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Epidemiological Characteristics of 6930 Emergency Trauma Patients in Guangming District, Shenzhen

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Abstract: The aim of this study is to analyze the epidemiological characteristics of emergency trauma patients in Guangming District, Shenzhen, with the objective of providing a scientific foundation for enhancing trauma care and optimizing the allocation of medical resources in the region. A retrospective study was conducted on clinical data from 6930 trauma patients treated in the emergency surgery department of our hospital on 2023. Statistical analysis was performed on variables including gender, age, date and time of injury, cause of injury, injury site, trauma classification, location of injury, and mode of hospital arrival. Among the 6930 trauma patients, there were 4786 males (69.06%) and 2144 females (30.94%). The highest incidence of trauma was observed in October (10.66%) and November (10.92%), while the lowest occurred in January (1.92%). The majority of injuries took place between 20:00-21:59 (15.35%), followed by 18:00-19:59 (13.45%) and 16:00-17:59 (12.29%). Falling injury accounted for the largest proportion of trauma cases at 23.62%, followed by blunt injury at 19.18%, traffic accident at 16.67%, and sharp injury at 15.92%. The age group between 35-59 years had the highest incidence rate of trauma, reaching up to 36.98%. Males exhibited a higher frequency of injury compared to females across all causes, except for chemical injury where the incidence rates were equal between genders. The limbs were most commonly affected, with upper limb accounting for approximately 31.33% and lower limb accounting for around 27.73%. The most prevalent locations of trauma were traffic road (23.91%) and public place (22.76%), while construction site (14.72%) accounted for the highest incidence of injuries resulting from falling injury from a high places, sharp instrument injury, and blunt injury. The distribution of minor, severe and critical injuries among trauma patients was 98.88%, 0.84%, and 0.27% respectively. Among cases involving severe and critical injuries, traffic accident (38.37%) and falling injury from a high place (24.42%) were identified as the primary causes. A comprehensive understanding of the epidemiological characteristics of trauma cases facilitates the rational allocation of emergency resources and enables the provision of safe, high-quality, and efficient emergency medical services. This comprehension further promotes the high-quality development of emergency trauma medicine and better meet the increasing demand for emergency medical services.

1. Introduction

With the continuous and rapid development of the socio-economic landscape and accelerated urbanization, there has been a corresponding increase in the incidence of traumatic events. Traffic injuries and workplace accidents occur frequently, exerting immense pressure on social medical resources and inflicting significant suffering upon patients and their families[1]. According to the research reports of relevant scholars, trauma emerges as a prominent contributor to global mortality and disability, characterized by its substantial morbidity rates, heightened levels of disability, and premature mortality[2]. In China specifically, trauma serves as the primary cause of death and disability among individuals under 40 years old who form a major part of the labor force; it also accounts for two-thirds of deaths in individuals under 45 years old. The impact on society's labor force along with loss in healthy life years far surpasses that caused by other diseases[3]. The Guangming area in Shenzhen serves as the pilot zone for the Comprehensive National Science Center of the Guangdong-Hong Kong-Macao China Greater Bay Area, boasts a permanent population of 1.0953 million. As an emerging district experiencing rapid development, it frequently witnesses trauma incidents that present certain challenges to the treatment of trauma patients. However, there is a dearth of research reports on the epidemiological situation concerning emergency trauma within this region.

This study aims to analyze the epidemiological characteristics of trauma patients treated at the emergency surgery department in Guangming District during 2023, with an objective to provide valuable insights for further enhancing patient services, improving treatment efficiency and quality, and reducing mortality and disability rates among severe trauma patients.

2. Materials and Methods

2.1. The source of data

We obtained data from the emergency department of our hospital, specifically covering the period from January 1, 2023, to December 31, 2023. Among a total of 66,674 cases initially considered, we excluded non-trauma patients and those with incomplete medical records. Consequently, we identified and included a final sample size of 6930 complete trauma cases for subsequent analysis.

