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October 13-14, 2021 • An Online “Virtual” Event

LEVERAGING EHMR FOR PROTOCOL ADHERENCE: ACUTE KIDNEY INJURY

OBJECTIVES:

To determine if utilization of predefined context phrases in the electronic health medical record (EHMR) improves protocol adherence utilizing the Acute Kidney Injury protocol at a pursuing Level 2 Adult Trauma Center.

METHODS:

A retrospective review at (**identifier**) Level 2 Pursuing Adult Trauma Center revealed increased incidence of acute kidney injury in July to September 2020. After thorough review the primary modifiable factor was deemed to be protocol adherence. A documentation adjunct was created for the electronic medical record (EPIC) and education was given to providers. Adult patients (age >18) from November 2020 to current admission at LVH-M Trauma with creatinine elevated from baseline >0.3 or GFR <50 was included. The primary endpoint was development of acute kidney injury. Secondary outcomes included: EPIC dot phrase utilization, maintenance of volume status, holding or discontinuing nephrotoxic medications, strict intake and output monitoring, urine electrolytes, renal ultrasound and nephrology consultation. Creatine levels at time of admission and at time of discharge were also reviewed.

RESULTS:

A total of 599 patients met the criteria and were put through the review process. At risk patients encompassed 16.2% of all trauma admissions through the study period. Overall, the number of acute kidney injury occurrences decreased from four over three months to one over the six-month study period. There was an increase in the percentage of discontinued/avoided nephrotoxic agents, maintained volume status, and strict intake and output following dot phrase implementation. A decrease in dialysis/CRRT cases was also observed pre and post protocol adherence. Marked improvement was detected in overall rate of an adverse event- acute kidney injury. Additionally, 97% of patients had improvement in serum creatinine at time of discharge.

Table 1: Identification of Problem - Overall Protocol Adherence Prior to EHMR Integration

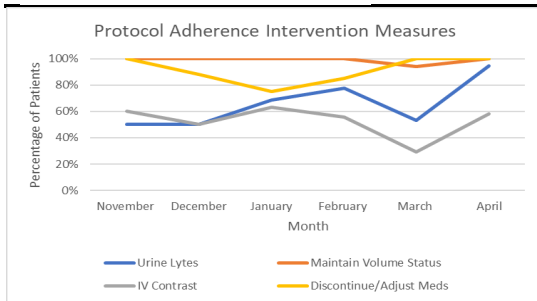
Metric	Value
Hosp Day Neph Consult	1.5 (1-2)
Avg GFR on ADMIN	37.3 (12-52)
Avg Cr on ADMIN	1.89 (1.04-3.52)
DC Nephrotoxic Meds	75% (3)
Daily Labs	75% (3)
IVF Administration	50% (2)
Strict I/O	0%
Bladder Scan	75% (3)
Dialysis/CRRT	25% (1)
Overall Protocol Adherence	0%

Table 2: Protocol Adherence Intervention Measures

Table 3: Synopsis of Results

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Metric	Pre	Post
Avg GFR on Admin	37.3	39.21
Avg Cr on Admin	1.89	1.66
DC Nephrotoxic Meds	75%	91.36%
Maintain Volume	50%	99.02%
Strict I/O	0%	92.71%
Dialysis/CRRT	4	1

CONCLUSION:

Early identification of patients who are at risk of development of AKI is crucial, given the consequences of such complications, therefore initiation of interventions is essential to prevent renal injury. Based on the study, implementation of an acute kidney injury protocol adherence marked improvement in the overall rate of an adverse event. At the time of discharge 97% of patients had improvement in serum Cr. 75% of patients discontinued nephrotoxic medications during hospital length of stay before utilization of protocol adherence documentation. Following implementation of protocol adherence, 91.36% of patients discontinued nephrotoxic medications during hospital length of stay. Pre implementation, 50% of patients and 0% of patients experienced maintained volume status and strict I/O monitoring respectively. Post implementation of protocol adherence, 99.02% of patients and 92.71% of patients encountered maintained volume status and strict I/O monitoring correspondingly. The number of acute kidney injury occurrences went from four pre utilization of protocol adherence, to just one case post utilization of protocol adherence. The implementation of acute kidney injury protocol adherence through EPIC dot phase documentation improved patient experience and safety during hospital stay. Utilizing technology available within a Level 2 Pursuing Adult Trauma can also help improve physician performance. Concerns regarding the study include: overutilization of nephrology, CT scans with IV contrast, especially in the elderly, without review of CKD history or current labs, less than 100% utilization of AKI protocol template and discontinuation/adjustment of nephrotoxic medications across all months of data analysis, and urine lytes not routinely ordered as part of AKI protocol. Through the initial implementation and following reevaluation, there was improvement in the rate of an incidence of an adverse event.

