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TRAUMA RECIDIVISTS: SURPRISINGLY BETTER OUTCOMES THAN INITIALLY-INJURED TRAUMA PATIENTS

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Abstract

Objective—The purpose of this study was to determine if there was a difference in hospital outcomes between trauma recidivists (RCID) and non-recidivists (NRCID).

Methods—Outcomes of RCID and NRCID were compared. A *recidivist* was defined as a patient with a history of hospital evaluation for injury within the prior 5 years. Patients with *good functional status* had a Glasgow Outcome Score of 4-5.

Results—Of the 2,127 patients admitted, 466 (22%) were recidivists. NRCID were more likely to have Injury Severity Score>25 (12% vs. 8.6%; p=0.04) than RCID. Eighty-eight percent of RCID were discharged with a good functional status compared with 83% of RCID (p=0.02). NRCID were more likely to be admitted to a critical care unit (43% vs. 36%; p=0.01), but there was no significant difference in hospital mortality.

Conclusions—RCID were less severely injured and had better hospital outcomes than NRCID.

Traumatic injury is the leading cause of death in the first four decades of life in most developed countries (1). It is also the third leading cause of all-age mortality behind only cancer and heart disease if unintentional injury and homicide are grouped together (2). Since the population affected by trauma is younger than for many other diseases, injury affects the potentially most productive members of society, thus the economic aspect of injury is staggering.

A *trauma recidivist* (RCID) is defined as a patient who presents on multiple occasions for different injury events. We have previously found that 25.2% of trauma patients in our institution had a previous injury requiring hospital evaluation in the prior five years (3). Trauma could thus be considered as a chronic disease with a risk of recurrence, as many injuries are not isolated, random events. Prior series have demonstrated many characteristics of trauma RCID; some of these include young age, male gender, racial minority, lack of health insurance, low socioeconomic status, substance abuse, and criminal activity (4-5). Many authors have addressed the issue of trauma recidivism, but most studies have been small retrospective series.

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Little is known about outcomes of trauma RCID. It is our belief that many trauma care providers assume that RCID have poorer outcomes. This study was meant to evaluate the hospital outcomes of RCID and compare them with first-time trauma patients (NRCID).

Patients and Methods

All patients who were trauma activations and who were admitted to a surgical service at MetroHealth Medical Center (MHMC), the level 1 trauma center in Cleveland OH, from May 4, 2009 until May 31, 2010, were included. Patients admitted directly to the hospital without being seen first in the Emergency Department (ED) were excluded.

Each patient was asked if, in the past five years, he or she had been evaluated in an ED for an injury, whether admitted or not. A positive response to this inquiry identified the patient as RCID. Patients who could not be asked this question on admission for any reason were asked at a later point in their hospital course. If a response still could not be obtained, a review of the electronic medical record was performed to evaluate if the patient had been treated at our hospital for an injury in the last 5 years.

Information for this study was obtained from the electronic medical record and the Northeastern Ohio Trauma System patient registry. Study variables for hospital outcomes included mortality, disposition, functional status, total length of stay, intensive care unit (ICU) length of stay, tracheostomy necessity, and ventilator days. Injury subgroups included vehicular, interpersonal violence (IPV), fall, and other. The IPV category included assaults, stab wounds, and gunshot wounds. The other category included self-inflicted wounds, bicycle crashes, industrial injuries, sporting mishaps, boating collisions, burns, bites, abuse, hangings, drownings, and smoke inhalation.

Hospital mortality was assessed by noting deaths that occurred before the patient was discharged from the trauma center. Disposition was recorded as home, rehabilitation facility, coroner/hospice, or other long-term facility. The patients' disposition from the ED was also recorded as floor, ICU, or operating room (OR). Patients who went directly to the angiography suite were included in the OR group.

Functional status was measured based on the Glasgow Outcome Score (GOS) as described by Jennett and Bond (10). Patients who had a return to an essentially normal life (with perhaps some minor deficits) were given a score of 5 for "good recovery." Patients who were disabled but independent (ambulatory with assistance at the time of discharge) were given a score of 4 for "moderate disability." Patients who were conscious but disabled (wheelchair-bound or bed-bound with intact mental capacity) were given a score of 3 for "severe disability." Patients who were minimally responsive (wheelchair-bound or bed-bound without intact mental capacity) were given a score of 2 for "persistent vegetative state." Patients who did not survive their hospitalization were given a score of 1 for "death." These patients were then grouped into a "functional" or "poor functional" status based on their GOS. Those with a GOS of 4-5 were said to have a *good functional status*, while those with GOS of 1-3 had a *poor functional status*.