2.2. Methodology

Patients were categorized into four age groups: ≤17, 18-34, 35-59, and ≥60 years old. Trauma incidents were analyzed and described based on the month and time of occurrence. Trauma causes were classified as mechanical, including falling injury, traffic accident, sports injury, falling injury from a high place, fighting injury, sharp injury, blunt injury, other injury; physical injury (burn/scald); chemical injury and biological injury (snake/bee/cat/mouse/bug bites). Injury sites included head and neck injury, chest injury, abdomen injury, spine and pelvis injury, upper limb injury, lower limb injury, and multiple injury. Trauma locations encompassed traffic road, public place (such as work areas, hotels, malls etc., home, school, construction site, factory, and other places. Patients' conditions were assessed using AIS-ISS scoring system: ISS ≤16 was classified as minor injury, ISS >16 indicated severe injury, and ISS >25 represented critical injury. Mode of hospital arrival was documented either as self-arrival or via emergency ambulance (120). The trauma patient information data screening involves proofreading and re-establishing the statistics of trauma patient data. This includes registration, statistics, and analysis of patients' age, sex, time of trauma, injury causes, injury parts, and occurrence of trauma.

2.3. Statistics

Data analysis was conducted using SPSS 19.0 and Excel software, with categorical data presented in counts and percentages [n (%)].

3. Results

3.1. General Information of Trauma Patients

From January 1,2023, to December 31,2023, a total of 6930 trauma patients were treated, comprising of 4786 males (69.06%) and 2144 females (30.94%), resulting in a male-to-female ratio of 2.23:1. The age range of the patients spanned from newborns to individuals aged up to 98 years old (Table 1).

Table 1: General Information of Trauma Patients. Causes of Trauma and Distribution by Age and Gender (n)

Trauma causes	≤17y		18~34y		35~59y		≥60y		Total		Total (n)	Constituent ratio (%)
	Man	Woman	Man	Woman	Man	Woman	Man	Woman	Man	Woman		
Falling injury	369	197	275	152	307	182	59	96	1010	627	1637	23.62%
Traffic accident	148	52	249	203	251	187	31	34	679	476	1155	16.67%
Sports injury	202	75	180	73	95	47	7	9	484	204	688	9.93%
Falling injury from a high place	32	20	48	2	123	10	5	2	208	34	242	3.49%
Fighting injury	86	14	73	35	109	43	4	4	272	96	368	5.31%
Sharp injury	101	40	384	102	348	96	20	12	853	250	1103	15.91%
Blunt injury	169	79	328	84	516	119	23	11	1036	293	1329	19.18%
Other injury	28	20	14	7	16	10	3	5	61	42	103	1.49%
Physical injury	23	8	22	13	22	10	1	0	68	31	99	1.43%
Chemical injury	0	0	1	3	4	2	0	0	5	5	10	0.14%
Biological injury	18	11	45	38	37	29	10	8	110	86	196	2.83%
Total (n)	1176	516	1619	712	1828	735	163	181	4786	2144	6930	100%

3.2. Temporal Distribution of Trauma

The incidence of trauma reached its peak in October (10.66%) and November (10.92%), while it was at its lowest in January (1.92%). The majority of injuries occurred during the time intervals of 20:00-21:59 (15.35%), 18:00-19:59 (13.45%), and 16:00-17:59 (12.29%), with the fewest incidents recorded between 4:00-5:59 (1.01%) and 2:00-3:59 (1.63%) (Fig. 1).

