

Geriatric Trauma Practice and Pitfalls

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Disclosures

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The Elderly Patient: Introduction

- Epidemiology
- Mechanisms
- Triage and evaluation
- Physiology
- Creating a Geriatric Trauma Service
- Results

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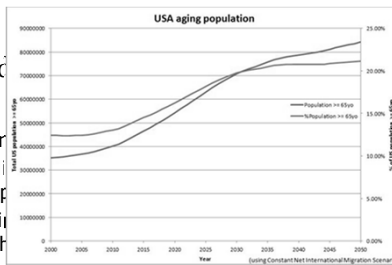
The Elderly Patient

- First: The age question, what is elderly?
- Many articles say 65
- Trauma mortality increases at age 55
- Will generally use 65 as the age for the purpose of this talk
- 23% of adult trauma population is 65 or older
- By 2050, 90 million will be over 65, 1/5 of the adult population

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Elderly: Epic

- Adult lifespan
- Multiple studies on the aging population
- The CDC estimates that the aging population will reach 2030.
- We will need to continue to adapt and learn to improve care for these patients as we did for penetrating violence in the 90's or more recently from military conflicts.



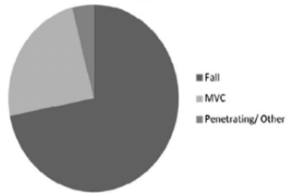
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Elderly: Epidemiology

- The elderly are more active
- They are driving more miles in cars
- They have greater accessibility given other mobility devices

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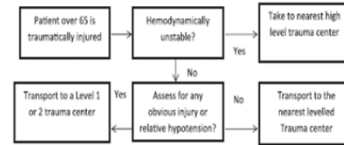
Mechanisms of Trauma



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Triage

- Geriatric morbidity and Mortality in trauma increases at age 55
- Geriatric patients treated at higher level trauma centers do better.



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Physiology/ Comorbidities



- 50% have hypertension
- 39% have heart disease
- All of the following occur more than 10%
 - Diabetes
 - CVA
 - COPD
 - Dementia
 - Arrhythmias
 - Endocrine disorders

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ABC's of Trauma

- We are used to the ABC's of ATLS
- Instead, we will review the ABC's of Elderly Trauma Care

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A

- Airway
 - More rigid neck from DJD
 - More chance of oral/ dental problems
 - Calcified trachea for trach
- Arrhythmia/ Atrial fibrillation
 - More common in elderly patients
 - Often requires anticoagulation
 - See "C"

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Beta Blocker

- Beta blockers
 - Including all other anti-arhythmic drugs such as Ca channel blockers.
 - Eliminates or blunts normal tachycardic response from hypovolemia or acute blood loss
 - May be protective of peri-trauma MI

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Coumadin, Jantoven, Marfarin

- Warfarin/ ASA
 - Higher proportion of patients on anticoagulants
 - Small traumas can lead to large bleeds
 - Why not to anticoagulate? Error of Omission vs. Commission
 - Was is the actual stroke rate?
 - Variable but likely 6- 10 % year

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D

- Delirium
 - Delirium recognized as a major role of ICU confusion.
 - Effects the elderly more, "sundowning."
 - Avoid Benzos and Narcotics
 - Sleep hygiene

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D

- Diabetes Mellitus
 - Growing number of patients with DM, worse if overweight.

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EKG

- EKGs
 - Silent MI common in this population.
 - Troponins can be followed, MI more likely 2-3 days after stress (either trauma or the OR)
 - Elderly often have baseline EKG changes
 - Obtain old EKG if possible.

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FRC

- FRC (Functional Residual Capacity)
 - Less reserve
 - Quicker to desaturate
 - More affected by partial or full pulmonary collapse
 - Pain and pain medicines can decrease FRC.

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GI Bleed

- H. pylori exposure to greater 80% of those over 80.
- AVMs in colon in older patients
- Less tolerant of GI blood loss
- Consider intervention sooner rather than later

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Hypertension

- Elderly often have baseline hypertension.
- All organs are used to higher perfusion pressure
- Seemingly normal BPs may induce poor perfusion

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Infection

- Harder to diagnose in the elderly
 - May lack fever and elevated WBC
- Elderly more likely to have been associated with healthcare facilities – thus more resistant organisms.
- Appropriate antibiotic therapy necessary as without reserve patients will not do well with untreated infections

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J- walking

- Hearing loss leads to risky behaviors on streets (and in cars)
- Decrease in mobility leaves them easy targets in the cross walks.

