



2009 OTA Annual Meeting
Manchester Grand Hyatt
San Diego, CA

Symposium II:
Surgical Timing: What's Emergent and What's Not

Elizabeth Ballroom, Level II

8:15am – 9:45am
Friday, October 9, 2009

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Disclosure: Faculty disclosure can be found starting on page 67 of the 2009 OTA Annual Meeting program.

True Emergencies

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Compartment Syndrome

One of the classic orthopaedic emergencies. Once the diagnosis is made, treatment (fasciotomy and evaluation of muscle viability) is emergent and only delayed by a patient *in extremis*.

Diagnosis

- Physical exam can be unreliable²⁵ and 'classic' findings late in process
- Pain out of proportion (with passive stretch of a muscle group) is one of the earliest and most sensitive clinical signs²⁵
- Paresthesia is early sign and is likely related to nerve ischemia²³
- Patients can develop compartment syndromes either acutely after fracture fixation or even after significantly delayed intervals^{24,25}
- Delta P (Δp) value (difference between measured compartment pressure to diastolic blood pressure) is supported for diagnosis when invasive monitoring is selected.²⁶

Treatment (Supported by evidence for leg compartment syndromes)

- McQueen and Court-Brown prospective evaluated Δp value at 30 and had no missed compartment syndromes.²⁶
- Treatment for other extremities (thigh, forearm) by extrapolation from studies for leg.^{10,31}
 - Same diagnostic techniques and values utilized.
- Well defined thresholds for irreversible injury to nerves and muscle with pressure related ischemia
- **Poorer outcomes (infection, amputation) with delay to diagnosis and treatment**^{9,38}

Legal Issues⁵

Malpractice claims uncommon

- Rate of malpractice claims related to CS estimated 0.002 claim per year of practice per surgeon
- Most prominent risk factor for an indemnity payment as a **delay before fasciotomy**
- The number of hours from the alleged presentation of the CS until fasciotomy was linearly associated with the dollar amount of the indemnity payment
- Most plaintiffs were employed, insured, and white
- Average indemnity payment \$426,000

Vascular Injuries associated with orthopaedic trauma

One of the most significant controversies in management involves the order of repair when combined vascular and bony injuries/dislocations occur. In the setting of a pulseless limb, the vascular repair is typically done first and orthopaedic stabilization follows. This can be problematic when the repair is performed with the fracture/dislocation in unreduced position as length restoration and angular correction can disrupt repair. Treatment acuity for 'occult' injuries-intimal disruptions-is more controversial.

Diagnosis

- Rapid detection and localization is key to management
- Classic 'hard' signs which require emergent management
 - Pulsatile hemorrhage
 - Expanding hematoma
 - Palpable thrill
 - Audible bruit
 - Pulseless limb (which persists after closed reduction/limb realignment)
- Ankle brachial index is effective non-invasive screening tool
 - Prospective study by Barei and Mills (knee dislocation). Excellent sensitivity, specificity and PPV with ABI less than 0.9²⁹
- Doppler (ultrasound)
 - Excellent sensitivity and specificity but operator dependent⁶
- Multi detector computed tomography angiography (CT angiography)
 - Good sensitivity and specificity, especially in proximal vasculature^{35,40}
 - Detection of vascular dissection less reliable

Treatment

- Delays in repair associated with high rates of amputation^{2,7,17,37}

Irreducible dislocations

Tremendous variety of injuries that require urgent reduction secondary to impaired vascular inflow or neurovascular compression. Little well-defined outcome data.

- Fracture dislocation of femoral head
 - Significant changes in blood flow with dislocation⁴⁴
 - Delayed treatment led to AVN (without posterior wall fracture)²⁷
- Knee dislocations must be emergently reduced to allow for evaluation of popliteal artery
 - High rate of popliteal artery injury³³

- Poor outcomes with delayed diagnosis of significant popliteal injury^{33,42}

Open Fractures

The treatment of open fractures has evolved this decade with the emergence of the trauma room—i.e. the insured daily availability of operating room time for emergent cases. In general, there is a trend toward more delayed treatment for open fractures. However, delayed treatment of open fractures is not well supported in the literature.

