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Injury patterns and outcomes in late middle age (55–65): The intersecting comorbidity with high-risk activity – A retrospective cohort study

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ABSTRACT

Background: Late middle age (LMA), is a watershed between youth and old age, with unique physical and social changes and declines in vitality, but a desire to remain active despite increasing comorbidity. While post-injury outcomes in the elderly are well studied, little is known regarding LMA patients. We analyzed the injured LMA population admitted to a rural, regional Level 1 Trauma Center relative to outcomes for both younger and older patients.

Materials and methods: Our registry was queried retrospectively for patients admitted 7/2008- 12/2015; they were divided into three cohorts: 18–54, 55–65, and > 65 years. Demographics, injury details, comorbidities, and outcomes were compiled and compared using ANOVA and Chi-square; $p < 0.05$ was significant.

Results: During the study period, 10,543 were admitted; 1419 (14%) were LMA who experienced overall injury mechanisms, severities and patterns that mirrored the younger cohort. However comorbidity rates were high (56.4%) and comparable to the elderly. LMA patients had the highest rates of alcohol abuse, morbid obesity, and psychiatric illness ($p < 0.0001$) and suffered the poorest outcomes: highest complications and hospital charges, and longest ICU and hospital LOS. LMA mortality (4.1%) was 41% higher than younger patients (2.9%; $p < 0.02$) and similar to the older cohort (4.7%; $p = 0.32$).

Conclusions: The LMA population has similar mechanisms and injury patterns to younger patients, while exhibiting comorbidity rates similar to the elderly. High-energy injuries exact a greater toll in LMA with poorer outcomes and greater resource utilization. Targeted outreach for injury prevention, and future studies, are needed to address high-risk behavior, substance abuse, and societal contributors.

1. Background

Late middle age (55–65) represents the final watershed between youth and old age. In this stage of life, many individuals remain in the workforce, have achieved a certain degree of financial freedom, and strive to keep active despite beginning to develop comorbidities [1–3]. Yet, as their children have moved away, and they prepare to transition toward retirement, this group also experiences certain social and psychological stresses related to a real or perceived decrease in vitality [2–4]. Indeed by their late 60's, 32% Americans have at least one chronic disease and 22% have greater than three [5]. Further, substance abuse disorders, depression, and other psychiatric diseases are increasingly common amongst the middle-aged [2–4,6,7]. We postulated that these factors combine to create a “perfect storm” of relatively unfit patients engaging in high-risk activity. While the “elderly,” those patients aged > 65, are known to have poorer outcomes after traumatic injury [8], little is known regarding the specific epidemiology and outcomes for those injured in late middle age (LMA). We sought to characterize the LMA injured population, treated at a rural Level 1 Trauma Center, and compare outcomes for this group to both younger and older patients in this setting.

2. Materials and methods

East Texas Medical Center (ETMC) is an American College of Surgeons Verified Level 1 Trauma Center, which leads a regionalized trauma system located in rural northeast Texas. ETMC admits approximately 1500 patients per year; nearly half are transferred from a stabilizing facility. After approval from the ETMC Institutional Review Board, the Trauma Center registry was queried to include all adult patients (aged ≥ 18 years) admitted from July 2008 through December 2015. Demographics, injury details, Injury Severity Score (ISS), comorbidities, and outcomes (complications, length of stay (LOS), mortality, hospital charges) were compiled in Excel spreadsheets

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Table 1
Demographics.

Demographics	< 55	55–65	> 65	p value
N (10543 Total)	5687 (54%)	1419 (14%)	3427 (32%)	
Age (Mean ± SD), yrs	52.9 ± 22.4			
Sex - % Male	73.8%	64.9%	40.3%	< 0.00001
Race				< 0.00001
Caucasian	71.0%	84.2%	92.8%	
Non-caucasian	29.0%	15.8%	7.2%	
Transfer	46.1%	45.5%	47.4%	0.37
Uninsured	31.3%	16.3%	3.9%	< 0.00001

(Microsoft, Redmond, WA). "Major Comorbidities" were any of the following: coronary artery disease, congestive heart failure, chronic obstructive pulmonary disease, diabetes mellitus, hypertension, morbid obesity, chronic renal failure, stroke history, cancer history, peripheral vascular disease, cirrhosis, dementia, or schizophrenia). Data were uploaded into Wizard for Mac (v1.8, Chicago, IL) for statistical analysis.

For this single-center retrospective cohort study, patients were separated into three age group cohorts: younger (18–54), late middle aged (LMA) (55–65), and elderly (> 65 years) and compared. ANOVA was used for continuous variables and Chi-square was used for categorical variables; $p < 0.05$ was significant. *Post hoc* testing, with Bonferroni correction, was used to further scrutinize significant differences between individual age groups.

3. Results

During the 7.5-year study period, 10,543 adult patients were admitted to ETMC after traumatic injury. Of these, 1419 (13.5%) were LMA. For the study population, mean age and demographics, by group, are summarized in Table 1.