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Lytes

- Electrolytes
 - Patients have decreased muscle mass and GFR.
 - Quick derangements as less physiologic buffer in patients.
 - DI or SIADH from even minor head trauma

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Medications

- Morphine/ Narcotics
 - Can be very potent and easily over done in elderly patient
 - Liver dysfunction
 - Renal dysfunction
- Steroids
- NSAIDS

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N

- Nutrition
 - Often poor due to immobility or economic state
 - Less reserve muscle and soft tissue
 - Left in a catabolic state after trauma
 - Feeding can be issue if hiatal hernia/ gastric atony

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N

- Neglect\ Abuse
 - Must be reported
 - Look for common signs

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Osteoporesis

- Osteoporosis/ DJD
 - Affects neck joints to decrease range of motion
 - May hinder X-ray interpretation of joints

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Platelet Dysfunction

- Clopidogrel (Plavix)
- Many patients on platelet inhibitors
- Risk of progressive head bleed increased
- We do not yet know a good way to reverse it

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Quit

- When is it time to quit?
 - Likelihood of patient greater than 70 with 3 organ failures leaves the hospital alive is about 3 %
 - 1996 10% Medicare patients spent > 1 week in the hospital in the last 6 months of life.
 - In 2005, that increased to 15%

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Renal failure

- Decreased muscle mass
- Normal Cr thus decreases with age
- Higher chance of hypotension affecting calcified renal arteries
- Patients over 80 on new HD have very poor 1 year survival rates.

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State Regulations

- CDC and state guidelines now include age>55 as a trauma activation criteria.
- Age is an independent marker of mortality that is multiplicative as one gets older, not just additive.

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Tachycardia

- Not well tolerated in stiff older hearts
- Many older patients have some diastolic dysfunction, thus their hearts do not relax well.
- Hypovolemia and tachycardia critically hinder perfusion as the ventricle is underfilled and thus has poor stroke volume and perfusion.

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Ulcers, Pressure

- Skin often thin and friable
- Less soft tissue to pad pressure points
- Back boards are significant cause of sacral decubus
- Items like NGTs also cause decubus as well.
- Will the government pay?

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Vessels

- Atherosclerotic
 - Thus affect
 - Manual and catheter determined blood pressure.
 - Ability to use IABP, other vascular interventions such as embolizations.
- Potentially venous thrombosis if previous health care visits

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Wall

- Elderly patients often hit a physiologic wall
- Instead of gradual declines in BP, they can seem more like children with a sudden drop off.
- Meds may well have an effect on this.
- Need to be aware of patients who are nearing that wall.

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X-rays

- Minor trauma can cause significant injuries.
- Tertiary review very important to find missed injuries.

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Y

- Why is this a health care concern?
- Aging population
 - From now to 2030, those >65 will grow from 60 mil to 108 mil, and increase from 21% to 31% of the population.
 - Now there are 66,000 people over 100, by 2020 it will be 214,000.

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ZZZZ

- Older patients need sleep
- Use non-narcotic, non-sedating meds for sleep.

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Take Home Points

- Minor mechanism can equal major trauma
- Physiology is disrupted by age and meds
- Delirium can be common
- Pain control essential even for minor rib fractures
- Incentive spirometry

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Physiology – Practical Issues

- Patients can have major injuries with minor trauma
 - Head bleeds
 - Splenic laceration
 - Fractures, not just hips – especially ribs
- With more frail tissues, patients develop wounds quicker
- Spine deformities are more prevalent
- So limit backboard use
- They will desaturate quicker on intubation
- They will respond poorly to benzodiazepams
- Their pressures are baseline higher so must be kept higher after injury

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At our institution...

- Several events occurred in a short time frame.
 - ACS review
 - TQIP data
 - Patient outcomes
 - Inefficient medicine consult service
 - Study on delays to the OR for hip fracture patients.
 - OE (observed to expected) ratios for the entire hospital needed improvement.
 - Age >55 was added to statewide trauma criteria.
- We also reviewed cases in our QI process that we thought could use improvement.

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Building the Case

- We first discussed these with the involved services
 - They agreed that changes were needed and supported our view.
 - Neurosurgery also agreed.
 - It turns out that medicine did not like taking care of these patient either, as they felt they were just dependent on surgical services for results.
- We reviewed our ACS, TQIP, and QI results with the hospital leadership.