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EXAMINING THE EFFECT OF RELATIVE VALUE REIMBURSEMENT ON ACADEMIC PRODUCTIVITY

OBJECTIVES:

Work relative value units (wRVUs) are used to measure the services provided by trauma surgeons and ultimately correspond with reimbursement for those services. wRVUs are defined in a nationally standardized fashion by the Centers for Medicare and Medicaid Services and are intended to account for work performed in the care of a patient, including preoperative evaluation, operative intervention, and postoperative care. Practice expenses and professional liability insurance costs are additionally factored in with the work provided by the surgeon in determination of total wRVU allotments for a given procedure/condition. This system therefore accounts for the clinical performance of surgeons however non-clinical work, particularly academic endeavors, are not captured by this model. Given that hospital reimbursement is tied to wRVU generation, and that surgeon compensation often includes wRVU targets or may be strictly wRVU-based, it stands to reason that the academic activities may be undervalued as clinical productivity is emphasized in this model. There have been proposals of an academic RVU (aRVU) model to generate values based upon the assessment of productivity in areas aside from direct patient care; research, publications, podium presentations, resident/student education, administrative pursuits, and community outreach programs all represent important non-clinical components of the field of trauma surgery. Little data exists regarding the emphasis on RVU generation and its effects on academic productivity within the field of trauma surgery. This study sought to determine if increased wRVU generation correlates with decreased academic productivity within a fiscal year.

METHODS:

A retrospective review of the wRVU generation and academic productivity of trauma surgeons at a Level 1 trauma center was performed. Monthly wRVU totals by surgeon were collected for fiscal years 2007-2019, as were monthly academic publications corresponding to each fiscal year. Statistical analysis utilizing Stata program was then performed to determine correlation between these variables.

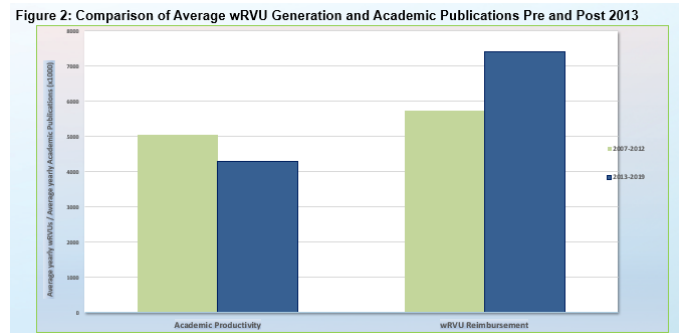
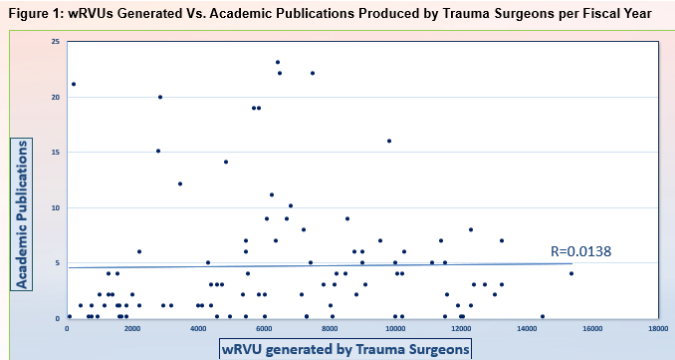
RESULTS:

Pearson correlation coefficient between total wRVU generation and total number of academic publications for each month of fiscal years 2007-2019 was calculated and found to be $R=0.0138$. A notable shift in wRVU generation was noted to occur around fiscal year 2013. Average monthly wRVU generation by surgeon prior to 2013 was 3011.97 and the average number of monthly publications was 5.06. After fiscal year 2013, the average number of monthly wRVUs generated by surgeon and monthly academic publications were 7410.72 and 4.3, respectively. When comparing surgeon productivity in their most productive years (wRVUs, publications), a negative relationship between total wRVUs generated and total academic publications was observed. Trauma Surgeon A, in their most productive academic year, generated 52.98% (6529.32 vs 12323.31, respectively) of the wRVUs that Trauma Surgeon B generated in their most productive year of wRVU generation. However, during this most-productive year in wRVU generation Trauma Surgeon B

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produced only 1 academic publication, which was 4.55% of the publications produced by Trauma Surgeon A (1 vs. 22, respectively)



CONCLUSION:

Little to no direct correlation between wRVU units generated and academic publications existed amongst trauma surgeons at a Level 1 trauma center over the course of the study from fiscal year 2007-2019. However, a trend in decreasing academic productivity was noticed following fiscal year 2013, when average monthly wRVU generation nearly doubled with a subsequent decrease in academic publications. Extremes of productivity, both academic and wRVU, tended to negatively affect the other. Maximum publication generation for Trauma Surgeon A led to nearly a 50% lower total wRVU generation as compared to Trauma Surgeon B's most productive RVU year. During Trauma Surgeon B's most productive wRVU year, only 1 (4.55%) publication was generated compared to the 22 publications generated by Trauma Surgeon A during their most productive academic year. As evidenced by this comparison, it can be inferred that increasing clinical work as evidenced by high wRVU generation leaves less time for academic pursuits. Conversely increasing academic pursuits as evidenced by a high number of publications tends to occur in the setting of fewer clinical interactions.

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CORRELATION OF RELATIVE VALUE UNIT REIMBURSEMENT WITH HOSPITAL LENGTH OF STAY IN TRAUMA SURGERY

OBJECTIVES:

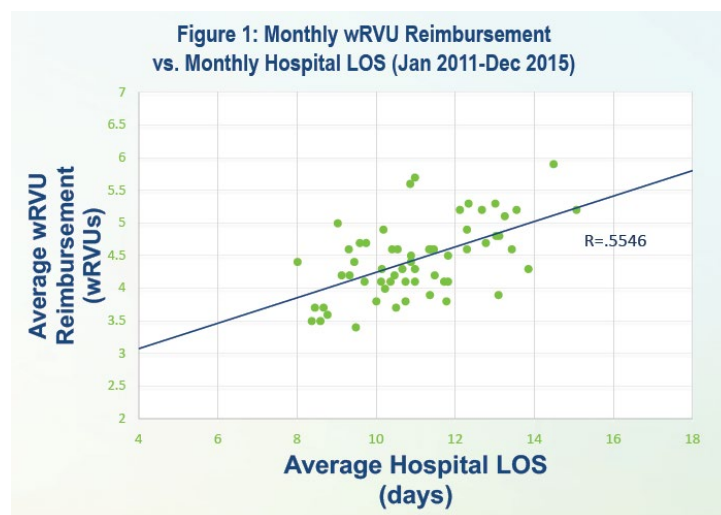
Determine if a correlation exists between work relative value unit (wRVU) generation and hospital length-of-stay (LOS) in trauma patients, and furthermore to ascertain if hospital LOS reduction initiatives have an impact on wRVU generation for trauma surgeons

METHODS:

A retrospective review of approximately 25,000 patient charts was performed for all patients admitted to the trauma service from 2011 – 2015, to bracket the length of stay initiatives implemented in 2013. Total wRVU reimbursement for each month, as well as monthly average length of stay for patients on the trauma service, were obtained. Scatter plot analysis and Pearson correlation test were used to evaluate for correlations between length of stay and wRVU generation.