- Unclear etiology of “6 hour” rule
- Friedrich¹¹ garden mold and dust in guinea pig surgical wound model “Simple” debridement cleared infection within 6 hours
- Robson³⁶ sampled contaminated wounds and screened for bacteria; demonstrated 10^5 organisms per gram of tissue as infectious threshold which was reached at 5.17 hours after injury
 - Conclusion: Poor quality data—early and logical concern for kinetics of bacterial colonization

The Basic Science

- Fundamental first step in bacterial colonization is the process of adhesion or permanent attachment.¹³
- Many common musculoskeletal pathogens utilize biofilm slime formation during colonization to deter host defenses.
- Adhesion is based on a **time-dependent** protein receptor interaction, polymer synthesis, charge, and physical forces. Biofilms participate in cell-cell aggregation and consolidate adhesion. Devitalized bone stripped of periosteum presents a collagen protein matrix and acellular crystal surfaces to which bacteria may optimally bind.¹⁵
- In-vitro studies suggest time dependent efficacy (**best within 3 hours** of inoculation) of low pressure pulsatile lavage versus high pressure lavage in *S. aureus* contamination model (human and canine bone).⁴ Rabbit model of bone contamination with *S. aureus* demonstrated increased staphylococcal adherence to bone after ultrasonication at **six hours**.¹² Explanation for time dependent effects may be explained by Gristina.¹⁶
 - Within three hours of exposure to a surface such as bone, *S. aureus* attaches to bone with weak Van der Waals forces and hydrophobic interactions

- After three hours, bone surface receptor interactions and chemical interactions strengthen the bonds between bacteria and bone
 - Conclusion
Bacterial adherence is time dependent process. Early debridement may optimize bacterial clearance.

The Wound Complexity

- Difficult to assess extent of soft tissue injury until surgical exploration and exposure.
- Common to discover higher than expected levels of contamination and nonviable tissue
- Foreign material may promote bacterial colonization¹⁴
 - Conclusion
Extensive contamination and tissue injury are possible with benign appearing soft tissue wound—urgent investigation of injury may be important

The Literature

- Minimum 9 **retrospective** studies^{1,3,8,18,20,30,32,34,39} that fail to identify increased risk of infection with delayed surgical debridement between 6-24 hours⁴³
- Two **small** prospective studies^{28,41} with total of 170 patients fail to identify increased risk of infection with delayed surgical debridement between 6-24 hours
 - One level 1 study⁴¹ with variety of fractured bones (41 tibias) and mostly Grade 1 open fractures (39/115)
- Three small retrospective studies^{19,21,22} demonstrate **increased** infection with surgical delay
 - Conclusion
Best available literature fails to provide support for emergent debridement or elective delay

Final Points

- Definitive prospective study difficult to perform
- Questions:
 - Do we really believe that timing is not a factor in bacterial colonization?
 - What is the acceptable time from injury to debridement?
 - Is there legal liability?

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Are they URGENT or EMERGENT? Cases that MAY be able to wait over night....and longer?

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Evidence: The traditional “*gold standards*” described for timing and ideal windows for fracture treatment have been debated, are the source of conflicting published reports, and are based largely on underpowered studies and/or theory translated from basic science.



Institutional changes in practice scenarios require us to consider each injury and patient independently and within our own hospital environment to assess the risks and benefits of different time intervals between injury and stabilization.

- 1) **What Injuries might be able to wait overnight?** The first question to ask is why and how these injuries were labeled “emergent”....Where did the “*gold standard*” come from?
 - a. Fractures associated with vascular injury→leading to patient death? Leading to muscular death?
 - b. Long bone stabilization....effect of unstable long bone on patient physiology? (i.e. femur fracture stabilization with respect to pulmonary function, association with multi-organ failure.)
 - c. Neurologic injury associated with fracture....nerve injury potentially reversible deficit with decompression prevention or which may get worse with ongoing skeletal instability? (i.e. spinal cord injury associated with burst fractures)
 - d. Interval to treatment correlates with bacterial contamination and correlation with irreversible bacterial colonization/infection?
 - e. Joint dislocations:
 - i. Cartilage death when left outside of the normal joint environment?
 - ii. Vascular supply to the bone disrupted secondary to the displacement of the bone with respect to its vascular pedicle?
 - f. *Fractures reported to be associated with bad outcomes that have been attributed to disruption of the fragile blood supply (i.e. AVN and nonunion secondary to fracture traversing the nutrient vascular source)?*

- 2) **Femoral Neck Fractures**
 - a. “*Young*” Patients (<50?)- or patients considered candidates for reduction and fixation based on their age and a general concern for performing arthroplasty in young patients despite the technical challenge required to obtain an anatomic reduction and rigid fixation of the femoral neck.
 - i. Why Emergency?