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Designing the Service

- Changed the case manager and social work model from floor based (passed off from floor to floor) to more team based, with all trauma SWs and CMs on the same team with regular meetings.
- Ensured our trauma attendings (and residents) all accepted the model that these patients were best served on the GTS.
- Developed our PT/OT numbers to be able to do 2x daily therapy on needed patients (Equivalent to ortho joint service floor)

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Designing the Service

- Worked with Anesthesia to ensure mutually agreed on testing was done rapidly prior to urgent surgery.
 - Included appropriate anesthesia buy in that minimal cardiac work up is needed for most surgeries unless patient is actively having MI or CHF.

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Screen for Non-Elective cases

- Acute cardiac disease
 - Unstable or severe angina
 - Myocardial infarction within 1.5 months
 - New or worsening heart failure symptoms
 - Significant arrhythmias
 - Severe valve stenosis.
- The above require a more thorough workup and possible cardiology consult. However, this is for risk assessment and OR planning, not to stop cases.

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Screen for Non-Elective cases

- Targeted labs and tests
 - Basic labs – CBC; BMP; T&S or T&C per procedure, others per symptoms or medications
 - ECG
 - CXR – suspicion for CHF, dyspnea, PNA, hypoxia
 - TTE – evaluate CHF with worsening symptoms, evaluation of a new/undiagnosed murmurs, reevaluation of known significant valvular disease (moderate or greater) if no recent study available (within 2 years)
- Continue/restart home medications ASAP
- Retrieval of records from most recent cardiac evaluation
- Cardiac devices – must determine brand and type and interrogate if > 3 months

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Designing the Service

- Included reviews of every non-surgical trauma patient admit to monitor for appropriateness.
- Included The Rehabilitation Institute of St. Louis to provide smoother transitions in care.
- Used APPs to provide more consistent communication with PCPs for further syncope work ups or anticoagulation needs.

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Standard Workup for GTS

- Current hospital fall risk assessment
- Medication review using Beers Criteria
 - Adjust for renal failure
 - Specific attention to betablockers and statins
 - Psychiatric medications, consider withdrawal effects of SSRI, TCA, Benzodiazepine, Antipsychotics, MAOI and steroids.
 - Avoid Benzodiazepine's
- Primary Care Physician Contact, if not known help to establish PCP
- Syncope evaluation if appropriate
- SW/CM Consult- home risk assessment

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Standard Workup for GTS

- Nutrition consult for BMI <20 >30
- PT/OT
- VTE Prophylaxis
- Anticoagulation Assessment
- Delirium evaluation

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Syncope work up

1. All trauma patients age 55 and over with suspected syncope will be assessed for inpatient observation.
2. History, physical, medication review, and directed diagnostic testing to include CBC, BMP, and EKG will be performed.
3. Orthostatic blood pressures will be taken when deemed able by the trauma team. These will be repeated daily for the duration of the patient's admission.
4. Telemetry monitoring will be instituted in these patients.

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Syncope Work Up

5. Clinical indicators for further testing and evaluation if the diagnosis is not otherwise apparent will include
Cardiopulmonary
 - a. SBP < 90, not trauma related
 - b. Shortness of breath
 - c. Congestive heart failure history
 - d. Abnormal EKG
 - e. Recurrent episodes
 - f. Family history of sudden death
 - g. Palpitations prior to syncope
 - h. Syncope during exercise
 - i. History of coronary artery or structural heart disease

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Syncope Work Up

6. If any of the above indicators are present or any of the testing positive, appropriate additional workup and consultation will be performed. Consultation can always be obtained per practitioner judgment on a case-by-case basis.
 - a. If cardiopulmonary indicators are present, a 2D echo will be performed, cardiology consult as necessary.
 - b. If the patient is dyspnic and history suggestive of PE, spiral CT scan of chest or VQ scan may be obtained.
 - c. If orthostatic, etiology will be sought and treatment as indicated.
 - d. Consider carotid Doppler exam, especially if bruit or with neurologic symptoms.
 - e. If none of the above are found, other studies as an outpatient could be considered and recommended to the patient's primary physician.

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Syncope Work Up

7. If no indicators are present and our workup as otherwise indicated above is negative, the patient may be discharged home with communication to and follow-up with the patient's primary physician and any appropriate specialists.

