Timing of Orbital Fracture Treatment
The best things don’t come to those who wait
Daniel R. Lefebvre, MD

Orbital Blow-Out Fracture
• Blowout vs. non-blowout

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Orbital Blow-Out Fracture

- Blowout fracture

Timing Considerations

- Evidence-based Medicine

<table>
<thead>
<tr>
<th>Level</th>
<th>Type of evidence</th>
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<tbody>
<tr>
<td>1</td>
<td>Systematic review with homogeneity of randomized control trials</td>
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<tr>
<td>2</td>
<td>Individual randomized control trial with a narrow confidence interval</td>
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<td>3</td>
<td>All other cohort studies</td>
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<td>4</td>
<td>Systematic review with homogeneity of cohort studies</td>
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<td>5</td>
<td>Individual cohort study (including low-quality randomized control trials, e.g., after ICU follow-up)</td>
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<td>6</td>
<td>“Outcomes” Research: Ecological studies</td>
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<td>Systematic review with homogeneity of case-control studies</td>
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<td>Individual case-control study</td>
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<tr>
<td>9</td>
<td>Case-series (trend indicating cohort and case-control studies)</td>
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</tbody>
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Grades of recommendation

- A: Consistent level 1 studies
- B: Consistent level 2 or 3 studies or extrapolations from level 1 studies
- C: Level 4 studies or extrapolations from level 2 or 3 studies
- D: Level 5 evidence or multiple inconsistent or inconclusive studies of any level
Timing Considerations

- Evidence-based recommendations

  - "Immediate" 24-48h:
    - Diplopia with CT evidence of muscle / soft tissue entrapment and non-resolving reflex, while (A:1)
    - "White-eyed blowout" fracture with marked extracocular motility and CT findings of muscle or peri-muscular tissue entrapment (A:1)

  - "Early" within 2 weeks:
    - Symptomatic diplopia, positive forcedduction, CT showing muscle / peri-muscular tissue entrapment, minimal clinical improvement (A:II)
    - Fracture with significant hypoglobus (A:II)
    - Floor fracture >50% → latent enophthalmos (B:II)
    - Progressive infraorbital hypesthesia (C:III)

- Observation
  - Minimal diplopia, not present in primary or downgaze, good ocular motility, no significant enophthalmos or hypoglobus.


Intervention Within Days: The White-Eyed Blowout

- White-Eyed Blowout Fracture
  - <16 years of age
  - Little to no external clinical evidence of trauma
  - White eye
  - Diplopia with limitation of vertical gaze
  - No enophthalmos
  - CT with minimal (if any) bone displacement
  - +/- tissue herniation ("tear-drop" sign on CT)

Intervention Within Days: The White-Eyed Blowout

- Retrospective review
- N = 20 patients, all < 18 years of age
- Surgery: between 48 hours to 40 days after injury


Intervention Within Days: The White-Eyed Blowout

- Surgical timing
  - N = 6 within 4 days (5/6 within 48 hours)
    - No patient had a permanent motility disturbance
  - N = 14 between 5 to 40 days (avg. 14.2 days)
    - Post-operative symptom (motility) resolution:
      - 3/4 by 4 weeks
      - 8/14 by 10 months
      - 3/14 continued limitation at 12 months
    - (8, 14, 17 days to surgery)


Question:

- Why are outcomes apparently worse in trap-door type fractures receiving later treatment?
  - Injury to muscle
  - Volkmann’s ischemic contracture?
  - Peri-muscular scarring / fibrosis
“disappearing muscle”

“deformed muscle”

Question:

- Since the orbital tissues and extra-ocular muscles are interconnected via complex septae, a muscle need not be directly impinged between bone in order to undergo potentially damaging forces.

- Does timely repair of blowout fractures in adults lead to improved outcomes?

