


Epidemiological changes of geriatric trauma in the United Arab Emirates

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Abstract

We aimed to study the epidemiological changes in geriatric trauma in Al-Ain City, United Arab Emirates, in the past decade to give recommendations on injury prevention.

Trauma patients aged 65 years and above who were hospitalized at Al-Ain Hospital for more than 24 hours or died in the hospital after their arrival regardless of the length of stay were studied. Data were extracted from the Al-Ain Hospital trauma registry. Two periods were compared; March 2003 to March 2006 and January 2014 to December 2017. Studied variables which were compared included demography, mechanism of injury and its location, and clinical outcome.

There were 66 patients in the first period and 200 patients in the second period. The estimated annual incidence of hospitalized geriatric trauma patients in Al-Ain City was 8.5 per 1000 geriatric inhabitants in the first period compared with 7.8 per 1000 geriatric inhabitants in the second period. Furthermore, mortality was reduced from 7.6% to 2% ($P=0.04$). There was a significant increase in falls on the same level by 14.9% (62.1%–77%, $P=0.02$, Pearson χ^2 test). This was associated with a significant increase of injuries occurring at home (55.4%–78.7% $P=0.0003$, Fisher Exact test). There was also a strong trend in the reduction of road traffic collision injuries which was reduced by 10.8% (27.3%–16.5%, $P=0.07$, Fisher Exact test).

Although the incidence and severity of geriatric trauma did not change over the last decade, in-hospital mortality has significantly decreased over time. There was a significant increase in injuries occurring at homes and in falls on the same level. The home environment should be targeted in injury prevention programs so as to reduce geriatric injuries.

Abbreviations: AIS = Abbreviated Injury Scale, EMS = emergency medical service, GCS = Glasgow Coma Scale, ICU = intensive care unit, ISS = injury severity score, NISS = new injury severity score, RTC = road traffic collision, SBP = systolic blood pressure, SD = standard deviation.

Keywords: Geriatric, incidence, injury, mechanism, prevention, trauma

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Ethical approval for this study was obtained from the Human Research Ethics Committee of the Al-Ain Hospital, Al-Ain, United Arab Emirates (AAHEC-03-20-008).

There is no additional data available to share with the readers. Data can be shared with the Editor of the Journal if requested.

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1. Introduction

Trauma is a disease of the young. However, the aging world population is changing this pattern with a significant impact on trauma outcomes.^[1,2] People are living longer and remain active well into old age. In 2019, 9% of the world population was over the age of 65 years, which is projected to exceed 16% by 2050.^[3] The percentage of geriatric patients included in trauma registries is increasing globally.^[2,4] In 2014, injuries in the age group 60 years and above accounted for more than 50% of all major trauma in England and Wales compared with 20% in 2005.^[1] Geriatric trauma is significantly different from trauma in young adults. It is now seen as a different disease characterized by low energy falls, delayed diagnosis, and increased mortality.^[5] The poor outcome in geriatric trauma is multi-factorial and attributed to co-morbidities, frailty, reduced physiological reserves, and the effects of prescribed medications.^[6]

The United Arab Emirates (UAE) is a high income rapidly developing country with about 80% expatriates, the majority of whom are young workers.^[7] Trauma, which mainly affects young men, is the second leading cause of death in the UAE, causing 17% of all deaths.^[7] We have previously studied geriatric trauma in our city and found that falls on the same level were the most frequent mechanism of injury and that death was high among pedestrian road traffic collision (RTC) injuries.^[8,9] Recently, we have shown an increased incidence of injuries in those above 60 years.^[10] The average life expectancy in the UAE

increased from 74.8 years in 2005 to 79 years in 2018.^[11] However, unlike in other countries, the proportion of those who are above the age of 65 years remained low because of the high percentage of young male workers.^[7] The geriatric group now constitutes around 1% of the population, of whom 58% are males.^[12] We aimed to study the epidemiological changes that occurred in geriatric trauma in Al-Ain City, UAE, in the past decade, to give recommendations on injury prevention.

2. Patients and methods

2.1. Ethical considerations

The Human Research Ethics Committee of Al-Ain Hospital, Al-Ain, UAE, has given ethical approval to perform this study (AAHEC-03-20-008).