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Ortho Post-Operative Weight Bearing

- Hip (IMN, perc screws, arthroplasty): weight bearing as tolerated unless stated otherwise, soft dressing
- Femoral shaft (IMN): weight bearing as tolerated, soft dressing
- Distal femur (ORIF): NWB, soft dressing
- Tibial plateau/proximal tibia (ORIF): NWB, soft dressing
- Tibia shaft (IMN): usually NWB and splinted
- Distal tibia/ankle/foot (ORIF): NWB, they will be splinted
- Acetabulum (ORIF): TTWB
- Humerus (ORIF): NWB, soft dressing
- Elbow (ORIF): NWB
- Forearm (ORIF): NWB
- Clavicle (ORIF): NWB, soft dressing

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Rib Fracture Triage

- 2 points:
 - Age \geq 60yo
- 1 point:
 - \geq 3 rib fractures
 - Bilateral rib fractures
 - Flail segment
 - IS < 500ml
 - Weak or no cough
 - Underlying chronic lung disease
- If \geq 3 points-admit pt to the SICU and consult pain for an epidural
- If \geq 2 points- consider admission to the OU and early pain consult for an epidural

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Anesthesia Work Up

Patients with any of the follow high-risk conditions usually require intensive preoperative evaluation and/or management prior to surgery. A cardiology consult may be required.

- Unstable or severe angina (angina with any of these features: new, increasing in frequency or severity, occurring with minimal activity or at rest)
- Myocardial infarction within 1.5 months. Also myocardial infarction within 1.5-12 months unless seen by cardiology or medicine and recommended management was implemented.
- New or worsening heart failure symptoms
- Significant arrhythmias (2nd or 3rd degree AV block, ventricular arrhythmias, ventricular tachycardia, HR<45, SVT, atrial fibrillation/flutter with ventricular rate >100)
- Severe valve stenosis. Severe valve regurgitation if accompanied by new or worsened symptoms.

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Anesthesia Work Up

Targeted lab/diagnostic assessment (selected tests and common preoperative indications in GTS population)

Basic labs – CBC; BMP; T&S or T&C per procedure (ensure floor completes check sample); INR for warfarin, liver disease, or nutritional impairment; PTT if unexplained and unusual bleeding history with tissue trauma or surgeries; CMP if liver disease history; BNP if clinical suspicion for acute CHF
ECG – known cardiovascular, peripheral arterial, or cerebrovascular disease; symptoms including poor functional capacity, tachycardia, bradycardia, irregular rhythm, chest pain, or dyspnea
CXR – suspicion for CHF, orthopnea, PND, significant peripheral edema, rales, unexplained dyspnea, tachypnea, new or increasing oxygen requirement, concern for pneumonia
TTE – evaluate cardiac function in patients with current heart failure or prior heart failure with worsening dyspnea, as well as those with dyspnea of undetermined origin, evaluation of an new/undiagnosed grade III systolic murmur, evaluation of diastolic murmurs, reevaluation of known significant valvular disease (moderate or greater) if no recent study available (within 2 years) or concerning symptoms

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Anesthesia Work Up

Continue/restart home medications ASAP, particularly: aspirin (but do not restart if prescribed for primary prevention or if ongoing major bleeding), beta-blockers (unless hypotensive, bradycardic, or acutely symptomatic reactive airway disease), statins, and respiratory medications. Consider restarting ADP antagonists (i.e., clopidogrel, prasugrel) in patients with drug eluting stents within 6 months or bare metal stents within 1 month (first contact attending, IPAP service, or cardiology for input).

Retrieval of records from most recent cardiac evaluation (echo, stress test, cardiac cath report, cardiologist note) can prevent delay of surgery for studies that may otherwise not need to be repeated.

Cardiac devices – must determine brand and type (pacemaker vs. pacemaker plus AICD). If possible, determine indication for implantation and pacemaker dependence. Call device company (or Electrophysiology) for device interrogation if dysfunction suspected, if recent ICD shock, or if no interrogation in >3 months.

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Implement and Adjust

- Originally intended no ICU patients on the GTS
- Found that would increase handoffs, so changed that in the first week.
- Started with 4-5 patients on the service.
- Have increased to 16-20 a day.
- Significant throughput
- Found that specific home medication issues were a problem in multiple patients.