Surgical Timing

Matteini et al 2004

- Retrospective, 108 consecutive orbital fractures
  - Severe injured (general / neurological) patients excluded

- Most fractures were of the floor (78/108)

- Diplopia present pre-op 73/101
Surgical Timing
Matteini et al 2004

- Time of surgery range: 1 hour to 12 days (avg. 4 d)
- Temporary persistence of “diplopia” was noted in 4 adult patients
  - All had surgery > 7 days following trauma (4 of 6)
  - Diplopia resolved by post-op week 2
- There were no cases of permanent diplopia in any patient in this series. Difficult to believe

Surgical Timing

- The Matteini et al paper has some shortcomings:
  - OMFS, not clear what level of ophthalmic examination has been performed
  - “diplopia” is not defined
    - In primary gaze, upgaze, etc.?
  - Likely missed many cases of non-primary gaze diplopia
  - But, notable that the only cases of identified diplopia occurred in pts who underwent surgery beyond 7 days

Surgical Timing
A more sophisticated analysis
GJ Harris

- 30 patients with blow-out fractures
- All had pre-operative diplopia
- Uniform surgery by GJ Harris
- All had formal binocular visual field testing POM 1 to 3
- Motility outcomes quantified by one group of investigators
- CT images reviewed by another group of investigators
Surgical Timing
A more sophisticated analysis
GJ Harris

- CT image classification

- A: mild / proportionate degree of soft tissue distortion relative to bony disruption
- B: greater / disproportionate degree of soft tissue herniation / distortion relative to bony disruption


Figure 1: Schematic classification of blow-out fractures, based on lesser (A) or greater (B) soft tissue distortion relative to bony fragment configuration. (Reprinted with permission from Harris et al.)

Figure 2: Field of single binocular vision 10 weeks after surgery. Vertical fusion measures 641. Shaded area represents diplopia in this case and depicts the full normal binocular visual field according to the format of Feibel and Roper-Hall (reprinted with permission from Harris et al.).

Figure 3: Schematic classification of blow-out fractures, based on lesser (a) or greater (b) soft-tissue distortion relative to bone fragment configuration (reprinted with permission from Harris et al.).

Figure 4: (Left) Coronal and (right) sagittal CT scans demonstrate soft-tissue displacement disproportionate to bone fragment separation.

Surgical Timing
A more sophisticated analysis
GJ Harris

First week after injury. Among the five patients with better results, three had surgery during the first week. The raw numbers are very small, but they suggest that this type of fracture might still have a favourable outcome if repaired promptly. The initial contusion, shearing, and laceration cannot be undone, but early reversal of ongoing tissue crush or severe stretch might limit late fibrosis, and for fractures with disproportionate soft-tissue displacement (Figure 4), we aim for repair within 1–3 days of the injury. Surgery within this interval is not always logistically possible, but we certainly no longer wait 2 weeks to intervene. Others have also recommended early surgery for these trap-door injuries, which are most common in children. Jordan et al. termed them 'white-eyed blow-out fractures', because severely restricted movement can occur with otherwise quiet eyes.
Surgical Timing
A more sophisticated analysis
GJ Harris

- 30 patients were ordered by degrees of vertical fusion POW 4 to 10

- Median binocular fusalional range:
  - 50% had fusion 86 degrees or less
  - 50% had fusion greater than 88 degrees


Surgical Timing
A more sophisticated analysis
GJ Harris

- B-type fx predominated (3:1) fusion below median

- A-type fx predominated (2:1) for better outcomes

- Away from median
  - <80 degrees of vertical fusion = 91% B-type fractures
  - > 105 degrees of vertical fusion = 78% A-type fractures


Surgical Timing
A more sophisticated analysis
GJ Harris

- Timing of surgery for B-type (worse) fractures:

  - Worse than median outcome:
    - 10 of 11 patients had surgery after post injury week 1

  - Better than median outcome:
    - 3 of 5 patients had surgery within first week

Surgical Timing

A more sophisticated analysis
GJ Harris

• Determination of surgical timing may benefit from analysis of degree of soft tissue derangement in relation to degree of bony injury

• Even more severe (Type B) fractures can have a good outcome if repaired early (< 7 days)


Conclusions

• Early repair is not only indicated for children

• ”Follow-up with oculoplastics in two weeks”
  • Not acceptable
  • Too late – If need surgery, want to operate by 1 week

• Bottom line(s):
  • White-eyed blowout fractures with marked motility disturbance need urgent repair (w/in 24 hours)
  • Adult blowout fractures need surgery before 7 days if significant soft-tissue distortion
  • Minimal bony injury with minimal to no motility disturbance:
    • Re-assess in few days / week +/- steroids (e.g. Medrol dose pack)

References