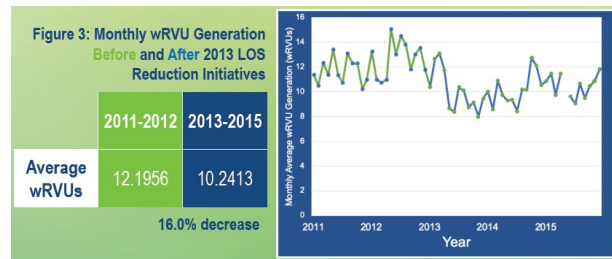
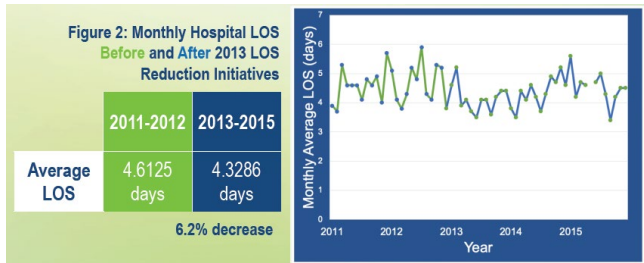
RESULTS:

A positive correlation between average monthly hospital LOS and wRVU generation ($R = 0.55$) was observed. Data was analyzed pre- (2011-12) and post- (2013-15) implementation of LOS reduction initiatives. The average LOS decreased by 6.2% in the post-implementation period as compared to the pre-implementation period (4.33 vs 4.61 days, respectively). Average monthly wRVU generation decreased 16.0% in the post-implementation time period, compared to pre-implementation period (10.24 vs 12.20 wRVUs, respectively).



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CONCLUSION:

A moderate positive correlation ($R=0.5546$) was observed between monthly wRVU generation and monthly length of stay for trauma patients. Based upon this observation, it was projected that wRVU generation would decrease following 2013 when length of stay initiatives were implemented at this institution. An analysis of the pre- and post-implementation data confirms a 6.2% decrease in the average hospital length of stay for trauma patients following the measures introduced in 2013. A greater decrease was seen in average wRVU generation per trauma patient, down 16% compared to pre-2013 levels. As evidenced by the data, the decrease in hospital length of stay correlates moderately to a decrease in wRVU generation per patient for the trauma surgeons at a Level 1 trauma center. Consequently, 2013 length of stay reduction measures may have contributed to a decrease in wRVU generation for trauma surgeons as it applies to the care of the patients admitted to the trauma surgery service. These findings support the hypothesis that reduction in trauma patient LOS may contribute to reduced wRVU generation. Trauma surgeon reimbursement through wRVU pay scales may be adversely affected by length of stay initiatives. Review and alteration of CMS criteria for RVU reimbursement in trauma care may incentivize increased productivity.

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Trends of Trauma Admissions in a Rural Trauma Center During Coronavirus Disease 2019 Pandemic

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Introduction: The rampant spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) led to implementing nationwide shutdowns and strict social distancing mandates. Many urban trauma centers anticipated a decline in trauma volumes during this time therefore reallocating hospital resources away from the trauma department. Our rural center followed the urban centers' recommendations. This study evaluates trauma trends in a rural level II trauma center during the pandemic.

Methods: A retrospective analysis of 1865 trauma admissions was performed from March 18 to November 15 prior to (2019) and during (2020) the US pandemic. Mechanism of injury along with Injury Severity Score (ISS) and basic demographics were collected. Both univariate and multivariate analyses were used to compare the data from both eras.

Results: There was no difference in the total number of trauma admissions prior to and during the pandemic (953 vs 912; $p > 0.05$). A subgroup analysis based on mechanism showed total blunt traumas decreased (920 vs 858; $p = 0.02$) while penetrating traumas increased (33 vs 54; $p = 0.02$) during the pandemic. Within the blunt trauma subgroup, we noted a significant increase in all-terrain vehicle accidents (31 vs 50, $p = 0.025$) and motorcycle accidents (71 vs 91; $p = 0.02$). There was no statistical difference in the median ISS, falls and motor vehicle accidents across the eras (Table 1).

Conclusions: Our rural trauma center reallocated resources away from the trauma service during the pandemic in anticipation for reduced trauma volumes. Our overall trauma admissions did not decline. We saw an increase in recreational vehicle crashes and penetrating traumas, the latter of which are typically associated with acute surgical intervention and thus would require more hospital resources dedicated to the trauma department. When considering the allocation of hospital resources during a pandemic, rural and urban trauma centers should consider their unique patterns of trauma admissions and population demographics.