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Methods - Implementation

Geriatric Trauma service admission criteria

- 55 or older
- Single system or multisystem low to moderate severity

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Methods –Study Design

- Pre-Post, time interrupted series with retrospective review of prospectively collected trauma database
- Pre GTS control group – All trauma patients \geq 55 admitted to Neurosurgery, Orthopedics, or Medicine in 2012
- Post GTS experimental group – All trauma patients \geq 55 admitted to the GTS for 15 months after implementation of the GTS, October 2013 through December 2014

There was a 9 month implementation phase between groups while all elements of the GTS were implemented.

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Methods

- Pre group was chosen as that is where the patients of concern were located prior to implementation and the intended target for GTS admissions
- For each group we collected Age, Gender, Mortality, Length of Stay (LOS), Injury Severity Score (ISS), Abbreviated Injury Scores (AIS), and comorbidities

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Methods

- We also reviewed patients not on the GTS service to evaluate for biased selection to the GTS
- Analysis was in SAS and included t-test, Mann-Whitney, Chi Squared when appropriate as well as regression analysis for Mortality and LOS results.

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Results – Patient Numbers

Team	Pre GTS		Post GTS	
GTS	NA		798	
Trauma	343		449	
Non Trauma	652		392	
Neurosurgery		221		203
Orthopedics		281		121
Medicine		150		68
Totals	995		1247	

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Results - Demographics

	Pre GTS	Post GTS	p value
Mean age (years)	74.1	77.2	<.0001
Gender (M/F, %)	245/433, 36%	240/414, 37%	NS
ISS	9.54	8.8	NS
AIS Head	1.23	0.81	<.0001
AIS Face	0.13	0.14	NS
AIS Chest	0.16	0.36	<.0001
AIS Abdominal	0.05	0.16	<.0001
AIS Extremities	1.45	1.6	0.0428
# of comorbidities	21.1	21.33	NS

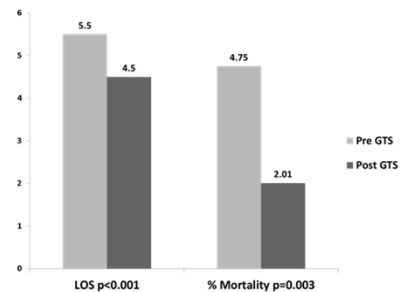
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AIS Extremities	1.45	1.6	0.0428
# of comorbidities	21.1	21.33	NS

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Results Mortality and LOS



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Mortality Logistic Regression

Effect	Odds Ratio Estimates		
	Point Estimate	95% Wald Confidence Limits	
AGE	1.011	0.985	1.038
Comorb	1.019	1.001	1.037
Pre vs Post GTS	0.506	0.263	0.972
AIS_Head	3.231	1.330	7.850
AIS_Face	2.066	0.908	4.701
AIS_Chest	1.140	0.417	3.115
AIS_Abdominal	0.626	0.078	5.026
AIS_Extremities	0.582	0.232	1.462
AIS_External	0.695	0.356	1.355

GTS, p=0.04, AIS Head, p=0.01, Comorb, p=0.04

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Length of Stay - Linear Regression

Variable	Parameter Estimate	Standard Error	p value
AGE	-0.00084	0.01267	NS
AIS_Head	0.42181	0.12905	0.0011
AIS_Chest	0.73959	0.19453	0.0001
AIS_Abdominal	0.34305	0.3009	NS
AIS_Extremities	0.801	0.15244	<.0001
Pre vs Post GTS	-1.0587	0.30098	0.0004

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Results – Non GTS Patients

Service	Pre GTS		Post GTS		Pre GTS		Post GTS	
	ISS	ISS	LOS	LOS	LOS	LOS	p	p
All Non Trauma	9.5	10	p=NS	5.5	5.0	p=NS		
Neurosurgery	14.1	14.6	p=NS	5.1	5.8	p=NS		
Orthopedics	7.4	6	P<0.001	5.1	3.9	p=0.046		
Medicine	6.8	6	P=0.041	6.7	4.9	p=NS		

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Weaknesses

- Retrospective
- Difficult to ensure Pre GTS Group is similar to Post GTS group
- Cannot determine which portion of the GTS was most effective in achieving the outcomes

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Study Conclusions

- Creation of a Trauma Surgeon led Geriatric Trauma Service significantly decreased mortality and length of stay at our trauma center.
- Head AIS is also a significant predictor of Mortality and increased LOS.
- In light of the increasing burden of older injured patients, trauma programs must develop robust systems to care for these patients safely and expediently.

