Original article

Patterns of injury and death in mass casualty incidents from 2013 to 2018 in Mogadishu, Somalia Mass casualty incidents in Mogadishu, Somalia

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Abstract;

Objective*:** Mass casualty incidents (MCI)s are a serious threat to public health in Mogadishu, Somalia. The present study aims to demonstrate the patterns of injury and clinical outcomes in MCIs in Mogadishu, Somalia. ***Methods*:** This is a retrospective, cross-sectional analysis of clinical data retrieved from patients involved in MCIs between 2013 and 2018 in Mogadishu, Somalia. Patient demographics were statistically analyzed with the anatomical site of injury, mechanism, and types of injury to find any meaningful association among each other in terms of clinical outcomes.Results*:** Four hundred (M/F: 62%/38%) cases were included in the present study. There was a significant association between the mechanism of injury and incidence of mortality (95% CI = 0.028-6.65) (p=0.02). Another significant association found was between the clinical presentation of injury and mortality rate of which the presence of external/or internal bleeding was highly associated with death (95% CI = 0.640- 3.163; OR:1.423) (p=0.02). ***Conclusion*:** Prompt precautions should be taken by improving awareness of the public through educational programs, preparing campaigns in coordination with the ministry of health, and influencing the power of the media should be used to reach everyone in the society.

Keywords: Mass casualty incidents (MCI);the pattern of injury; Somalia;prevention

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Introduction;

The devastating effects of disasters on public health have increased dramatically during the last decades, particularly where urbanization steadily increases. Severe and permanent disabilities, which may occur as a clinical consequence, prevent the injured person from continuing his daily routine, leading to the deterioration of life quality and even death. The main objective of a disaster medical responder (DMR) should be to reveal its consequences on public health and to create the best possible scenario for affected individuals. Hospitals should function as a safe

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environment for health care workers and provide essential medical care to mass casualty victims.

Mass casualty incidents (MCI)s usually occur in a short period. They may result from a single incident such as a stadium stampede or transport accidents, geophysical disasters like hurricane and flood events, terrorist attacks, biological disasters, and mass gatherings that exceed local logistics support capabilities[1-2]. MCIs led by terrorist activities have special consideration in terms of clinical outcomes. As the name implies, many victims are affected mostly during MCIs caused by terrorist attacks, and health care workers are exposed to associated biological, chemical, or radiological threats. Moreover, secondary and sometimes tertiary consecutive hits of initial attack lead to more devastating consequences. MCIs due to terrorist attacks usually present with higher injury severity scores (ISS) (approximately 30%> 15), greater requirement for intensive care unit (ICU) follow-up (>20%), prolonged hospital stays, and increased mortality rates[3].

Decades of ongoing violence, drought, poor governance, and lack of humanitarian aid have led to one of the world's worst humanitarian crises in Somalia. Especially; since 2011, there has been an increased rate of terrorist attacks, which have left thousands of civilians dead and wounded[4-6].There is a significant lack of knowledge in addressing the pattern of injury and rate of death from MCIs in Mogadishu, Somalia, which is a critical issue in the training of health care workers to improve clinical outcomes by reducing both morbidity and mortality rates[7]. Therefore, we aimed to assess patterns of injury and death in MCIs, and find out their clinical association with health status in Mogadishu, Somalia, from 2013 to 2018. We are willing to improve public awareness by giving detailed, informative data revealing the extent of the problem and making recommendations for preventive measures to abolish the current thread against public health.

Methods;

The present study was conducted in Keydsaney Hospital in Karan District and Madina Hospital in Wadajir district to analyze the patterns of MCIs. Types, frequencies, and clinical presentation of injuries were analyzed to present the actual status of the threat against the health system of Somalia and to define preventive measures to improve the current situation. Comparisons between age and gender groups were performed based on different injury patterns. Any meaningful associations achieved through statistical analysis with regards to type (traffic accidents, terrorist attacks, car blasts), the mechanism (blunt or penetrating), and anatomical site (facial, trunk, extremity) of injuries with pre-described demographic features were investigated.

Statistical analysis

Clinical characteristics of the research sample were compared using the x2 tests. Association between dependent and independent variables was analyzed by calculating the odds ratio (95% confidence interval (CI)). The processed data was demonstrated in tables. In the context of research, $P \leq 0.05$ was considered statistically significant. Statistical analysis of the study was performed using SPSS® version 20.0 (IBM, Armonk, New York, USA).

Ethical clearance: Ethical approval for the study was obtained from the researchers and the ethical committee of Benadir University. The researchers ensured that all the information obtained would be kept only for the study.