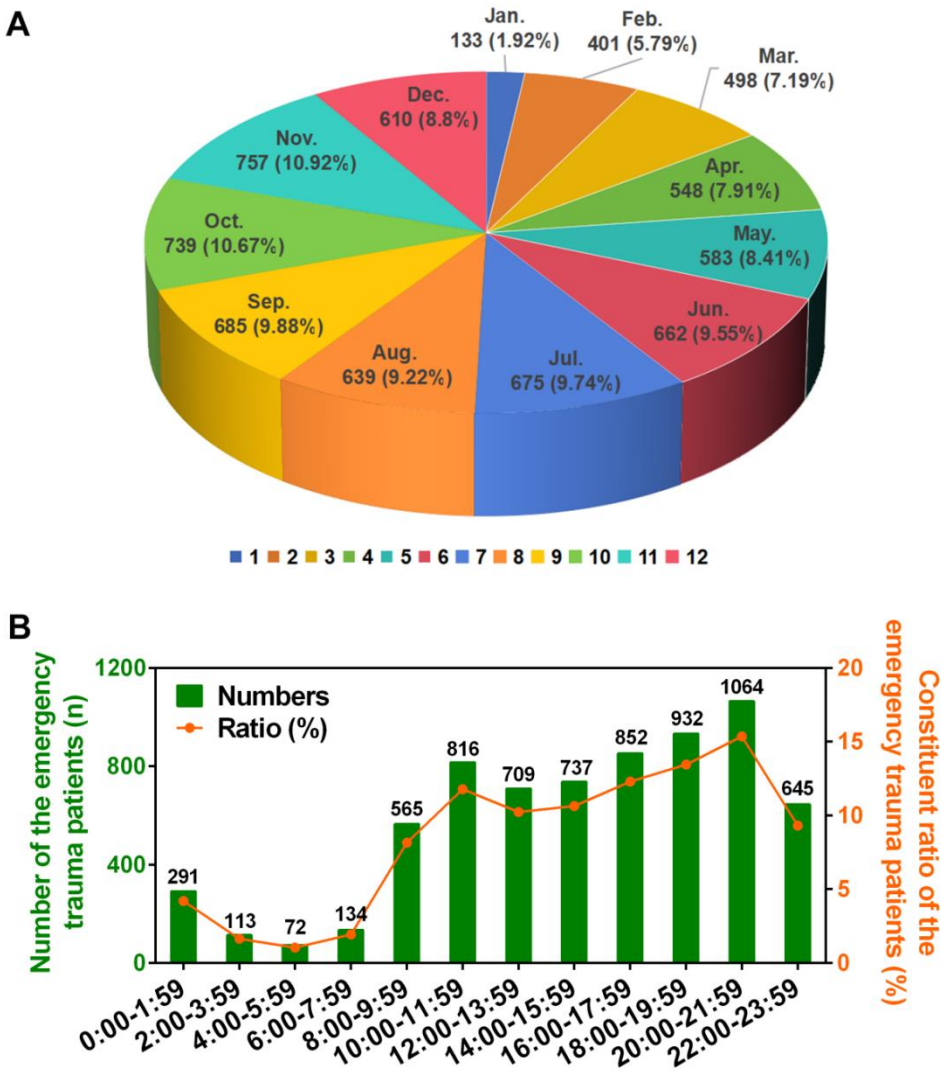

Figure 1: Temporal Distribution of Trauma

3.3. Causes of Trauma and Distribution by Age and Gender

The primary etiologies of trauma included falling injury (23.62%), blunt injury (19.18%), traffic accident (16.67%), and sharp injury (15.92%). Age distribution revealed that 1692 cases (24.42%) were ≤17 years old, 2331 cases (33.64%) were between 18-34 years old, 2563 cases (36.98%) were between 35-59 years old, and 344 cases (4.96%) were ≥60 years old. Gender distribution indicated a higher incidence of trauma among males compared to females across all causes, with the exception of chemical injuries where the incidence was similar (Table 1).