1. Historically, the rate of nonunion and avascular necrosis reported with this injury in the young patient approach 50%, and arthroplasty is a poor salvage option based on age and likelihood of revision surgery.
 2. Swiontkowski et al., 1980- Institutional protocol of emergent surgical stabilization with anatomic reduction of the neck via open means as necessary and rigid internal fixation led to a significantly decreased rate of AVN and nonunion:
 - a. This paper was the first to label this surgery a “surgical emergency” in young patients.
 3. Since this pivotal publication, several publications (all small series) support this concept of early intervention
- ii. Why not emergency?
1. Recent authors report equal rates of nonunion and avascular necrosis, poor functional outcomes and need for revision surgeries in patients treated both early and those treated in a delayed manner.
 - a. Factors besides the time interval may be more important (quality of reduction, intra-capsular pressure, rigidity of fixation.)

Current Expert Opinion: Survey of experts (active membership in the OTA)

- “Anatomic reduction” considered the most important variable and “time to operation” the least important variable in patient outcomes. 30% responded felt that the gold standard interval for stabilization was within 6 hours, 41% responded 6-12 hours, and 25% answered 12-24 hours.
- Given the hypothetical scenario in which there was a trauma room available for a guaranteed start time in the morning, 36% would start surgery if the patient presented by 8:00, an additional 42% would start the case as late as midnight, but only 12% of respondents would start the case after midnight.
- In contrast, given the same question but WITHOUT protected OR time in the morning, 60% would start the case after midnight while only 12% wouldn’t start surgery after 8:00 PM.

- b. *Old Patients (>50?):* or those patients considered good candidates for arthroplasty if excellent reduction and fixation of the neck cannot be easily obtained by closed means.
- i. Why Emergency?
1. Surgical interval has primarily been investigated with respect to patients’ medical status and perioperative complications, which are thought to increase with unnecessary delay in operation.
 - a. Early surgery (<24 hours of admission) associated with reduced pain and LOS and probably major complications among patients medically stable at admission.

- b. Early compared (within 24, 36, and 48 hours of admission) with late operative (>48 hours after admission) treatment of patients with a hip fracture is associated with an improved ability to return to independent living, a reduced risk for the development of pressure ulcers, and a shortened hospital stay.
 - ii. Why not Emergency?
 - 1. In the face of medical co-morbidities that can be optimized within 4 days, investigators have shown that delay in surgery is better for the patient's outcome
 - a. All patients, regardless of reason for delay, had an increase in mortality if surgery was delayed for greater than 4 days.
 - 2. While predictive indicators have been evaluated with respect to surgical failures of femoral neck fixation in the elderly patients, the time interval to internal fixation OR to arthroplasty hasn't been evaluated as it has in younger patients
 - a. Pre-injury cognitive and functional status, age, bone quality, and Garden classification have been evaluated as predictive factors for failure in this treatment group.

3) Talus Fractures

- i. Why Emergency?
 - 1. While never correlated, the high rates of osteonecrosis and nonunion were anecdotally attributed to disruption of the fragile blood supply by early investigators
 - 2. Plausibility of causation applies: primary vessels course through in the most common area of fracture, thus it makes sense that their injury would lead to the clinically common events of AVN and nonunion.
 - 3. Reduction and fixation of these fractures has been advocated to protect any remaining blood supply to the talar body and promote revascularization and enhance probability of union.
- ii. Why Not Emergency?
 - 1. Harborview-Pivotal study: first to apply statistical methods to evaluate the correlation of time interval to surgery with AVN....**found no correlation**. Osteonecrosis was associated with talar neck comminution and open fractures, confirming prior studies that higher-energy injuries are associated with more complications and a worse prognosis.