Categorical variables were analyzed with Chi-square tests or Fisher's exact test, while continuous variables were analyzed with the Student's *t* test. Multivariable logistic regression analysis was used to calculate the adjusted odds ratios. Significance was attributed to a p value <0.05. All analysis was conducted with SPSS version 17.0. This study was approved by the Institutional Review Board at MHMC.

Results

Of the 2,127 patients admitted to the hospital during the study period, 466 (22%) were RCID and 1661 (78%) were NRCID. Fourteen RCID and 28 NRCID died in the ED, leaving 2,087 patients for analysis.

NRCID tended (p=0.07) to be slightly older than RCID: 44.2±23.9 years versus 42.1±20.9 years respectively (Table 1). Black patients accounted for 27% of RCID and 21% of NRCID (p=0.03). White patients represented 69% of RCID and 74% of NRCID (p=0.02). The majority of both groups were males with 76% in the RCID group and 69% in the NRCID group (p=0.05). The NRCID tended toward a higher mean ISS of 12.2±10.1 compared with RCID, who had an average ISS of 10.9±8.1 (p=0.08). There were more penetrating injuries among the RCID (21% vs. 11%; p<0.001). There were also significant differences among the causes of injuries, with significantly more RCID having injuries resulting from IPV (25% vs. 14%; p<0.001), while more NRCID sustained injuries from vehicular collisions (37% vs. 27%; p<0.001). There was no difference in the prevalence of falls between RCID and NRCID.

Following the initial evaluation in the trauma bay, RCID tended to go directly to the regular patient floor (50% vs. 46%; p=0.07) while significantly more NRCID went to the ICU (43% vs. 36%; p=0.01). No significant difference was found in direct OR admission between RCID and NRCID. At hospital discharge, significantly more RCID than NRCID were sent to their homes (72% vs. 66%; p=0.01), while more NRCID went to either skilled nursing facilities, rehabilitation centers, or other long-term facilities, (28% vs. 24%; p=0.05). There were no significant differences in hospital length of stay, ICU days, ventilator days, or need for a tracheostomy between RCID and NRCID.

Unadjusted analysis revealed that RCID had 48% higher odds of leaving the hospital with a good functional status compared with NRCID (p=0.02; Table 2). After controlling for gender, race, age, and ISS, RCID had 13% higher odds of having a good functional status at discharge compared with NRCID, but this was no longer significant. There was no significant difference in hospital mortality between the two groups.

Analysis of hospital outcomes in the subgroup analysis revealed that the IPV, fall, and vehicular subgroups all had a higher proportion of RCID with a good functional status at discharge and of NRCID with a poor functional status at discharge, but this only reached significance in the fall subgroup. There was no significant difference in hospital mortality between RCID and NRCID in the subgroup analysis.

Comments

Several authors have described characteristics of trauma RCID. Brooke found that of 15,973 trauma victims, 15.7% were RCID, defined as repeat trauma admissions over a 7-year period (6). Also, for each subsequent penetrating trauma visit, the mortality increased over twofold. A case-control study by Cooper found that RCID had a median age of 31 and that recidivism was associated with being a black male and with unemployed status, lack of medical insurance, an annual income less than $10,000, current drug use, and testing positive for psychoactive substances (4).

A number of studies have specifically targeted interpersonal violence (IPV) and recidivism. Morrissey found that of 389 patients who sustained penetrating trauma over a 12-month period in New Orleans, 32.6% had sustained two or more episodes of penetrating trauma (5). It was found that the incidence of recurrent trauma was highest in males, blacks, and the uninsured. In a study examining youths less than 25 years of age in San Francisco who were

victims of IPV (gunshot wounds, stab wounds, or assaults) by Tellez, it was found that 16% had suffered a prior episode of IPV and that 94% of these had experienced this within the past five years (7). Over a 3-year period, 38 youths died due to this repeat IPV; of these 92% were due to gunshot wounds.