2.2. Patient population

Trauma patients aged 65 years and above who were hospitalized at Al-Ain Hospital for more than 24 hours or died in the hospital after their arrival, regardless of the time of death, were studied. Data were extracted from the Al-Ain Hospital trauma registry. Two periods were compared; March 2003 to March 2006 and January 2014 to December 2017. The population of Al-Ain City was estimated to be 463,000 inhabitants during the first period^[13] and 766,000 during the second period.^[12] The estimated number of those 65 years or older was 3241 (0.7%) in the first period and 8043 (1.05%) in the second period.^[14] Al-Ain Hospital is the main hospital managing trauma patients in Al-Ain City, treating 80% of these patients.

2.3. Data collection

The data of the registry were collected over 2 periods of time. The first was a limited time (2003–2006) which was a research project funded for a few years by the UAE University as a feasibility study.^[15,16] It was stopped due to a lack of public funding.^[10] The registry was restarted in 2013 through governmental support given by the Department of Health of Abu Dhabi Emirate as a quality assurance project. The first registry had 300 variables, while the second has more than 500 variables. Nevertheless, the data of the 2 periods have the same quality. Data were prospectively collected by trained trauma fellows in the first period and trained registry nurses in the second period. The first registry was developed locally, while the second registry is based on the platform of the American College of Surgeons, National Trauma Data Bank, and variables were collected right from the pre-hospital time till death of the patient or discharge from the hospital. Data validation and completion are done periodically and are centrally coordinated by the Department of Health, Abu Dhabi. The senior author (FMAZ) established the first registry and is very familiar with the second one. He supervised the coding to be accurate and similar. The variables which were available in both registries were used for the comparison.

2.4. Studied variables

Studied variables included age, gender, nationality, mechanism and location of the injury, physiological and anatomical severity markers (systolic blood pressure, heart rate, injury severity score (ISS), New Injury Severity Score (NISS), Glasgow Coma Scale (GCS), intensive care unit (ICU) admission, length of hospital

stay, and clinical outcome. We categorized nationality into UAE and non-UAE groups because the risks of injury for these 2 groups in our city are different.^[17]

2.5. Statistical analysis

The incidence of geriatric trauma was calculated as follows: $(1.25 \times \text{annual admissions}) / (\text{population}/100,000)$. This was necessary because Al-Ain hospital sees 80% of all trauma patients in our city. Multiplying our annual admission figures by 1.25 provides an estimate of the total trauma load in the city. The mortality rate was calculated by dividing the total number of in-hospital trauma deaths by the annual number of admitted trauma patients multiplied by 100. Continuous data were presented as mean (standard deviation (SD)), ordinal data as median (range), and categorical data as number (%). Categorical data of 2 independent groups were compared using Fisher Exact test or Pearson χ^2 test as appropriate. Continuous or ordinal data of 2 independent groups were compared using the Mann–Whitney *U* test. We used the Statistical Package for the Social Sciences (IBM-SPSS version 26, Chicago, Il) for statistical analyses. A *P*-value of <0.05 was accepted as statistically significant.

3. Results

An average of 22 geriatric patients was admitted to Al-Ain hospital annually during the first period, and an average of 50 geriatric patients admitted annually during the second period. The estimated geriatric population in Al-Ain City was 3241 in the first period and 8043 in the second period. Accordingly, the estimated annual incidence of hospitalized geriatric trauma patients in Al-Ain City was 8.5 per 1000 geriatric inhabitants in the first period compared with 7.8 per 1000 geriatric inhabitants in the second period. This indicates a slight reduction in the incidence over the studied period in Al-Ain City (<1 in 1000) despite the annual increase in the number of the geriatric population.

Table 1 compares the demography and severity of the injury of the geriatric patients in the 2 periods. The median (range) of the patients' age increased over time from 70 (65–100) years to 74 (65–105) years ($P=0.025$, Mann–Whitney *U* test). (Fig. 1). There was no difference between gender, with males and females constituting 50% of the patients in both periods.