Results;

Most MCIs were male cases (n=248 (62%)). The majority (n=256 (64%)) of the study population were registered in Madina Hospital, and the less (n=144 (36%)) were retrieved from Keydseney Hospital. In the study group, 259 (64.75%) patients were injured, and 141 (35.25%) patients had lost their lives due to different MCIs. The majority of the study population (n=266 (66.5%)) was involved by the ones between 15 and 35 years of age. Lesser ones were between 35 and 60 years of age (n=118 (29.5%)) which was followed by those younger than 15 years (n=12 (3%)) of age and the ones older than 60 years (n=4 (1%)) of age concerning decreasing order. The highest mortality rates recorded were among participants in the 15-35 age group (n=85 (60.3%)). Thirty-five and sixty years of age interval were the second-highest group (n=51 (36.2%)) with deceased cases, and the remaining five deceased cases were recorded in >60 years of age (n=3 (2.1%)) and <15 years of age (n=2 (1.4%)) groups consecutively. There has been found no significant association between age and rate of mortality (p=0.4369) (95% CI = 0.267-1.72 (OR:0.678)) (Table 1).

Variables		Clinical outcome		Total	p Value	Exp (B)	95% CI for Exp (B)	
		Survived n (%)	Deceased n (%)				Lower	Upper
Age	<15	10 (3.9)	2 (1.4)	12	0.4369	0.678	0.267	1.72
	15-35	181 (69.8)	85 (60.3)	266				
	35-60	67 (25.8)	51 (36.2)	118				
	>60	1 (0.5)	3 (2.1)	4				
	Total	259 (64.75)	141 (35.25)	400				
Gender	Male	153 (59.1)	95 (67.4)	248	0.736	1.338	0.245	7.307
	Female	106 (40.9)	46 (32.6)	152				
	Total	259 (64.75)	141 (35.25)	400				
Hospital	Madina	170 (85)	86 (71.4)	256	0.341	2.259	0.405	12.602
	Keydsaney	89 (15)	55 (28.6)	144				
	Total	259 (64.75)	141 (35.25)	400				

Car blast injuries were occupied by 154 (38.5%) MCIs, which was followed by bomb explosion injuries(n=116 (29%)), while gunshot and traffic accident injuries were least of all, with 67 (16.75%) and 63 (15.75%) patients in consecutive order. The vast majority (n=244 (61%)) of MCIs had occurred between 2016 and 2018, whereas 156 (39%) were recorded between 2013 and 2015 (Table 2).

Table 2 Types and frequencies of injuries

Mass Casualty Incident		Frequency (n=)	Percentage (%)
Nature of incident	Armed force gun fire	67	16.75
	Car blast injury	154	38.5
	Planted bomb injury	116	29
	Traffic accidents	63	15.75
	Total	400	100
Time of incident	2013 - 2015	156	29
	2016 - 2018	244	71
	Total	400	100

Concerning the primary anatomical site of injury, trunk injuries were the most affected anatomical region in MCIs (n=128 (32%)). Head and facial injuries (n=124 (31%)) were the second most common site of the injured anatomical region, and that was followed by lower (n=91 (22.7%)) and upper extremity (n=57 (14.3%)) injuriesin consecutive order. Penetrating injury (n=267 (66.8%)) was the dominant injury mechanism among investigated MCIs, and the remaining less was due to blunt-type injuries (n=133 (33.2%)). Clinical presentations of the victims were mostly with external bleeding (n=145 (36.3%)), that was followed by internal bleeding (n=105 (26.3%)) while the least frequent clinical presentations were incidents with fracture (n=79 (19.7%)) and concussion/ laceration (n=71 (17.8%)) (Table 3).

Mortalities mostly presented with external bleeding (n=73 (51.8%)) and internal bleeding (n=55 (39%)), which was followed by concussion and laceration (n=9 (6.4%)) while the less had occurred due to fractures (n=4 (2.8%)) respectively. There was a significant association between the clinical presentation of injury and mortalit rate (95% CI = 0.640- 3.163, OR=1.423) (p=0.02). The clinical course of penetratingly injured cases was more likely to end up with mortality compared to bluntly injured ones (n=107 (75.9%) vs. n=34 (24.1%)), which was found statistically significant (95% CI = 0.028-6.65, HR=16.9) (p=0.02). Fifty-eight (41.1%) of the deceased were trunk injured, and the least mortality rate was recorded among those with only upper extremity injuries (n=9 (6.4%)). Even though

trunk injured cases were found more likely to be deceased than other injured cases (95% CI = 0.292-3.968, OR:1.077), there was no statistical association between mortality rate and site of injury (p=0.694) (Table 3-4).