Recidivism in other populations has also been studied. For example, McGwin found that in the elderly population that those who had been injured were 3.25 times more likely to be injured during a defined follow-up period compared with an uninjured cohort (8). Those who were found to be at the greatest risk for recurrent trauma were found to be women and those with chronic medical conditions or functional impairment. Toschlog studied recidivism in a rural setting and found that over nine years, 3.4% of consecutive trauma patients were RCID (9). These rural trauma RCID tended to be older, white, and female. Common features with urban trauma, however, were noted in that these rural RCID had higher alcohol levels and higher prevalence of cocaine use. The total cost for all rural RCID over this period exceeded $7 million.

Little work has been done to evaluate the outcomes of trauma RCID. In this study, contrary to our initial hypothesis, trauma RCID did not have worse hospital outcomes when compared with NRCID. In fact, 88% of trauma RCID had a good functional outcome when discharged from the hospital compared to 83% of NRCID, although there was no difference in hospital mortality between the two groups. RCID thus had a 48% greater odds of a good functional status compared with NRCID, and this was statistically significant ($p=0.02$). After adjustment for age, gender, race, and ISS, however, the effect was attenuated and was no longer significant. The fact that there was a trend toward younger age in RCID and the fact that RCID were less severely injured likely accounted for this difference. Multivariate logistic regression analysis also revealed that patients aged 80 and above had 70% lower odds of a good functional outcome compared with those aged 21-40. In addition, every unit increase in ISS was associated with a 12% decreased odds of having a good functional status. These two associations were statistically significant.

We acknowledge certain limitations to our study. This study only included patients seen at our level 1 trauma center. There are several other level 2 and level 3 trauma centers in the area that could have treated many of the trauma recidivists in our community. Other trauma recidivism studies have also faced this challenge (6, 7). A study including all regional trauma centers would be more representative of all trauma RCID treated in this community. Additionally, the data used only represents one year of trauma patient visits to the hospital. A follow-up study investigating hospital outcomes for trauma patients over a 5 or 10-year period would decrease this limitation. A significant number of trauma RCID might expire before reaching the hospital, thus going directly to the coroner. This could lead to an inaccurate hospital mortality calculation. Future studies should include mortality information from all local coroner’s offices and also all surrounding hospitals.

Our study shows that the hospital outcomes of trauma RCID are not as poor as we previously thought. Factors contributing to these better than expected outcomes might include protective factors among RCID that prevent them from being more severely injured. These factors have yet to be elucidated and require more investigation. It is important to remember that despite their better than expected hospital outcomes, trauma RCID impart a significant financial burden to society and have been found to have an increased risk of mortality with subsequent trauma visits. Therefore, further investigation into the characteristics of trauma recidivism is necessary to effectively combat this public health problem.

References

1. American College of Surgeons Committee on Trauma. Advanced Trauma Life Support Student Course Manual. 9th edition. American College of Surgeons; Chicago, IL: 2012.
2. National Vital Statistics Reports. Deaths: Final Data for 2009. Volume 61(Number 7) http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_07.pdf.
3. McCoy AM, Como JJ, Greene G, et al. A novel prospective approach to evaluate trauma recidivism: the concept of the past trauma history. J Trauma Acute Care Surg. 2013; 75:116–121. [PubMed: 23778450]
4. Cooper C, Eslinger D, Nash D, et al. Repeat victims of violence: report of a large concurrent case-control study. Arch Surg. 2000; 135:837–843. [PubMed: 10896379]
5. Morrissey TB, Byrd CR, Deitch EA. The incidence of recurrent penetrating trauma in an urban trauma center. J Trauma. 1991; 31:1536–1538. [PubMed: 1942177]
6. Brooke BS, Efrom DT, Chang DC, et al. Patterns and outcomes among trauma recidivists: it only gets worse. J Trauma. 2006; 61:16–20. [PubMed: 16832245]
7. Tellez MG, Mackersie RC, Morabito D, et al. Risks, costs, and the expected complication of re-injury. Am J Surg. 1995; 170:660–664. [PubMed: 7492022]
8. McGwin G, May AK, Melton SM, et al. Recurrent trauma in elderly patients. Arch Surg. 2001; 136:197–203. [PubMed: 11177141]
9. Toschlog EA, Sagraves SG, Bard MR, et al. Rural trauma recidivism: a different disease. Arch Surg. 2007; 142:77–81. [PubMed: 17224504]
10. Jennett B, Bond M. Assessment of outcome after severe brain damage. Lancet. 1975; 305:480–484. [PubMed: 46957]