Expert Recommendations: Urgent reduction of dislocations and treatment of open injuries. Proceeding with definitive rigid internal fixation of talar neck fractures after soft-tissues swelling has subsided may minimize soft-tissue complications.

Vallier HA, Nork SE, Barei DP, Benirschke SK, Sangeorzan, BJ

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Femoral Neck Fractures: Young

Time to surgery matters:

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Femoral Neck Fractures: Old

Medical Concerns

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Talus Fractures-Time correlated with AVN?

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Damage Control Orthopaedics for Pelvic and Extremity Injuries

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Define DCO

“Damage control is an approach that contains and stabilizes orthopaedic injuries so that the patient’s overall physiology can improve.” Roberts et al. ICL JBJS 2005

- Provisional stabilization of fractures
 - Control of hemorrhage
 - Provisional fixation and stabilization of soft tissue injuries
- Resuscitation of patient
- Return for definitive fixation when patient is no longer in “second hit window”

How to decide on DCO vs. early total care

Inflammatory markers

- Inflammatory and counter-inflammatory markers studied
- IL-6 correlates to systemic inflammatory response and outcomes
 - Questionable practicality in real world – availability variable
- Pape et al JTrauma 2002 53:452-462.
- Pape et al. JTrauma 2001;50:989-1000.

Stability of the patient during acute resuscitation

- Stable
- Borderline
- Unstable
- Extremis

Stable undergo definitive management per local standards of care

Unstable and Extremis patients treated with DCO

Borderline patients less easy to define

- Pape and colleagues in Hanover define as:
 - Polytrauma patients with ISS>40 without thoracic trauma
 - ISS > 20 with thoracic trauma
 - Polytrauma with abdominal trauma
 - CXR with bilateral pulmonary contusions
 - Pulm art pressure increase > 6 mmHg during intramedullary nailing

Other criteria available including Louisville criteria for shift to DCO

- pH < 7.24
- Transfusion requirement > 10 units
- Hypothermia (T < 35 deg C)
- Prolonged operative times of > 90 min
- Coagulopathy

Subgroups who may benefit from DCO are

- Elderly

Thoracic Trauma
Head Injured
Pelvis fx with exsanguinations
Femur fractures

Elderly

50% mortality in patients over 65 with ISS > 20
Greenspan J Trauma 1985;25:60-4.

Thoracic trauma

Eastern Association for the Surgery of Trauma Practice Management
Guidelines Work Group reviewed lit

- No RCT
- In available literature no difference between early (< 48 hour nailing) and delayed fixation
- Consider pulm function, hemodynamic status, operative time, blood loss and whether fx is open or closed.

Head Injury

Eastern Association noted no difference in outcomes for < 48-hour fixation vs. delayed fixation based on Level II and Level III evidence.

Of critical importance is appropriate neurological monitoring

ICP monitoring in ICU and OR imperative

- 70 mm Hg cerebral perfusion pressure
- ICP < 20 mmHg

Femur fx

- Particular concern raised in patients with concomitant pulmonary injuries
 - Pape et al J Trauma 2002;53:452-62.
- Bilateral fractures noted to have increased mortality and incidence of ARDS

Pelvis with exsanguinations

- Determining the roles of
 - Provisional stabilization
 - Angiography
 - Pelvis packing

Role of angiography controversial

- Other sources (thoracic and abdominal) ruled out as cause
- Stabilization of pelvis (provisional with ex-fix, sheet, c-clamp)
- Ongoing transfusion requirement (4 units)

Considerations for angiography

- Delay of greater than 3 hours detrimental
 - Agolini et al J Trauma 1997;43:395-9.
demonstrated 5 times increased risk of mortality
 - Noted average procedure times of 90 min
- Time requirement at your center for angiography

- Logistical consideration as well as length of procedure

Fractures at highest risk for requiring angio

- APC III
- Lateral compression injuries
- Injuries in those > 55

Pelvic packing

- Performed more commonly in Europe
- Some centers in US using it as part of a protocol to achieve haemodynamic stability.

