Gunshot Injuries of the Hand

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Introduction

- Civilian type injuries
- Small caliber arms
- Wound ballistics = interaction of projectile with tissue
- Wound ballistics determine wound characteristics

Physics

- Kinetic energy
- Pitch, yaw, roll
- Deformation
- Soft/hollow point bullets

Wound Ballistics in the Hand

- Permanent cavity, temporary cavity small
- Fragmentation on bone
- Crushed, devitalized tisssue surrounded by zone of marginally viable and potentially devitalized tissue

Rational Wound Management

- **Emergent irrigation and debridement in the operating room**
- **Skeletal fixation - external fixation and K wires**
- **Open wound treatment**
- **Intravenous antibiotics**
- **Delayed primary closure of soft tissues at three to ten days after wounding**
- **Primary amputation for nonviable distal parts of digits**
- **Splinting, elevation and early occupational therapy**

The Experience

- 11 patients, 21 fractures
- One primary amputation
- Two delayed amputations
- No infectious complications
- Main complications hardware related
- Four skeletal reconstructions with bone grafting, fusion of non salvagable joints

Patient	Gender	Handedness	Injury	Mechanism	Associated injuries
#1	male	left	left	assault	Bladder
#2	male	left	left	assault	None
#3	male	right	left	assault	Humerus, high median and radial nerve palsies
#4	male	right	right	assault	None
#5	male	right	left	assault	Maxillofacial
#6	male	left	left	accident	None
#7	male	right	left	assault	shoulder, thigh
#8	male	right	left	accident	None
#9	female	right	left	accident	None
#10	male	right	right	assault	right forearm
#11	male	right	right	assault	pancreas, colon, chest wall

Primary Treatment

Patient	Skeletal injury	Soft Tissue Injury	Primary Treatment
#1	D1 – P1, D2 - P1, MC	NVBs & extensors of D1, D2	D1, D1 – external fixator, repair of EDC, EPL
#2	D4 – P2, D3 – P3	NVBs D3 and D4	CRPP D4 P2
#3	D4 - MC	Partial tendon lacerations	CRPP RF MC
#4	D2 – MC, P1, D3 – P1, D4 – P1	EDC D4	External fixation D2, ORIF + K-wires D4, D3
#5	D1 MC	muscle	CRPP
#6	Tumb MP	muscle	External fixator
#7	D3 – P1, D3 – P1	D3 – EDC, D4 – NVBs, EDC, FDS/FDP	D3 – blade plate
#8	none	D5 - extensors	Extensors, sagittal band
#9	Thumb – MC, P1	muscle	External fixator
#10	D3-MC	D3EDC, radial NVB, FDS, FDP	ORIF K-wires
#11	D5 – MC, D4 MC	EDC D4/5	External fixator

Complications

Patient	Amputation	Other complications
#1	D2 (ray, delayed)	Instability of external fixator, additional pin placed
#2	D3 at DIP (primary)	None
#3	none	Loosening of K-wires, revision CRPP
#4	none	Congestion D3
#5	none	None
#6	none	Loosening of external fixator, reapplication
#7	D4 at P1	None
#8	none	None
#9	none	Pin tract infection
#10	D3 ray (delayed primary)	None
#11	none	Pin tract infection

Definitive Reconstruction

Patient	Secondary Reconstruction
#1	ICBG, fusion MPJ, IP of thumb
#2	None
#3	ICBG for nonunion
#4	Returned to native country
#5	None
#6	ICBG, fusion MPJ
#7	None
#8	None
#9	ICBG, fusion MPJ
#10	None
#11	pending (imprisoned)

Spare Parts in Secondary Reconstruction

- Skeletal and soft tissue elements
- Deletion of a non functional ray during secondary reconstruction
- No new donor site
- Win – win situation with respect to hand function

Conclusion

- Ballistics determine wound management
- Staged approach – resist the urge to close, the desire to reconstruct
- Serious infectious complications can be avoided by open/staged treatment
- Maximum preservation aids in definitve reconstruction

Thank You !