Patients in the second period had significantly less tachycardia; median (range) heart rate of 84 (36–124) beats per minute compared with 88.5 (61–140) beats per minute ($P=0.004$, Mann–Whitney *U* test). They also showed significantly higher GCS on arrival to the emergency department (ED) compared with the first period; mean (SD) GCS of 14.82 (1.28) compared with 14.17 (2.92), ($P=0.024$, Mann–Whitney *U* test). There was no difference in the ISS and the NISS or ICU admission between the 2 periods. There was a strong trend for a shorter length of hospital stay overtime; median (range) 5 (1–91) days compared with 6 (1–44), ($P=0.06$, Mann–Whitney *U* test). There was a significant decrease in mortality over time, 2% compared with 7.6%, ($P=0.04$, Fisher Exact test).

Table 2 compares the different mechanisms of injury. There was a significant increase of falls on the same level, which increased by 14.9% (62.1%–77%, $P=0.02$, Pearson χ^2 test). There was also a strong trend in the reduction of RTC injuries (27.3%–16.5%, $P=0.07$, Fisher Exact test). There was a statistically significant difference in the location of injury between

Table 1

Demography and severity of the injury of hospitalized geriatric patients during the period of 2003 to 2006 (n=66) and 10 years later (n=200) during the period of 2014 to 2017, Al-Ain Hospital, Al-Ain, United Arab Emirates.

Variable	Years 2003–2006	Years 2014–2017	P value
Age	70 (65–100)	74 (65–105)	0.03
Gender			0.99
Male	33 (50%)	100 (50%)	
Female	33 (50%)	100 (50%)	
UAE nationals	28 (42.4%)	93 (46.5%)	0.57
SBP	152.5 (70–222)	145 (95–265)	0.11
Heart rate	88.5 (61–140)	84 (36–124)	0.04
GCS*	15 (3–5), 14.17 (2.92)	15 (3–5), 14.82 (1.28)	0.02
ISS	7 (1–26)	6 (1–25)	0.88
NISS	9 (1–32)	9 (1–29)	0.88
ICU admission	3 (4.5%)	13 (6.5%)	0.77
Hospital stay	6 (1–44)	5 (1–91)	0.06
Death	5 (7.6%)	4 (2%)	0.04

GCS = Glasgow Coma Scale, ICU = intensive care unit, ISS = Injury Severity Score, NISS = New Injury Severity Score, SBP = systolic blood pressure.

P = Fisher Exact test for categorical data and Mann–Whitney U test for ordinal or continuous data.

* Data are presented median (range) or number (%) as appropriate. GCS is presented in the sequence of median (range), mean (SD) because the median is the same despite the presence of statistical significance.

the 2 periods. (Table 3). Homes and streets/highways were the most common location of injury in both periods. Injuries at homes significantly increased over time (55.4%–78.7%, $P=0.0003$, Fisher Exact test). In contrast, there was a significant reduction in trauma occurring on streets/highways and workplaces over time (29.2%–15.7%, $P=0.016$); and 12.3% to 1.5%, ($P=0.0009$; Fisher Exact test).

There was no difference in the anatomical injured regions between the 2 periods, except the chest, which significantly reduced over time; 27.7% to 15.5%, ($P=0.042$ Fisher Exact test) (Table 4). Nevertheless, there was no difference in the severity of

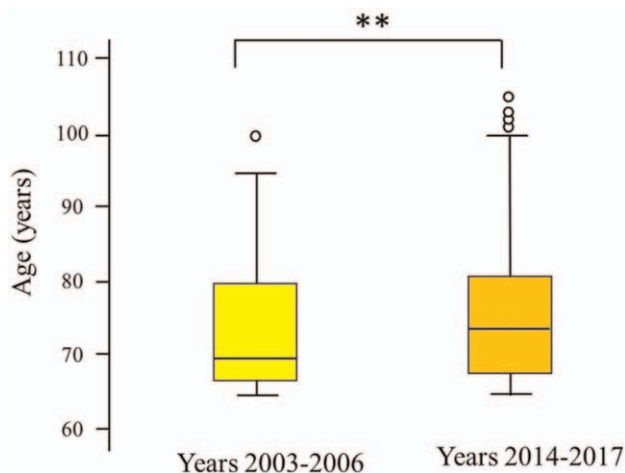


Figure 1. Box-and-whiskers plot of age for hospitalized geriatric trauma patients during the period of 2003 to 2006 (n=66) and 10 years later (n=200) during the period of 2014 to 2017, Al-Ain Hospital, Al-Ain, United Arab Emirates. The box represents the 25th to the 75th percentile IQR. The horizontal line within each box represents the median. P values by Mann–Whitney U test. IQR = interquartile range.