Table 3; Demonstration of injury patterns with rates of survival and deceased

Mechanism of injury	Frequency (n=)	Percentage (%)	Survived n (%)	Deceased n (%)	p value
Penetrating	267	66.75	160 (61.8)	107 (75.9)	0.02
Blunt	133	33.25	99 (38.2)	34 (24.1)	
Total	400	100	259 (64.75)	141 (35.25)	
presentation	Clinical Frequency (n=)	Percentage (%)	Survived n (%)	Deceased n (%)	p value
External bleeding	145	36.3	72 (27.8)	73 (51.8)	0.09
Internal bleeding	105	26.3	50 (19.3)	55 (39)	
Concussion and laceration	71	17.8	62 (23.9)	9 (6.4)	
Fractures	79	19.7	75 (29)	4 (2.8)	
Total	259	100	259 (64.75)	141 (35.25)	

Table 4 Injury pattern and clinical presentation

Mechanism of injury	Frequency (n=)	Percentage (%)	Survived n (%)	Deceased n (%)	p value
Penetrating	267	66.75	160 (61.8)	107 (75.9)	0.02
Blunt	133	33.25	99 (38.2)	34 (24.1)	
Total	400	100	259 (64.75)	141 (35.25)	
Clinical presentation	Frequency (n=)	Percentage (%)	Survived n (%)	Deceased n (%)	p value
External bleeding	145	36.3	72 (27.8)	73 (51.8)	0.09
Internal bleeding	105	26.3	50 (19.3)	55 (39)	
Concussion and laceration	71	17.8	62 (23.9)	9 (6.4)	
Fractures	79	19.7	75 (29)	4 (2.8)	
Total	259	100	259 (64.75)	141 (35.25)	

Fifty-five (39%) cases have lost their lives in the operation theatre, while 30 (21.3%) were brought dead, 18 (12.7%) and 38 (27%)have died in the emergency resuscitation room and ICU, respectively (Table 5). Sixty-three (44.7%) cases admitted to the hospitals were severely injured but conscious, while 30 (21.3%) were already dead when brought. The rest had consisted of either unconscious patients (n=28 (19.9%)) or the ones without life-threatening injury (n=20 (14.1%)).

Discussion;

Patterns of injury and death in MCIs of Mogadishu, Somalia, between 2013 and 2018 have been investigated in the present study to put forward the clinical associations among different age and gender groups with types of injuries in terms of morbidity and mortality. The current analysis has revealed a mortality rate of 35.25%, which was majorly associated with the scarcity of the basic skills of first-aid resuscitation and the lack of an established disaster planning program in the case of aMCI.

The young age group (15-35 years of age) was the population with the highest death rank. Young people occupy the great majority of the people in Somalia, such that the median age is 17.7 years and nearly half of the population is within 0-14 years of age[8]. This current status leads the incidence of mortalities to be seen more frequently, particularly among young age groups.

Clinical presentations following injury leading to death may differ from one occasion to another. For the present study, external and internal bleeding has become the most frequent clinical presentation resulting in mortality. Even though statistical analysis of current data has revealed no significant result, this may have a clinical significance in patient management. It may be interpreted that nearly half of the cases with bleeding could not be saved, probably due to the lack of knowledge of health care workers, especially in bleeding resuscitation. Educational programs for the public and professional health care workers may be implemented to solve this current problem.

The male population and their numbers in MCIs were dominant compared to their gender counterparts (64% vs. 36%). This difference didn't achieve a statistically significant value contributing to clinical outcomes in this retrospective analysis. The gender population is roughly balanced in Somalia[8]. But men occupy the majority of the people working outside, being in more contact with the social environment, unlike women who mostly beingheld responsible for housework and dealing with the care of the children. This social status of Somalia, driven by cultural and religious factors, leads men to be more affected by outdoor events like MCIs.

Penetrating injuries were the dominant mechanism of injury in MCIs that ended up with mortality, which was statistically significant. There are numerous studies in relevant literature investigating the impact of the mechanism of injury on clinical outcomes[9,10]. Though, it is not accurate to draw a definite conclusion solely based on the presented findings between mortality rate and mechanism of injury. Instead of defining a significant clinical association between mortality and mechanism of injury, we may say that MCIs that occurred in Mogadishu, Somalia, between 2013 and 2018 were primarily due to penetrating injuries that had a significant impact on mortality rates.

About one-fifth (21.3%) of the affected cases from MCIs were already dead when admitted to the hospitals. This number of people who ended up with mortality may be associated with a lack of knowledge and experience in first-aid and cardio-pulmonary resuscitation (CPR), which leads to an increase in morbidity and mortality rates during the transfer of the cases from the scene of the accident to the health facilities. CPR is the initial critical step in the management of trauma patients. It may possess difficulties and eventually end up with a dismal prognosis if not applied under appropriate protocols[11]. Providing basic first-aid training coordinated by the minister of health would enable too many lives to be saved instead of dying on the way of transfer to the nearest health facilities.