Keywords: coronavirus, trauma, hospital resource allocation, pandemic

Table 1

	2019 (n = 953)	2020 (n = 912)	Univariate P-value ^a	OR (CI)	Multivariate P-value ^b
Injury severity score (median [IQR])	5.00 [2.00, 9.00]	5.00 [2.00, 9.00]	0.94		
Penetrating	33 (3.5)	54 (5.9)		2.00 (1.25-3.19)	< 0.01
Gunshot assault	6 (0.6)	12 (1.3)	0.20		
Stabbing assault	7 (0.7)	10 (1.1)	0.56		
Blunt	920 (96.5)	858 (94.1)	0.02	Ref	Ref
Motor vehicle accident	179 (18.8)	163 (17.9)	0.65		
Motorcycle accident	71 (7.5)	91 (10.0)	0.06	1.46 (1.05-2.03)	0.02
ATV	31 (3.3)	50 (5.5)	0.03	1.80 (1.13-2.86)	0.02
Fall	514 (53.9)	462 (50.7)	0.17		

a = Kruskal test

b = Multiple logistic regression model with variable selection by forward and backward step wise Akaike information criterion (AIC). Stepwise variable selection AIC = 2554 compared to all variable AIC = 2681

Surgical Rescue: A System-Wide MTP Rapid Response Program

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Objectives: The Acute Care Surgeon is a frequently utilized in-house resource for patients in extremis. However, there is often no one to call for patients in need of rapid surgical expertise for hemorrhage control in non-trauma designated hospitals. Within a health system that otherwise has access to such trauma resources, we aimed to develop a process whereby a backup Acute Care Surgeon could be activated and rapidly deployed to a non-trauma designated hospital within the same health system to aid in the active resuscitation of patients unexpectedly in extremis.

Methods: Patients were identified on activation of the hospital's massive transfusion protocol. The blood bank automatically notified the on-call trauma attending at the closest trauma center within the health system of any patient undergoing its definition of massive transfusion. The blood bank provided the patient name, location and attending physician. The on-call trauma attending then discussed the case with a bedside provider and quickly ascertained the need for additional resources. The backup surgeon was dispatched to the patient location to assist directly in hemorrhage control and resuscitation as well as determine the need for transfer to one of the system's trauma centers post-stabilization.

Results: In 2018 to 2020 there were 36 MTP activations at non-trauma designated hospitals within our health system. The blood bank notified the on-call trauma attending and a backup trauma surgeon was dispatched 28% of the time. Cases ranged from expected and/or controlled hemorrhage during cardiac or vascular surgery cases to unexpected complications during elective general, urologic, orthopedic or spine related cases to gastrointestinal bleeding to obstetrical emergencies peripartum. The trauma surgeon assisted anesthesia with resuscitation and/or scrubbed to assist and employ damage control and definitive surgical techniques.

Conclusions: Within a mature healthcare system, resources can be pooled, mobilized and dispatched across hospitals to meet the needs of patients in extremis. Utilizing this approach resulted in improved outcomes due to the knowledge and skill of the Acute Care Surgeon with regards to damage control resuscitation and rapid coordination of transfer to higher levels of care. Further research is needed to understand the benefit of utilizing Acute Care Surgeons for surgical rescue at non-trauma designated hospitals.

Routine Repeat Imaging of Pediatric Blunt Solid Organ Injuries is Not Necessary

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Routine Repeat Imaging of Pediatric Blunt Solid Organ Injury is Not Necessary
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Objectives:

Nonoperative management of hemodynamically stable patients with blunt splenic and/or hepatic injury has been widely accepted in the pediatric population. However, variability exists in the utilization and timing of repeat imaging (computed tomography or ultrasound) to assess for delayed complications (increased hemoperitoneum, pseudoaneurysm, delayed splenic rupture, new area of injury, infarct, abscess, vascular thrombus, pancreatic fistula, arteriovenous fistula, bile leak) during the index hospitalization. Recent level-IV evidence suggests that repeat imaging in children should be performed based on a patient's clinical status rather than on a routine basis. The aim of this study is to examine the rate of delayed complications and interventions (operative or interventional radiologic) in pediatric trauma patients with blunt splenic and/or hepatic injuries who undergo repeat imaging prompted either by a clinical change (CC) or non-clinical change (NCC) including institutional recommendations/protocols.