3.4. The distribution patterns of injured body parts in patients with varying etiologies of injury

According to statistical data, limbs are the most common sites of injury among different causative factors. Specifically, there were a total of 2171 cases involving upper limb, accounting for 31.33%, and 1922 cases involving lower limb, accounting for 27.73%. The next most affected area is the head and neck injury with a total of 1359 cases, representing 19.61% of all injuries. Falling

injury, blunt injury, and traffic accident often result in injuries to the limbs and head and neck injury; sports and sports injury are more likely to cause limb injuries; while falling injury from a high place can lead to damage in multiple injury including the head and neck injury as well as the limbs (Table 2).

Table 2: The distribution patterns of injured body parts in patients with varying etiologies of injury (n)

Trauma causes	Trauma sites						
	Head and neck injury	Chest injury	Abdomen injury	Spine and pelvis injury	Upper limb injury	Lower limb injury	Multiple injury
Falling injury	486	72	13	103	393	405	165
Traffic accident	185	53	15	38	138	370	356
Sports injury	76	25	16	63	142	353	13
Falling injury from a high place	45	17	4	23	26	51	76
Fighting injury	152	34	31	13	36	9	93
Sharp injury	78	14	9	3	721	273	5
Blunt injury	293	52	30	32	544	343	35
Other injury	8	10	3	12	57	13	0
Physical injury	13	4	4	0	33	23	22
Chemical injury	4	1	0	0	2	3	0
Biological injury	19	2	5	0	79	79	12
Total (n)	1359	284	130	287	2171	1922	777
Constituent ratio (%)	19.61%	4.10%	1.88%	4.14%	31.33%	27.73%	11.21%

3.5. The distribution of patient injury locations varies depending on different causes of injury

Table 3: The distribution of patient injury locations varies depending on different causes of injury (n)

Trauma causes	Trauma locations						
	Traffic road	Public place	Home	School	Construction site	Factory	Other places
Falling injury	247	622	481	178	51	23	35
Traffic accident	1141	6	0	4	2	2	0
Sports injury	46	268	62	292	10	7	3
Falling injury from a high place	13	33	31	11	133	20	1
Fighting injury	58	204	24	63	16	3	0
Sharp injury	42	170	285	73	338	186	9
Blunt injury	66	151	187	86	461	368	10
Other injury	13	5	54	2	5	17	7
Physical injury	2	7	63	8	1	15	3
Chemical injury	0	2	1	1	0	6	0
Biological injury	29	109	39	14	3	0	2
Total	1657	1577	1227	732	1020	647	70
Constituent ratio	23.91%	22.76%	17.71%	10.56%	14.72%	9.33%	1.01%

Traffic road and public place are the most prevalent sites for injuries, accounting for 23.91% and 22.76% respectively. Among traffic accident victims, 98.79% occur on traffic road, while falling injury (38.00%) and fighting injury (55.43%) predominantly transpire in public place. Construction site serve as the primary locations for falling injury from a high place, representing 54.96% of all fall victims. Sharp and blunt injury injuries also frequently manifest at construction site, constituting 30.64% and 34.69% of sharp and blunt injury patients respectively. physical injury

primarily results from burn and scald injury, with home being the site where they occur in majority (63.64%), while biological injury account for 55.61%, mostly transpiring in public place (Table 3).

3.6. Characteristics of the distribution of injury severity

The distribution of trauma patients is as follows: 98.76% are categorized as minor, while severe and critical cases account for 0.97% and 0.27%, respectively. Among the severe and critical patients, traffic accident contribute to 38.37% of injuries, followed by falling injury from a high place at 24.42%. The occurrence of multiple injury is prevalent among severe and critical injured patients, constituting 61.19% and 89.47% of severe and critical injury cases respectively. The findings indicate that among minor, severe, and critical trauma patients, the percentages of those who contacted emergency ambulance (120) for hospital admission are recorded as 4.51%, 89.55%, and 89.47%, respectively (Fig. 2).