This analysis is one of the most extensive studies conducted in Somalia, specifically investigating the actual status of MCIs with a large patient population. Also, being a multi-centric study improves the strength of the statistical analysis. On the other side, the hospital records provide limited information on the victims' demographic features, narrowing the investigation window. Besides that, we don't have the necessary data to assess the severity of injuries. Thus, the lack of data has led to limited interpretation.

Conclusion:

Severely injured patients should be identified during disaster triage, and immediate resuscitation should be assured. It is critical to choose which people will get the most benefit and select those with no chance of survival. This management strategy requires a certain level of knowledge and experience. Disaster planning is one of the critical steps in disaster management. 'Coordination' and 'cooperation' are crucial in disaster planning. Different working groups or help organizations should be integrated into the primary plan to prevent confusion. Different injury severity scales may be referred to evaluate and determine the further triage of the injured.

Potential threats should be assessed as a priority, and necessary precautions should be taken accordingly. Since MCIs may present with high mortality rates even in fully equipped facilities, it is recommended to initiate a well-trained emergency and disaster response team ready to engage in any mass casualty disasters to give the needed emergency and triage help. Social media can be used for educational purposes and awareness campaigns to strengthen the impact of these programs and spread it to every corner of the country. Well-trained community health workers may use those media platforms mainly to educate about first-aid and resuscitation in case of disasters or mass casualties. Pre-structured and well-designed awareness campaigns in coordination with the ministry of health and local authorities can be established.

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Conflicts of interest statement

The authors have no conflicts of interest to declare.

Authors' contribution

Data gathering and idea owner of this study: Mahad Abdullahi Nor and Recep Ercin Sonmez.

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References:

1. World Health Organization: Mass casualty management systems: strategies and guidelines for building health sector capacity. Health action in crises injuries and violence prevention. [Jun;2021].
2. Moran ME, Zimmerman JR, Chapman AD, Ballas DA, Blecker N, George RL. Staff Perspectives of Mass Casualty Incident Preparedness. *Cureus*. 2021;**13**(6):e15858. https://doi.org/10.7759/cureus.15858
3. Ashkenazi I, Kessel B, Khashan T, Haspel J, Oren M, Olsha O, et al. Precision of in-hospital triage in mass-casualty incidents after terror attacks. *Prehosp Disaster Med*. 2006;**21**(1):20-3.https://doi.org/10.1017/s1049023x00003277
4. Aschkenasy-Steuer G, Shamir M, Rivkind A, Mosheiff R, Shushan Y, Rosenthal G, et al. Clinical review: the Israeli experience: conventional terrorism and critical care. *Crit Care*. 2005;**9**(5):490-9. https://doi.org/10.1186/cc3762
5. Elkheir N, Sharma A, Cherian M, Saleh OA, Everard M, Popal GR, et al. A cross-sectional survey of essential surgical capacity in Somalia. *BMJ Open*. 2014;**4**:e004360. https://doi.org/10.1136/bmjopen-2013-004360
6. Alimoglu O, Eren TT, Tombalak E, Leblebici M, Azızoglu S, Sever S, et al. Volunteer Surgical Team in Somalia. *Indian J Surg*. 2018;**80**:447–451. https://doi.org/10.1007/s12262-017-1626-y
7. Omar M, Sönmez RE, Hassan M, Alimoğlu O. Prevalence of war victims in Madina Hospital, Mogadishu, Somalia. *Bangladesh Journal of Medical Science*. 2020;**19**(3):401-403. https://doi.org/10.3329/bjms.v19i3.45855
8. The World Factbook. Langley, Virginia: Central Intelligence Agency. 2018. Retrieved 4 November 2018.
9. Roach MJ, Chen Y, Kelly ML. Comparing Blunt and Penetrating Trauma in Spinal Cord Injury: Analysis of Long-Term Functional and Neurological Outcomes. *Top Spinal Cord Inj Rehabil*. 2018;**24**(2):121-132.https://doi.org/10.1310/sci2402-121
10. Santiago LA, Oh BC, Dash PK, Holcomb JB, Wade CE. A clinical comparison of penetrating and blunt traumatic brain injuries. *Brain Inj*. 2012;**26**(2):107-25.https://doi.org/10.3109/02699052.2011.635363
11. Olasveengen TM, Mancini ME, Perkins GD, Avis S, Brooks S, Castrén M, et al. Adult Basic Life Support: International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. *Resuscitation*. 2020;**156**:35-79. https://doi.org/10.1016/j.resuscitation.2020.09.010