Cotheren et al. J Trauma 2007;62:832-42. Initiated packing of true pelvis with concurrent provisional pelvis stabilization if 4 U PRBC transfusion on arrival

- Procedure time approximate 20 min
- Arteriography if post packing continued instability (4/24)
- No deaths due to blood loss
- Procedure can be performed in the time needed to set up for arteriography

Timing of conversion from damage control to definitive fixation

- Avoid second hit window
 - Increases in inflammatory mediators days 2,3, 4 with return to OR
Pape et al. J Trauma 2001;50:989-1000.
- Re-evaluation of patient stability
- Co-ordination of other services (spine, general surg, neuro surg) regarding planning of operative intervention and return to OR

Staged Management of Periarticular Injuries

Brett D. Crist, MD University of Missouri

Soft Tissue Injury

- Soft tissue injury is a critical factor in determining outcomes of tibial plateau and pilon fractures
- Assessing the initial soft tissue injury and how it will evolve is difficult based upon initial evaluation.
- Assessing the bony injury is easy—x-rays and CT.

Tibial Plateau Fractures

Low Energy fractures

Primary ORIF based upon patient factors—medical comorbidities, etc.

High Energy Fractures

- Watson JT. High-energy fractures of the tibial plateau. *Orthop Clin NorthAm.* 1994;25:723–752.
 - 4 factors determining outcome
 - Articular step-off
 - Extent and separation of condyle fracture lines
 - Metadiaphyseal dissociation
 - INTEGRITY OF SOFT TISSUE ENVELOPE
 - Unicondylar Fractures and Bicondylar Fractures
1. **Primary ORIF indications**
 - a. Open fractures and compartment syndrome?
 - b. Problems
 1. Making an already compromised limb worse
 2. Wound breakdown and infection
 - Up to 88% in bicondylar plateaus treated with dual plating
 - Young MJ, Barrack RL. Complications of internal fixation of tibial plateau fractures. *Orthop Rev.* 1994;23:149–154.
 - Moore TM, Patzakis MJ, Harvey JP. Tibial plateau fractures: definition, demographics, treatment rationale, and long-term results of closed traction management or operative reduction. *J Orthop Trauma.* 1987;1:97–119.
 - Covall DJ, Fowble CD, Foster TE, et al. Bicondylar tibial plateau fractures: principles of treatment. *Contemp Orthop.* 1994;28:115–122.
 - Mallik AR, Covall DJ, Whitelaw GP: Internal versus external fixation of bicondylar tibial plateau fractures. *Orthopaedic review* 1992;21:1433-1436.

2. **Delayed ORIF**
Initial stage

- a. Length and angular-stable
 - 1. Well-padded splint/knee immobilizer
- b. Length or angular-unstable
 - 1. Knee-spanning External fixator
 - Benefits
 - a. Monitor soft tissues
 - b. Stabilize fracture to allow soft tissue resolution
 - c. Prevent further cartilage injury
 - d. Mobilize patients
 - e. Improved CT scan evaluation due to ligamentotaxis
 - Complications
 - a. Pin tract infections
 - b. Knee stiffness
 - c. Neurovascular injury during placement
 - d. Tethering of muscles/tendons
 - Egol KA, Tejwani NC, Capla EL, Wolinsky PL, Koval KJ: Staged management of high-energy proximal tibia fractures (OTA types 41): the results of a prospective, standardized protocol. *Journal of orthopaedic trauma* 2005;19:448-455; discussion 456.
 - Anglen JO, Aleto T: Temporary transarticular external fixation of the knee and ankle. *Journal of orthopaedic trauma* 1998;12:431-434.