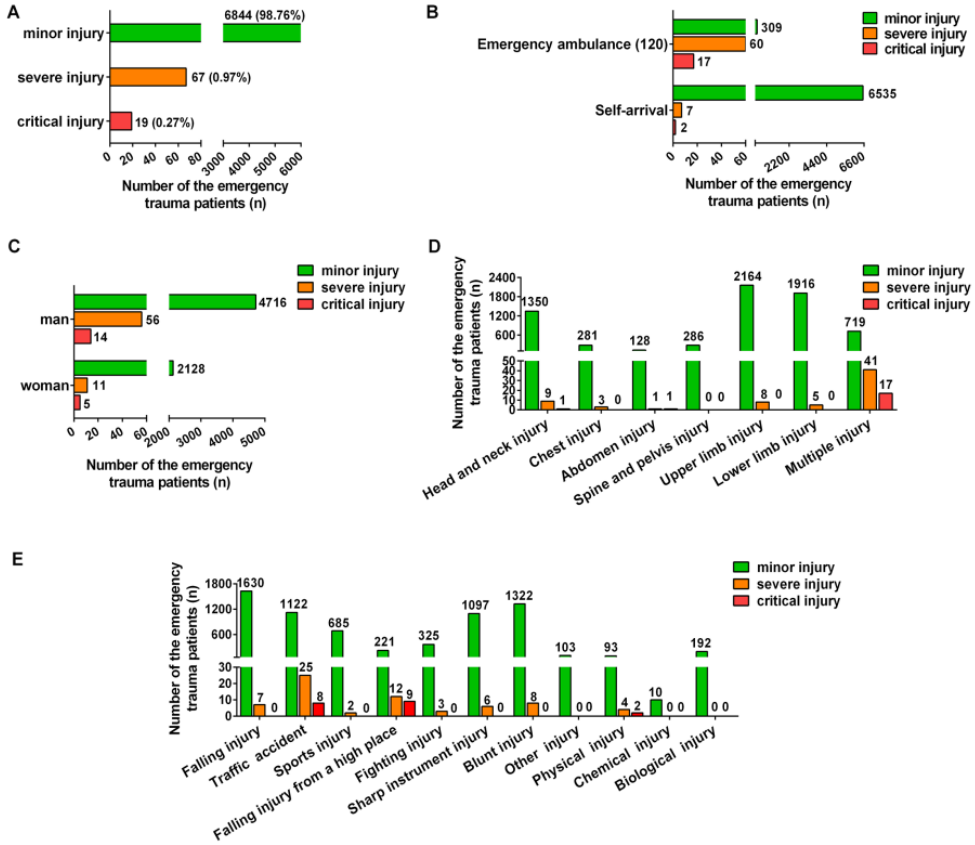

Figure 2: Characteristics of the distribution of injury severity

4. Discussion

In recent years, trauma-related disability and mortality have emerged as global public health concerns[4]. In China, trauma leads to more than 500,000 disabilities and 750,000 deaths annually, exerting a significant impact on public health and quality of life. Research suggests that implementing effective measures for trauma prevention can effectively reduce the incidence of traumatic events as well as associated mortality and disability rates[5].

Our findings demonstrate that trauma primarily impacts males and individuals in the young to middle-aged adult demographic, which aligns with previous research. The primary reason is that this demographic constitutes the predominant workforce in society, necessitating frequent social

engagements and involvement in high-risk occupations, thereby augmenting their susceptibility to exposure to traumatic hazards and consequently rendering them more susceptible to experiencing traumatic events[6].During the months of October and November, there is an increased incidence of trauma patients primarily observed between 20:00-21:59, 18:00-19:59, and 16:00-17:59. This can be attributed to the favorable climatic conditions during autumn when temperatures are relatively cooler, leading to a higher frequency of outdoor activities. Furthermore, these specific time periods coincide with peak traffic congestion on roads and public areas, as well as heightened activity in the construction and manufacturing sectors. Consequently, there is an augmented likelihood of encountering hazardous situations resulting in traumatic incidents[7]. In response to this prevailing trend, it is imperative to enhance education on road safety legislation, intensify public safety prevention measures, and promote occupational safety within enterprises and institutions. This will bolster the overall safety consciousness among the population and consequently mitigate the incidence of traumatic incidents[8]. Additionally, medical establishments should reinforce emergency protocols for pre-hospital and in-hospital treatment during peak periods of trauma cases, thereby adopting a proactive approach and enhancing the quality of initial trauma care.