3.1. Injury data

Mechanisms of injury and major injuries sustained are presented in Table 2. LMA patients had the highest rate of motorcycle crashes and the highest rate of "falls greater than ground level" compared to the other groups. The LMA cohort also had similar rates for all-terrain vehicle (ATV) crashes and "other" non-fall blunt trauma (i.e. animal-related, tractor/machinery, boating/recreational) to the younger group, which were much higher than observed in older patients. Overall, the combined rate for injuries due to these higher risk activities was greatest amongst LMA patients accounting for 35.7% of injuries, compared to 32.9% for younger patient injuries, and only 10.3% for elderly patients ($p < 0.00001$). Rates for penetrating injury and assaults fell in between the other two groups.

Table 2
Injury Data.

	< 55	55–65	> 65	p value
Mechanism of Injury				
Motor Vehicle Crash	33.9%	20.3%	11.9%	< 0.00001
Motorcycle Crash	7.0%	9.8%	1.0%	< 0.00001
ATV/other blunt	23.5%	20.2%	7.1%	< 0.00001
Fall from Height	4.4%	7.7%	3.0%	< 0.00001
Ground level fall	11.3%	33.9%	74.8%	< 0.00001
Penetrating Trauma	13.4%	5.7%	2.0%	< 0.00001
Assault	6.5%	2.4%	0.2%	< 0.00001
Injury Patterns				
ISS (mean ± SD)	*11 ± 9*	*11 ± 8*	10 ± 6	< 0.00001
Traumatic Brain Injury	*19.0%*	*20.5%*	23.5%	< 0.005
Spine Fracture	*20.1%*	*21.6%*	15.7%	< 0.00001
Rib Fracture(s)	17.1%	23.0%	11.6%	< 0.00001
Hemo/pneumothorax	*19.1%*	*16.8%*	8.0%	< 0.00001
Abdominal Organ/Viscus	12.7%	8.2%	4.0%	< 0.00001
Open Extremity Fracture	*12.5%*	*10.4%*	5.1%	< 0.00001
Pelvic Fracture	*9.3%*	*8.5%*	7.0%	< 0.002
Spinal Cord Injury	*2.8%*	*3.9%*	2.0%	< 0.0005

Italics: statistically similar between groups in *post hoc* testing.

Table 3
Comorbidities.

	< 55	55–65	> 65	p value
Substance Abuse				
Alcohol	9.6%	11.6%	3.5%	< 0.00001
Tobacco	29.9%	24.9%	9.7%	< 0.00001
Illicit Drugs	6.4%	3.3%	2.1%	< 0.00001
Substance Abuse (any)	36.1%	31.3%	12.9%	< 0.00001
Comorbidities				
Hypertension	13.0%	41.8%	57.4%	< 0.00001
Diabetes Mellitus	5.2%	*20.3%*	*22.0%*	< 0.00001
COPD	2.4%	8.6%	11.7%	< 0.00001
Psychiatric Illness	5.0%	7.8%	5.8%	< 0.0003
Morbid Obesity	4.9%	8.7%	4.5%	< 0.00001
Comorbid status	23.9%	56.4%	72.2%	< 0.00001

Italics: statistically similar between groups in *post hoc* testing.

For injury severity and types of injuries sustained (injury pattern), analysis demonstrated differences between age groupings for all injures compared. Post hoc testing between individual groups revealed that for injury severity and rates for most injuries tested, the young cohort and the LMA group were statistically similar. Specifically the incidence of traumatic brain injury (TBI), hemo/pneumothorax, pelvic fracture, spine fracture, spinal cord injury, and open extremity fracture were all statistically similar between the young and LMA groups. Further, LMA patients actually had the highest rate of rib fractures, spine fractures, and spinal cord injuries amongst the study population. Patterns for the elderly group were overall very different and seemed to reflect the lower energy mechanisms.

3.2. Comorbidities

Substance abuse and comorbidity rates are presented in Table 3. Alcohol abuse was actually highest amongst the LMA group. Tobacco abuse also remained common into LMA while illicit drug abuse was not. Overall, rate of substance abuse amongst LMA patients was high, approaching that of the younger cohort and was 2.4 times greater than in the elderly group. In contrast, compared to the younger patient cohort, LMA patients had much higher rates of hypertension, COPD, diabetes, and obesity. Diabetes rates were statistically similar to the older cohort ($p = 0.19$). Morbid obesity was highest amongst the LMA group. As expected, overall "comorbid status" for LMA patients fell between the other two cohorts but more closely approached the elderly cohort.

3.3. Outcomes

Outcomes are presented in Table 4. Infectious, non-infectious, and

Table 4
Outcomes.

	< 55	55–65	> 65	p value
Complications				
Infectious	7.0%	8.7%	6.7%	< 0.05
Major (non-infectious)	7.0%	9.6%	7.7%	< 0.003
Total	9.1%	*11.8%*	*10.1%*	< 0.003
Length of Stay				
ICU (mean ± SD), d	5.9 ± 8.5	6.9 ± 8.9	6.1 ± 7.1	< 0.005
Hospital (mean ± SD)	7.1 ± 9.6	7.7 ± 8.9	6.4 ± 5.7	< 0.00001
Charges (mean)	$126,900	$168,300	$113,300	< 0.02
Mortality	2.9%	*4.1%*	*4.7%*	< 0.00002

Italics: statistically similar between groups in *post hoc* testing.