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Conclusion

- GTS is effective
- Find your needs and use that as data for change
- Implement protocols to ease the transition
- Get buy in from services before going forward

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PDCA

- Did we just push mortality out of the hospital?
- Did shorter LOS lead to more readmissions?
- We studied the same population again.

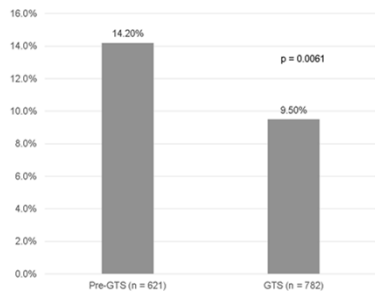
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Table 2: Demographics

	Pre-GTS (n = 621)	GTS (n = 782)	p-value
Age (years)	74.11	77.14	<.0001
ISS	8.99	8.68	0.272
AIS Head	1.10	0.79	<.0001
AIS Face	0.12	0.13	0.6891
AIS Chest	0.16	0.35	<.0001
AIS Abdominal	0.05	0.16	0.0757
AIS Extremities	1.49	1.62	0.0257
Length of stay (days)	5.39	4.48	<.0001
Number of comorbidities, n	20.78	21.30	0.5163

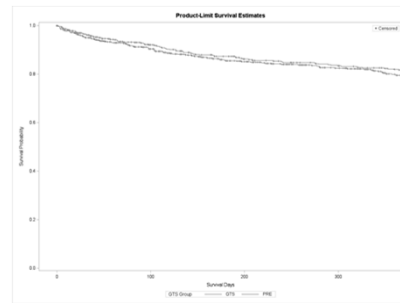
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Unplanned Readmissions



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Survival Curve



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PDCA

- Eighty-eight (14.2%) of the pre-GTS group had an unplanned readmission in the first 30 days following discharge, compared to 74 (9.5%) of the GTS patients (p = 0.0061).
- Mortality was not significantly different at 3 and 6 months and at 1 year.
- At all-time points, only age was significantly associated with mortality.

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What About Time to OR?

- Had been longer if admitted later in the week.
- Now:

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Demographics of PRE and GTS Patients

	PRE	GTS	p-value
N	500	271	
Age	77.9 ± 11.4	79.4 ± 10.3	0.06
Sex	318 (63.6%)	178 (65.7%)	0.6
ISS	9.1 ± 0.4	9.2 ± 0.5	0.06
Admitted to Floor	475 (95%)	252 (93.0%)	0.07
ICU requirement	58 (11.6%)	39 (14.4%)	0.3
ASA	2.9 ± 0.6	3.0 ± 0.5	0.1
Operative management	466 (93.2%)	249 (91.9%)	0.5

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Hip Patients

• Outcomes of PRE and GTS Patients

	PRE	GTS	p-value
Time to OR, days	1.7 ± 1.4	1.3 ± 0.9	0.0006
Mortality	11 (2.2%)	2 (0.7%)	0.1
LOS	6.4 ± 9.0	5.0 ± 2.1	0.01
ICU LOS	4.1 ± 4.0	3.1 ± 1.5	0.2

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Time to OR			Length of Stay		
Variable	Coefficient	p-value	Variable	Coefficient	
Intercept	1.2		Intercept	1.2	
Age	0.0008	0.9	Age	0.0008	
Sex			Sex		
Male	Reference		Male	Reference	
Female	-0.08	0.4	Female	-0.08	
ISS	-0.10	0.2	ISS	-0.10	
Day of Week			Day of Week		
Monday	Reference		Monday	Reference	
Tuesday	-0.3	0.1	Tuesday	-0.3	
Wednesday	-0.2	0.2	Wednesday	-0.2	
Thursday	-0.08	0.6	Thursday	-0.08	
Friday	-0.1	0.5	Friday	-0.1	
Saturday	0.1	0.5	Saturday	0.1	
Sunday	-0.1	0.4	Sunday	-0.1	
ASA	0.5	<.0001	ASA	0.5	
Admitting Service			Admitting Service		
GTS	Reference		GTS	Reference	
PRE	0.4	0.0002	PRE	0.4	

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Next Steps

- Have initiated Geriatric Trauma Clinic
- Have initiated Fracture Liaison Service
 - Inpatient labs
 - ENDO follow up
 - Dexa scans

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Thank You



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