Statistical analysis of trauma etiology reveals that falling injury, blunt injury, traffic accident, and sharp injury constitute the predominant causes. Falling injury can result in bodily harm across diverse anatomical regions and frequently occur in both public place and home. The primary etiology of injury in patients aged ≥60 is attributed to falling injury, which can be ascribed to the age-related decline in physical function, mobility, and sensory abilities commonly observed among the geriatric population. Multiple studies have elucidated the primary determinants of falling injury among older adults, encompassing reduced muscular strength, basic diseases, inadequate vitamin D levels, and environmental influences[9]. Older individuals frequently exhibit pre-existing conditions like osteoporosis; thus even a minor fall can result in grave consequences. Therefore, it is imperative to promote the active engagement of elderly individuals in appropriate physical exercise, regularly conduct comprehensive physical examinations for managing underlying medical conditions, adequately supplement with nutrients such as vitamin D, and enhance care and support for the aging population. These measures are indispensable in preventing falling injury among older patients. Factory and construction site are high-risk environments for both blunt and sharp injury, which is closely associated with the nature of the work being performed. Therefore, it is imperative for organizations to establish standardized operating procedures in order to effectively mitigate the occurrence of occupational accidents[10].

With the rapid urban economic development, there has been a surge in the number of motor vehicles, consequently resulting in a substantial increase in traffic accident and their associated trauma[11]. The study revealed that traffic accident account for 16.67% of the overall injury count, causing harm to various anatomical regions including the head and neck injury, limbs, and multiple injury. These incidents predominantly occur on traffic road and contribute to a proportion of 38.37% in terms of severe and critical injury, thus resulting in grave consequences such as fatalities. Statistics suggest that the prevalence of traffic accident injuries is disproportionately higher among young and middle-aged individuals, attributed to their heightened social involvement. Some individuals in this demographic exhibit a disregard for traffic safety measures and engage in risky behaviors such as reckless driving, intoxicated driving, and driving under the influence of alcohol, often culminating in severe traffic accidents[12]. The incidence of traffic accident injuries in this area is comparatively lower compared to statistical studies conducted in other regions, which can be attributed closely to the stringent traffic regulations, enforcement measures, and vigilant patrols implemented by the Shenzhen Traffic Department. The results from numerous studies have demonstrated that traffic accident are impacted by a multitude of factors, encompassing the development and enforcement of traffic regulations, road conditions, as well as public

consciousness regarding safety. Therefore, the effective reduction of traffic accidents can be achieved through the strengthening of promotion and enforcement of traffic regulations, improvement in road traffic infrastructure, enhancement of public awareness on traffic safety, and cultivation of self-discipline in complying with traffic regulations.

Sports injury predominantly occur in the adolescent population, with the limbs and head being the most prevalent sites of injury. Students are more prone to sustaining injuries on school premises, while young adults face a higher risk of injury in public place during sports activities. The design and implementation of exercise and physical activities should be tailored to individual abilities and limitations. Certain specialized exercises may require professional guidance and supervision to mitigate the risk of injuries[13]. The city of Shenzhen, being an international metropolis, boasts a well-established public safety management system. However, incidents of fighting injury persist primarily within night markets, post-alcohol consumption scenarios, and cases involving domestic violence. To prevent the occurrence of such violent incidents, it is imperative to implement more robust measures aimed at upholding public order and proactively addressing potential issues. Simultaneously, an increased number of first-aid stations should be established in densely populated areas such as night markets, bars, and entertainment venues to minimize emergency response time for medical treatment. Furthermore, enhanced safeguards must be provided to protect the rights and welfare of women and children, demonstrating a steadfast commitment towards eradicating instances of domestic violence.