Methods:

A nine-year (2011-2019), retrospective, dual-institution study was performed of children (0-17 years) with blunt splenic and/or hepatic injuries. Patients were grouped based on reason for repeat imaging: clinical change (CC) or non-clinical change (NCC). CC included imaging prompted by patient symptoms, laboratory abnormalities, or vital sign changes. NCC included imaging performed on a routine, scheduled basis. The rate of organ specific delayed complications and interventions was examined by reason for scan. All data from the study was submitted to the Pennsylvania Trauma Outcome Study (PTOS) database.

Results:

A total of 307 injuries were included in the study period (174 splenic, 113 hepatic, 20 both). Of 194 splenic injuries, 30 (15.5%) underwent repeat imaging (CC = 19; NCC = 11). Of 133 hepatic injuries, 27 (20.3%) underwent repeat imaging (CC = 21; NCC = 6). There was no difference in the incidence of organ specific delayed complications between the CC and NCC groups. Of the four patients with complications necessitating intervention, only one was identified based on NCC.

Conclusion:

There was no difference in the incidence of delayed complications or interventions between the CC and NCC groups for either splenic or hepatic injuries. Our data suggests routine repeat imaging is unnecessary in children with blunt splenic and/or hepatic injuries; therefore, practitioners may rely on a patient's clinical change.

A Uniquely Violent Year – The Impact of Social and Political Events on 2020 Urban Injury Patterns

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Background: 2020 was marked by social and political events that substantially disrupted healthcare. The COVID-19 pandemic, lockdown, public health measures, as well as civic and political unrest over racial tensions during an election year could plausibly impact injury care. We hypothesized that increased injuries related to high-risk activities during 2020 was temporally related to sociopolitical unrest and pandemic public health measures.

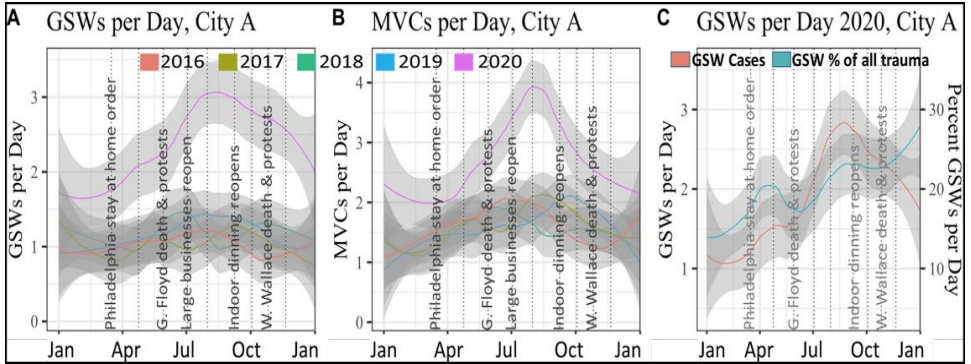
Objective: To describe the impact of sociopolitical events that took place in 2020 on rates of urban injury in two US cities.

Methods: Retrospective data from two Level 1 urban, adult trauma centers in different US states (City A population:1.6M, City B:0.21M) were assessed (1/1/2020-12/31/2020). Calendar months were divided into quartiles and compared to analogous quartiles in years 2016 -2019. Variables studied (demographics, injury mechanisms and outcomes) were compared between years, and across 2020 quartiles, against a backdrop of key sociopolitical events.

Results: More patients presented for injury in 2020 (A: n=1057, B: n= 1053) than in prior years ($p<0.05$). Compared to 2016-2019, 2020, patients were more often black (A:63.1% vs. 69.8% $p<0.001$; B:31.0% vs. 34.3%, $p=0.02$). Institution A patients were more likely to be male ($p=0.002$) & younger ($p<0.001$) in 2020 vs. 2016-2019. Both institutions noted a steep rise in gunshot wound (GSW) and motor vehicle collision (MVC) injuries following state lockdowns (Fig A, B) with a persistent rise in GSWs until late fall (Fig C).

Conclusion: 2020 was a unique year of sociopolitical unrest interwoven with a pandemic. Most affected populations were young, black males in two

different urban centers and primarily involved GSWs and MVCs. Future disaster response planning should consider the drivers of these trends to mitigate their impact, especially in vulnerable populations.