Definitive ORIF

- When edema resolves/skin wrinkles and fracture blisters/abrasions re-epithelialize
1. Dual incision technique
 1. Up to 8.4% deep infection rate
 - i. Barei DP, Nork SE, Mills WJ, Henley MB, Benirschke SK: Complications associated with internal fixation of high-energy bicondylar tibial plateau fractures utilizing a two-incision technique. *Journal of orthopaedic trauma* 2004;18:649-657.
 - ii. Barei DP, Nork SE, Mills WJ, Coles CP, Henley MB, Benirschke SK: Functional outcomes of severe bicondylar tibial plateau fractures treated with dual incisions and medial and lateral plates. *The Journal of bone and joint surgery* 2006;88:1713-1721.
 - iii. Egol KA, Tejwani NC, Capla EL, Wolinsky PL, Koval KJ: Staged management of high-energy proximal tibia fractures (OTA types 41): the results of a prospective, standardized protocol. *Journal of orthopaedic trauma* 2005;19:448-455; discussion 456.
 2. Single incision technique with locking plates
 1. Decreased infection rate
 - i. Schutz M, Kaab MJ, Haas N: Stabilization of proximal tibial fractures with the LIS-System: Early clinical experience in Berlin. *Injury* 2003;34(suppl 1):A30-A35.
 - ii. Stannard JP, Wilson TC, Volgas DA, Alonso JE: Fracture stabilization of proximal tibial fractures with the proximal tibial LISS: Early

- experience in Birmingham, Alabama (USA). *Injury* 2003;34(suppl 1):A36-A42.
- iii. Cole PA, Zlowodzki M, Kregor PJ: Less Invasive Stabilization System (LISS) for fractures of the proximal tibia: Indications, surgical technique and preliminary results of the UMC Clinical Trial. *Injury* 2003;34(suppl 1): A16-A29.

Pilon Fractures

1. Primary approach

- a. Benefits
1. Decreased number of surgeries/time in the hospital
- b. Negatives
1. Complication Rates
 1. Wound breakdown/infection rates >50%
 - Wyrsh B, McFerran MA, McAndrew M, et al.: Operative treatment of fractures of the tibial plafond. A randomized, prospective study. *J Bone Joint Surg Am* 1996;78:1646-1657.
 - McFerran MA, Smith SW, Boulas HJ, Schwartz HS: Complications encountered in the treatment of pilon fractures. *J Orthop Trauma* 1992;6:195-200.
 - Bourne RB, Rorabeck CH, Macnab J: Intra-articular fractures of the distal tibia: the pilon fracture. *J Trauma* 1983;23:591-596.
 - Moller BN, Krebs B: Intra-articular fractures of the distal tibia. *Acta Orthop Scand* 1982;53:991-996.

2. Delayed approach

- a. Benefits
1. Decreased complication rates
 1. Deep infection rate <7%
 - Patterson MJ, Cole JD: Two-staged delayed open reduction and internal fixation of severe pilon fractures. *J Orthop Trauma* 1999;13:85-91.
 - Sirkin M, Sanders R, DiPasquale T, Herscovici D, Jr.: A staged protocol for soft tissue management in the treatment of complex pilon fractures. *J Orthop Trauma* 1999;13:78-84.
 - Anglen JO: Early outcome of hybrid external fixation for fracture of the distal tibia. *J Orthop Trauma* 1999;13:92-97.
 2. Able to perform multiple surgical approaches if needed
 - Howard JL, Agel J, Barei DP, Benirschke SK, Nork SE: A prospective study evaluating incision placement and wound healing for tibial plafond fractures. *J Orthop Trauma* 2008;22:299-305; discussion 305-296.
- b. Negatives
1. Number of surgeries
 2. Time in external fixator
 3. Decreased ankle ROM

1. Anglen JO, Aleto T: Temporary transarticular external fixation of the knee and ankle. *Journal of orthopaedic trauma* 1998;12:431-434.

The Influence of the Orthopedic "Trauma" room on the Care of Extremity Trauma

Philip Wolinsky, MD The University of California at Davis Medical Center

Definition of an "Urgent" Orthopedic Operating Room

Daily dedicated OR room

For orthopedic trauma patients

Staffed with experienced orthopedic personnel

Time that does not release

Not the GS trauma room!

