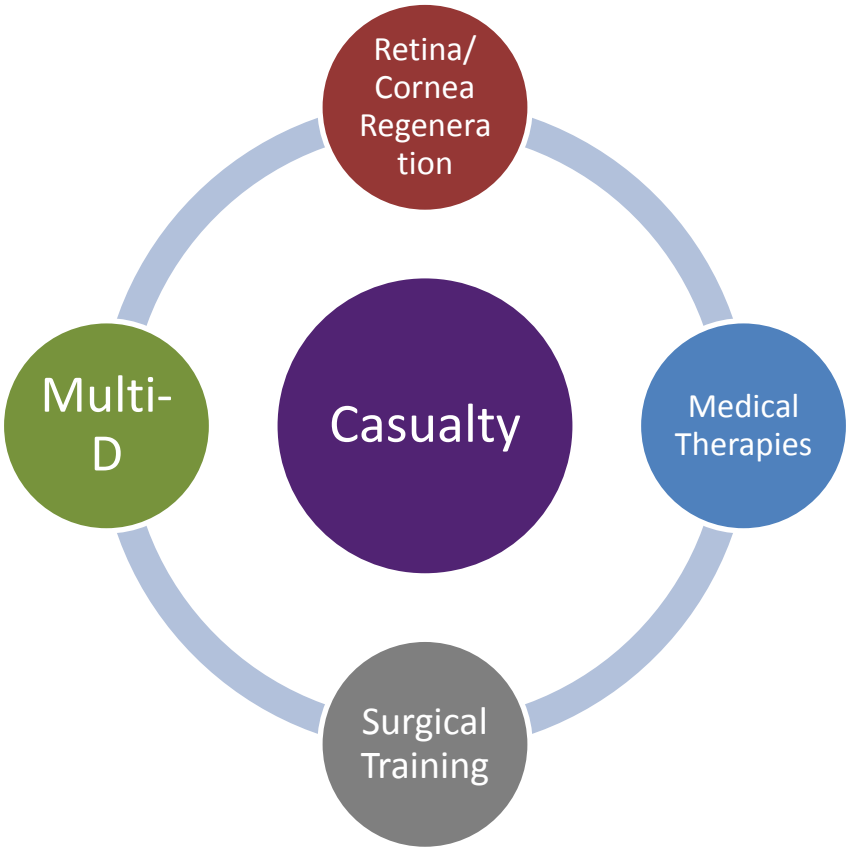
Current Status

- Working to compile data from National Naval Medical Center Records
- Extend follow-up interval of previously reviewed cases
- Enroll and follow up on patients in a long-term prospective tracking study at Walter Reed
- Continuing to actively treat 46 wounded warriors at Walter Reed Bethesda

Walter Reed National Military Medical Center

Efforts to enhance patient outcomes

- Wireless retinal prosthesis
- Development of artificial corneal graft
- 3-D bioprinting: Development of ophthalmic tissue for surgical training
- Implementation of ocular injury simulator surgical systems in training military ophthalmologists
- Assessing the effects of concomitant traumatic brain injury and vision loss on wounded warriors
- Amniotic membrane and umbilical cord matrix therapy for better controlled corneal wound healing
- Topical IL-1 to inhibit corneal scarring



QUESTIONS?