Table 2

Comparison of the mechanism of injury of hospitalized patients during the period of 2003–2006 (n=66) and 10 years later (n=200) during the period of 2014–2017, Al-Ain Hospital, Al-Ain, United Arab Emirates.

Mechanism	Years 2003–2006		Years 2014–2017		P value
	Number	%	Number	%	
Same level fall	41	62.1	154	77	0.02
RTC	18	27.3	33	16.5	0.07
Fall from height	2	3	1	0.5	0.15
Heavy object	1	1.5	3	1.5	0.99
Burn	1	1.5	5	2.5	0.99
Machinery	0	0	1	0.5	0.99
Others	3	4.5	3	1.5	0.16
Total	66	100	200	100	

Data are presented as numbers (%).
RTC = road traffic collision.

the injury of any region, as shown by the Abbreviated Injury Scale of the regions. (Table 5).

4. Discussion

Our study has shown a minimal reduction in the incidence of geriatric trauma (<1 in 1000) over the studied period in Al-Ain City despite the increased annual numbers of the geriatric population.

Mortality reduced from 7.6% to 2% over the last decade despite having the same severity of the injury. There was a significant increase in falls on the same level and a strong trend for reduction of RTCs. These were associated with a significant increase in injuries occurring at homes and a reduction in those occurring on the streets and highways.

Contrary to others,^[4,18] there was no increase in the incidence of geriatric trauma in our study because the majority of the population are young expatriate workers who prefer to go back home when they retire. The mean age of the geriatric population in Al-Ain city has increased over the last decade. Nevertheless, those who are over 65-year-old constitute around 1% of our population.^[19] Despite that, they constituted 2.6% (66/2573) of the first trauma registry and 5.7% (200/3519) of the second registry.^[10] This is similar to the trends shown in other trauma registries globally.^[2,4]

Patients arrived in the ED with reduced tachycardia and increased GCS in the second period compared with the first.

Table 3

Comparison of location of injury of hospitalized patients during the period of 2003–2006 (n=65) and 10 years later (n=197) during the period of 2014–2017, Al-Ain Hospital, Al-Ain, United Arab Emirates.

Location	Years 2003–2006		Years 2014–2017		P value
	Number	%	Number	%	
Home	36	55.4	155	78.7	0.0003
Street/highway	19	29.2	31	15.7	0.02
Workplace	8	12.3	3	1.5	0.0009
Off road	2	3	1	0.5	0.78
Public area	0	0	5	2.5	0.33
others	0	0	2	1	0.99
Total	65	100.0	197	100.0	

Data are presented as numbers (%).
P = Fisher Exact test.

Table 4

Distribution of injury by different regions in geriatric trauma patients in Al-Ain Hospital during the period of 2003–2006 (n=65) and 10 years later (n=200) during the period of 2014–2017, Al-Ain Hospital, Al-Ain, United Arab Emirates.

Region	Years 2003–2006	Years 2014–2017	p value
	Number (%)	Number (%)	
Head and neck	10 (15.4%)	16 (8%)	0.09
Face	5 (7.7%)	17 (8.5%)	0.99
Chest	18 (27.7%)	31 (15.5%)	0.04
Abdomen	1 (1.5%)	9 (4.5%)	0.46
Spine	7 (10.8%)	38 (19%)	0.18
Upper extremity	9 (13.8%)	35 (17.5%)	0.57
Lower extremity	33 (50.8%)	101 (50.5%)	0.99
External	1 (1.5%)	14 (7%)	0.13

Data are presented as numbers (%).

P=Fisher Exact test.

There has been growth and improvement in the Abu Dhabi Emirate Emergency Medical Service (EMS) in the last few years, with 80% of the ambulances now fully equipped with ALS capability.^[20] The improved vital signs reflect the overall improvement in EMS pre-hospital care.