Challenges of Fracture Care

Elective cases: Get done Mon- Friday daytime

True "emergency" cases: have to get done during nights/ weekends

Semi-urgent cases:

The hardest to fit in

"No mans" land on the OR schedule

Don't have any night time priority

No daytime priority

Often relegated to the next night where they don't have a high priority etc

Off hour surgery issues:

? Most experienced surgeons

Career burnout- years of scheduling frustrations

Potential lack of specialized equipment/ personnel

Strain on surgeons- the most experienced surgeons opt out of call as they get older

TR Potential Advantageous

Surgery done during day time

Well-rested personnel

Knowledgeable personnel

Equipment is readily available

Predictable use of OR time

Decrease "off hour" OR staffing

Less bumping of elective cases

Less bumping of office hours

Decrease trauma staff "burnout"

Less night time operating

Trauma becomes a viable long term career option

TR Potential Disadvantageous

All cases may get put off until morning

Potential increase in complications:

Infections- open fractures

AVN: femoral neck, talar neck

Inefficient use of personal and OR resources if there are not enough daytime cases

88% of room time utilized

Literature

Bhattacharyya T, Vrahas M, Morrison S, et al. The value of the dedicated orthopedic trauma operating room. J Trauma 60, 2006: 1336-1341

Fewer “elective” ortho cases were bumped
72% reduction in hip fractures done after 5 pm
Femoral nailing:
Night- 261 minutes, higher complication rate
Day- 219 minutes ($p < 0.04$)

Logistically feasible
Improves OR flow
Decreased operative time
Decreased complication rate

Wixted J, Reed M, Eskander M, et al. The effect of an orthopedic trauma room on after-hours surgery at a level 1 trauma center. J Ortho Trauma 22(4), 2008: 234-236

Despite a 14% increase in overall # of orthopedic cases

16% decrease in cases after 7 pm

44% decrease in case between MN- 7 am

More frequent transfer of care of closed femoral shaft fractures to an orthopedic traumatologist (10% to 54%)

Elder G, Harvery E, Vaidya R, et al. The effectiveness of orthopedic trauma theaters in decreasing morbidity and mortality: a study of 701 displaced subcapital hip fractures in two trauma centres. Injury 36, 2005: 1060-1066

Comparison of 2 Level 1 trauma centers with and without a “trauma” room
Trauma room: Mon- Friday first 4 hours of the day
701 patients with low energy hip fractures
No differences in preoperative major co-morbidities or ASA score

Lemos D, Nilssen E, Khatiwada B, et al. Dedicated orthopedic trauma theatres: effect on morbidity and mortality in a single trauma centre. Can J Surg. 52(2), 2009: 87-91

Hip hemi before and after establishment of a **4 day/ week** ortho trauma room (245 vs 212)
All low energy subcapital hip fractures
No ASA differences
Delay to surgery increased (57 vs 72 hours)

No difference in mortality

Personal Observations

More surgeons are staying in trauma as a long term career at least partly as a result of more manageable schedules

Standard of Care: Google Definitions:

“Treatment that experts agree is appropriate, accepted and widely used. Health care providers are obligated to provide patients with the standard of care. Also called standard therapy or best practice”

“A diagnostic and treatment process that a clinician should follow for a certain type of patient, illness, or clinical circumstance”

“Measure against which a defendant’s conduct is compared. The required standard in a professional negligence or medical malpractice case is the standard of the average qualified practitioner in the same medical specialty.”

“The standard of care used in malpractice cases has been stated as, A physician is bound to bestow such reasonable and ordinary care, skill, and diligence as physicians and surgeons in good standing in the same neighborhood, in the same general line of practice, ordinarily have and exercise in”

Standard of Care

Trauma room hospital:

Standard of care for a lower energy open fracture that comes in ‘late’ will be first case in the morning

Non-trauma room hospital:

Same injury but since there is no OR in the am
Standard is it goes that night/ evening!

Call Issues

Non- trauma room hospitals:

Expected to do urgent cases after your elective cases are done

If there is an OR available

Not a good model for providing region-based care

Conclusions

Trauma rooms:

Can be efficiently utilized

Can decrease bumping of elective cases

Can decrease cancellation of office hours

Can decrease the number of “after hours” cases

Can decrease the morbidity of patients with hip fractures

May decrease the length of trauma procedures

Can direct the care of trauma patients to trauma experienced surgeons

Prerequisites

Sufficient cases to fill the dedicated OR time

Sufficient trained orthopedic surgeons who are interested in staffing the room

Institutional support for the room and personnel for the room