Table 1

Patient Descriptive Data

	Recidivists N=452 (22%)	Non-Recidivists N=1633 (78%)	p-value
Race			
Black	122 (27%)	335 (21%)	
White	311 (69%)	1214 (74%)	0.01
Other	19 (4%)	84 (5%)	
Gender			
Male	342 (76%)	1125 (69%)	0.005
Age	42.1 ±20.9*	44.2 ± 23.9*	0.07
Injury Severity Score	10.9 ±8.1*	12.2 ±10.1*	0.003
Injury Type			
Blunt	355 (79%)	1429 (88%)	<0.001
Penetrating	96 (21%)	179 (11%)	
Injury Cause			
Interpersonal Violence	112 (25%)	232 (14%)	
Fall	145 (32%)	559 (34%)	<0.001
Vehicular	120 (26%)	599 (37%)	
Other	75 (17%)	243 (15%)	
ED Disposition			
Floor	228 (50%)	746 (46%)	
ICU	164 (36%)	699 (43%)	0.04
Operating Room	60 (13%)	188 (12%)	
Discharge Disposition			
Home	327 (72%)	1080 (66%)	
Rehabilitation	45 (10%)	208 (13%)	0.08
Long Term Facility	61 (14%)	252 (15%)	
Coroner/Hospice	19 (4%)	93 (6%)	
Hospital Length of Stay	4.8 ± 6.1* 3 (1-53)**	5.3 ± 7.4* 3 (1-82)**	0.11
ICU Length of Stay	2.0± 5.2* 0 (0-44)**	2.7± 6.6* 0 (0-66)**	0.03
Ventilator Days	0.8± 3.6* 0 (0-39)**	1.3± 4.6* 0 (0-54)	0.02
Tracheostomy	13 (3%)	69 (4%)	0.15

*Means ± SD;

** Median (Range)

ED = Emergency Department; ICU = Intensive Care Unit

Table 2

Recidivist (RCID) vs. Non-recidivist (NRCID) Outcomes

Results – All mechanisms	**RCID N = 452**	**NRCID N = 1633**	**Unadjusted Analysis OR (95% CI)**	**p**	**Adjusted Analysis* OR (95% CI)**	**p**
Functional Status	351 (88%)	1128 (83%)	1.48 (1.06 – 2.06)	0.02	1.13 (0.78 – 1.65)	0.53
Hospital Mortality	18 (4%)	86 (5%)	0.75 (0.44 – 1.25)	0.27	1.22 (0.69 – 2.17)	0.49
Results – Interpersonal Violence	**RCID N = 112**	**NRCID N = 228**	**Unadjusted Analysis OR (95% CI)**	**p**	**Adjusted Analysis * OR (95% CI)**	**p**
Functional Status	90 (94%)	171 (88%)	2.02 (0.79 – 5.13)	0.10	1.62 (0.52 – 5.09)	0.41
Hospital Mortality	4 (4%)	11 (5%)	0.73 (0.23 – 2.35)	0.60	1.03 (0.27 – 3.89)	0.97
Results - Fall	**RCID N = 145**	**NRCID N = 559**	**Unadjusted Analysis OR (95% CI)**	**p**	**Adjusted Analysis * OR (95% CI)**	**p**
Functional Status	117 (90%)	391 (82%)	1.93 (1.04 – 3.59)	0.04	1.47 (0.75 – 2.86)	0.26
Hospital Mortality	8 (6%)	35 (6%)	0.87 (0.40 -1.93)	0.74	1.53 (0.63 – 3.71)	0.35
Results - Vehicular	**RCID N = 120**	**NRCID N = 673**	**Unadjusted Analysis OR (95% CI)**	**p**	**Adjusted Analysis * OR (95% CI)**	**p**
Functional Status	88 (85%)	443 (81%)	1.35 (0.75 – 2.43)	0.32	1.08 (0.55 – 2.11)	0.82
Hospital Mortality	2 (2%)	30 (4%)	0.36 (0.09 – 1.54)	0.17	0.54 (0.11 – 2.64)	0.45

* After adjusting for Gender, Race, Age and Injury Severity Score