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Use of the Hybrid Operating Room for Pelvic Angiography

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Introduction: The use of the hybrid operating room (OR) is an emerging practice in critically injured patients with pelvic fractures requiring a multidisciplinary approach. Our aim was to evaluate the timeliness of pelvic angiography comparing the hybrid OR to the interventional radiology (IR) department. We hypothesize that time to angiography would be shorter in the hybrid OR than in the IR department.

Methods: All PTOS patients with pelvic fractures in a single level 1 trauma center were identified from January 2014 to May 2021 from the hospital trauma registry. Patients who went directly to the OR or IR from the emergency department (ED) and who underwent pelvic angiography were included. Data collected included age, ED arrival time, initial systolic blood pressure (SBP) and Injury Severity score (ISS). Primary outcome was time to initiation of pelvic angiography from arrival to ED. This was determined by the time difference from ED arrival to the first fluoroscopic image recorded. Secondary outcome was in-hospital mortality. Univariable analysis was performed with a p value of <0.05 considered statistically significant.

Results: Of 581 patients with pelvic fractures, 49 (8%) met inclusion criteria. Of these, 19 (39%) were treated in the hybrid OR. Hybrid OR patients underwent other procedures (exploratory laparotomy, [n=11], intracranial pressure monitor insertion [n=4], completion amputations [n=2], external fixation of extremities [n=2], resuscitative percutaneous balloon aortic occlusion [n=1], closure of complex lacerations [n=2]). Three had preperitoneal pelvic packing during laparotomy. Only two patients had only angiography without other procedures. Hybrid OR patients were more severely injured (median ISS 33 vs. 16.5, p=0.001), younger (median age 51 vs 68 years, p=0.002), and had lower initial SBP (median 113 vs 135 mmHg, p=0.04) with a shorter time to angiography (median 111 vs 140 minutes, p=0.05). Mortality was higher in the hybrid OR patients (6/19 [31%] vs 1/30 [3%], p=0.01). Only one death was directly related to hemorrhage.

Conclusion: Time to initiation of pelvic angiography was shorter in the hybrid OR patients despite the need to perform associated procedures prior to angiography. The hybrid OR appears to be an efficient use of resources for the critically injured patient requiring operative procedures with pelvic fractures.

Title: The Impact of Location of Injury on Physical Functioning, Pain Intensity, and Pain Interference Six Months After Injury

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Objectives

Traumatic injuries can have lasting physical effects that persist long after hospitalization, but little is known about how various injury diagnoses impact long-term recovery. We compared pain and physical functioning at 6 months between patients with and without lower extremity (LE) injuries. We hypothesized that patients with lower extremity injuries (LEI) would have worse outcomes than patients with any other injuries (OI).

Methods

We surveyed patients admitted to a level 1 trauma center between 7/2019-11/2020 six months after injury about functioning and quality of life after injury, using the PROMIS-29 instrument, a primary care PTSD screen (PC-PTSD-5), and questions about substance use, employment, and living situation. Injury location and severity were collected from our institutional trauma registry. LE patients were compared to OI patients. PROMIS-29 scores were converted to t-scores to compare outcomes to the U.S. population. Responses were analyzed using chi square, t-tests, and Wilcoxon signed-rank tests for differences between groups.

Results

124 patients completed the 6-month post trauma survey, including 48 (38.7) LEI patients. There were no significant differences in age (42 (25-59) years vs 43 (29-60) years, $p=0.53$), race (62% vs. 63% Black, $p=0.58$), sex (33% vs 25% female, $p= .35$) or mechanism of injury. LEI patients more often underwent an operation (81% vs 37%, $p < 0.001$). At 6 months, LEI patients had a mean PROMIS T score for pain interference of 53 (SD 12) compared to 56 (12) for OI patients ($p=0.21$) and a mean PROMIS T score for physical function of 43 (SD 10) compared to 44 (12) for patients without lower extremity injuries ($p=0.85$). LEI patients had a mean score for pain intensity of 3 on a scale from 0 to 10 compared to 5 for patients without lower extremity injuries ($p=0.12$).

Conclusion

Contrary to our initial hypothesis patients with lower extremity injuries had similar PROMIS T scores for pain and physical function compared to those without lower extremity injuries. Future studies should incorporate the impact of injury location and of polytrauma on long-term function and quality of life.