According to statistical data, the overall proportion of trauma patients resulting from falling injury from a high place is 3.49%, with construction site accounting for 54.96% of these incidents and comprising 24.42% of serious and critical injury cases. The multifaceted nature of factors contributing to injuries resulting from falling injury from a high place presents a formidable challenge in the field of clinical trauma emergency. The occurrence of falling injury from a high place often results in severe injuries, characterized by a high prevalence of multiple injury, which may lead to their misdiagnosis. Both pre-hospital and in-hospital mortality rates are significantly elevated, posing challenges for effective treatment[14]. To proactively mitigate injuries resulting from falling injury from a high place, it is imperative to enhance safety measures within the construction site, strengthen education and training programs, and cultivate a heightened safety consciousness among construction workers, thereby ensuring their well-being on-site. The site where emergency medical personnel respond to falling injury from a high place may not always be secure, and the patient's condition is often intricate and critical, necessitating the presence of specialized trauma emergency personnel who can deliver initial on-scene emergency care prior to transferring the patient to a hospital. Therefore, it is imperative for these professionals to undergo comprehensive training in various emergency skills, including cardiopulmonary resuscitation (CPR), airway management, ventilator management, fluid administration, hemostasis techniques, dressing of open wounds, immobilization and transportation protocols for fracture patients, as well as prompt injury control measures aimed at preventing secondary complications. The statistical data reveals that several severe and critical injured patients were transported to the hospital by their family members or colleagues at the scene, utilizing private vehicles and alternative modes of transportation. Regrettably, despite rescue efforts, this resulted in one fatality. The act of self-transportation significantly increases the fatality risk for patients, given their already severe injuries, and any improper handling may worsen their condition. Therefore, it is imperative to ensure professional pre-hospital care. The consideration of specific social factors cannot be disregarded; however, it is imperative for both the government and healthcare institutions to enhance their educational endeavors. By ensuring convenient transportation and prompt access to professional treatment through dialing 120, we can significantly augment the efficiency of patient care.

The envenomation resulting from snakebites presents a significant medical challenge in numerous developing tropical and subtropical nations[15]. Shenzhen is situated in the subtropical region and exhibits a maritime monsoon humid climate. It harbors a diverse array of venomous snakes, encompassing five families comprising 11 genera and 14 species. These include renowned snakes such as trimeresurus and coral snake, alongside less prevalent taxa like mock viper and rhabdophis guangdongensis. Our hospital is designated hospital for snake bites, a total of 34 patients were admitted between January and December, with the majority being bitten by trimeresurus, a few by coral snake and non-venomous species, one patient was bitten by a king cobra. Following the administration of standardized treatment protocols, including antivenom therapy, all patients with venomous snakebites experienced no apparent complications. Maintaining constant vigilance is of paramount importance for ensuring safety, especially when engaging in outdoor activities. Exercise utmost caution and avoid walking barefoot in areas that may potentially harbor venomous snakes, such as grassy terrains and shrubbery. Additionally, it is advisable to wear long-sleeved shirts and trousers while utilizing appropriate protective equipment. Meanwhile, we need to cultivate the ability to identify the unique traits of venomous snakes, understand their behavioral patterns and active times to effectively avoid them. In the unfortunate event of a venomous snake bite, we need to promptly seek immediate medical attention and provide comprehensive information about the species to facilitate targeted treatment. Currently, the complexity and diversity of trauma pose a significant challenge to pre-hospital and in-hospital emergency care, establishing trauma as an "unignorable disease" of the present era. The current state of China's trauma emergency system is still in its nascent stage, characterized by insufficient investment and the absence of a dedicated governmental agency to coordinate various facets pertaining to trauma emergencies, such as decision-making, establishment of emergency funds, enactment of emergency legislation, development of trauma emergency systems, re-education and certification for trauma surgeons.