The mean ISS and the NISS were similar over the study periods. In addition, there was a trend toward reduced mean hospital length of stay, but the proportion of ICU admissions were similar. Over the last decade, the trauma system in Al-Ain City has evolved with the establishment of a regional trauma database and the introduction of a number of injury prevention interventions that targeted the reduction of RTCs and work-related injuries. In addition, a trauma group was established with a mission to improve trauma management, research, and training to a high international standard.^[10] These improvements in the trauma system may explain the reduced mortality and hospital length of stay in the current study. Other factors, such as changes in hospital admission and discharge policies, may have also played a role.

Similar to others falls on the same level, and RTC remained the leading mechanisms of geriatric trauma in our city with a significantly increased rate of low falls.^[21,22] Injuries occurring at homes in our study have increased by about 23%. This is similar to other studies in which falls at homes were the most common cause of geriatric trauma.^[11,23] At present, older people are generally more active and independent, although they spend

Table 5

AIS of different injured regions of geriatric trauma patients during the period of 2003–2006 (n=65) and 10 years later (n=200) during the period of 2014–2017, Al-Ain Hospital, Al-Ain, United Arab Emirates.

Region	Years 2003–2006	Years 2014–2017	P value
Head and neck	2 (1–4)	2 (1–4)	0.99
Face	2 (1–2)	1 (1–2)	0.45
Chest	2 (1–3)	2 (1–4)	0.64
Abdomen	1 (1–1)	1 (1–3)	0.8
Spine	2 (1–2)	2 (1–3)	0.97
Upper extremity	2 (2–3)	2 (1–3)	0.57
Lower extremity	3 (1–3)	3 (1–3)	0.67
External	2 (2–2)	1 (1–5)	0.4

AIS=Abbreviated Injury Scale.

more time in their homes. Nevertheless, their risk of falls increases because of the use of medications, their weak muscles, and because of imbalance when walking.^[24] The home environment should be targeted in injury prevention programs so as to reduce geriatric injuries. A recent systematic review concluded that multi-factorial interventions, including exercise, environment or assistive technology, and medication review, may reduce geriatric falls by 23%.^[25] Similarly, Keall et al reported a 26% annual reduction in injuries caused by falls at home.^[26]

Our study has shown a significant reduction in the percentage of geriatric chest trauma. In contrast, others have reported an increase in chest trauma diagnosis, which was attributed to the liberal use of computed tomography.^[27] Al-Ain hospital has a 24-hour computerized tomography scanning and reporting. The cause for the reduced incidence of thoracic injuries in our study is unknown, but it is unlikely to be due to missed diagnosis.

5. Limitations

We have to highlight that our study has certain limitations. *First*, the study population is small due to the unique nature of the UAE population, having a very low proportion of geriatrics. This precludes a more advanced multivariate statistical analysis to define the determinants of geriatric trauma mortality.

Second, there was a gap between the studied 2 periods due to a shortage of funding. Trauma registries are an important source of information to monitor changes in the trauma pattern and outcomes of injury prevention interventions. Nevertheless, they need strong financial support to continue for long periods. *Third*, our study population is retrieved from trauma registry data and is subjected to the usual limitations of registry data. Inclusion criteria and minimum dataset in trauma registries vary. Accordingly, some registries may only include very severe trauma patients like those with high injury severity, those who are admitted to the ICU, or those who die in the hospital.^[28] We had a wider inclusion criterion. Nevertheless, we did not include in our registry patients with mild injuries, such as those who were admitted for less than 24 hours or were discharged home in good condition from the ED). Our registry also does not include patients who died at the scene. This is a potential source of underestimation of the trauma-related mortality rate in our community. *Forth*, missing data were not a major problem in our study because they were collected prospectively, and we did not perform any missing data imputation. Nevertheless, missing data are generally more common in those who die. *Finally*, this is a single-center study, and our results may not represent the whole UAE.

6. Conclusions

Although the incidence and severity of geriatric trauma did not change over the last decade, in-hospital mortality has significantly decreased over time. There was a significant increase in injuries occurring at homes and in falls on the same level. The home environment should be targeted in injury prevention programs to reduce geriatric injuries.

Author contributions

DOA, AAC, MG, HOE, and FMAZ contributed to the study conception and design. DOA, HOE, and FMAZ contributed to the acquisition and coding of data. FMAZ analyzed the data and

wrote the results section. DOA and FMAZ drafted the manuscript DOA, AAC, MG, HOE, and FMAZ critically read the manuscript. All authors read and approved the final manuscript.

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