5. Conclusion

By analyzing the epidemiological characteristics of trauma patients in this region, valuable insights can be gained into the epidemiological features of trauma patients. This will facilitate public education and training initiatives, as well as enable strategic allocation of medical resources within the hospital and establishment of a streamlined medical process. As a result, we not only can the incidence of traumatic events be reduced, but also the treatment for trauma patients seeking healthcare can be expedited and standardized. This will facilitate the standardization of severe trauma treatment and the establishment of a comprehensive trauma care system, playing a pivotal and propelling role in effectively responding to major sudden public health emergencies.

References

[1] James SL, Castle CD, Dingels ZV, et al. Global injury morbidity and mortality from 1990 to 2017: results from the Global Burden of Disease Study 2017. Inj Prev. 2020. 26(Supp 1): i96-i114.

[2] Moore K. Trauma mortality: understanding mortality distribution to improve outcomes. J Emerg Nurs. 2014. 40(4): 405-406.

[3] Yang L, Shimei W, Nan HU, Cong BI. Epidemiological characteristics of 100974 prehospital emergency trauma patients in the central urban area and surrounding area of Tianjin city. China Modern Doctor. 2023. 61(26): 37-41.

[4] Soori H, Khorasani-Zavareh D. Road traffic injuries measures in the Eastern Mediterranean Region: findings from the Global Status Report on Road Safety - 2015. J Inj Violence Res. 2019. 11(2): 149-158.

[5] Jullien S. Prevention of unintentional injuries in children under five years. BMC Pediatr. 2021. 21(Suppl 1): 311.

[6] Arshi A, Barad JH, Patel RK, Allis JB, Soohoo NF, Johnson EE. The Crush Index: Orthopedic Trauma as an Economic Indicator. Orthopedics. 2017. 40(4): 248-255.

[7] Holland AJ, Soundappan SS. Trauma hazards in children: An update for the busy clinician. J Paediatr Child Health. 2017. 53(11): 1096-1100.
[8] Mahikul W, Aiyasuwan O, Thanartthanaboon P, et al. Factors affecting bus accident severity in Thailand: A multinomial logit model. PLoS One. 2022. 17(11): e0277318.
[9] Cohen S, Nathan JA, Goldberg AL. Muscle wasting in disease: molecular mechanisms and promising therapies. Nat Rev Drug Discov. 2015. 14(1): 58-74.
[10] García-Mainar I, Montuenga VM. Risk self-perception and occupational accidents. J Safety Res. 2024. 88: 135-144.
[11] AlKheder S, AlRukaibi F, Aiash A. Analysis of risk factors affecting traffic accident injury in United Arab Emirates (UAE). Eur J Trauma Emerg Surg. 2022. 48(6): 4823-4835.
[12] Heinrich D, Holzmann C, Wagner A, et al. What are the differences in injury patterns of young and elderly traffic accident fatalities considering death on scene and death in hospital. Int J Legal Med. 2017. 131(4): 1023-1037.
[13] Videmšek M, Gregorčič M, Hadžić V, Karpljuk D, Šuštaršič A. Injuries of Primary School Children during Sports Activities. Zdr Varst. 2023. 62(2): 87-92.
[14] Rey-Merchán M, Gómez-de-Gabriel JM, López-Arquillos A, Choi SD. Analysis of Falls from Height Variables in Occupational Accidents. Int J Environ Res Public Health. 2021. 18(24): 13417.
[15] Abd El-Aziz TM, Shoulkamy MI, Hegazy AM, Stockand JD, Mahmoud A, Mashaly A. Comparative study of the in vivo toxicity and pathophysiology of envenomation by three medically important Egyptian snake venoms. Arch Toxicol. 2020. 94(1): 335-344.