

Evaluation of Missed Cases of Fractures and Soft Tissue Injuries in Patients with Multiple Trauma in a Teaching Trauma Centre within 6 Months

Abstract

Introduction: Delays in diagnosing musculoskeletal injuries in patients who have suffered polytraumas can lead to long-term functional and aesthetic disorders. This study investigates the undiagnosed cases of fractures and soft tissue damage in multiple trauma patients in a teaching trauma centre within 6 months.

Materials & Methods: This cross-sectional descriptive study was conducted on polytraumas patients referred to a teaching trauma centre within 6 months.

Results & Discussion: In 339 polytrauma patients, 21(6.2%) had undiagnosed injuries: 15 (71.4%) men and 6 (28.6%) women with mean age of 39.3 ± 8.5 years (11 to 82 years) were studied. The average duration of hospitalization for undiagnosed fractures and soft tissue injuries in polytraumas patients was 4.4 ± 2.3 days. The most common sites of undiagnosed injuries were the clavicle (22.2%), followed by metacarpal and femoral neck (16.7%), acetabulum and intertrochanteric (11.1%), and distal fibular fractures (8.3%).

Conclusion: Late diagnosis of fractures in trauma hospitals is not uncommon, Middle age of 40-60 years and clavicular and femoral neck fractures are important and common ones to remember.

Keywords: Delayed diagnosis, Bone fractures, Soft tissue injuries, Polytrauma.

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Introduction

Trauma is a significant public health concern and a leading cause of death and permanent disability among adults, children, and young people (ages 1–44). It is also the third leading cause of death across all age groups^(1,2). One of the primary barriers to accurately diagnosing injuries and evaluating their potential is the lack of standardized reporting criteria in articles^(3,4). Furthermore, the prevalence of bone fractures caused by road accidents is exceptionally high, ranking among the top three most common injuries resulting from such incidents⁽⁵⁾.

In recent years, advancements in technology and healthcare have improved people's quality of life. Despite this, events such as accidents, conflicts, violence, and other traumatic phenomena, including vehicle collisions, occupational accidents, and injuries sustained during contact sports, have significantly exacerbated the physical harm individuals endure⁽⁶⁾. The causes and mechanisms of trauma vary, and their impact depends on factors such as the location of the injury on the body, the victim's age, and gender^(7–10).

Globally, the most common causes of such injuries among adults are road accidents, violence, falls, and sports injuries⁽⁸⁾. The most frequent soft tissue injuries include lacerations, hematomas, contusions, and abrasions, with lacerations being the most common type of trauma-induced soft tissue injury (38%). The age group most affected by soft tissue injuries is 0–30 years (61.5%)^(11,12).

In developing countries like Iran, road accidents are the leading cause of injuries. However, in developed countries, the use of seat belts and strict penalties for driving under the influence of alcohol have significantly reduced traffic-related injuries, making violence the most common cause of trauma^(8,11).

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Unfortunately, in Iran, there is no specific organization responsible for recording the short- and long-term medical outcomes of road accidents. Such information is sporadically documented by the Ministry of Health, Ministry of Labor, and other agencies⁽⁹⁾.

In hospital emergency departments, the primary focus is on addressing acute, life-threatening conditions in trauma patients. Many other injuries may be overlooked and diagnosed later, with delayed diagnoses potentially leading to irreversible complications. Certain injuries, particularly orthopedic injuries, are often missed during initial evaluations⁽¹²⁻¹⁵⁾. Undiagnosed injuries are described as negligence on the part of the trauma surgeon, potentially resulting in a negative experience for polytrauma patients, overshadowing the surgeon's efforts, and sometimes leading to litigation^(12,14).

Few authors in orthopedic literature have discussed commonly undiagnosed injuries or suggested ways to reduce their incidence. Initial evaluations are usually conducted by the emergency department or trauma surgery physician. Nowadays, formal secondary assessments have become a standard part of examining polytrauma patients. These assessments typically involve a comprehensive physical examination of the patient approximately 24 hours after admission, a review of all prior imaging studies, and, if necessary, additional blood tests and radiographic studies. These evaluations should be repeated once the patient regains consciousness and can cooperate⁽¹⁶⁻¹⁸⁾.

The secondary assessment was first recommended by Anderson et al. to identify injuries missed during earlier examinations⁽¹²⁾. Limited studies in Iran and globally have investigated undiagnosed fractures in polytrauma patients⁽¹⁹⁻²¹⁾. Since no prior research has addressed undiagnosed soft tissue injuries in Iran, particularly in Urmia, this study aims to examine undiagnosed fractures and soft tissue injuries in polytrauma patients presenting to Imam Khomeini Hospital from December 21, 2021, to June 21, 2022.

In a study conducted by Sadeghpour et al. in 2007, undiagnosed injuries in polytrauma patients in Tabriz were examined. This research, involving 487 patients, reported an overall prevalence of polytrauma at 18.51%. Among the patients, 28 individuals (7.6%) had hidden injuries that were discovered during the study. In total, 32 undiagnosed injuries were identified in these 28 patients, most of which involved muscular and skeletal damage. The most

common sites of these injuries were the ankle and foot, as well as the wrist and hand⁽²²⁾.

Similarly, in a study conducted by Sarafraz et al. in 2015, associated ear, nose, and throat (ENT) injuries in polytrauma patients were investigated at Shahid Rahnemoun Hospital in Yazd during 2012 and 2013. Among 54 cases, 12 (22%) had nasal fractures, and four presented with septal hematomas, which led to severe infections and significant deformities⁽²³⁾.

Materials & Methods

This descriptive, cross-sectional prospective study was conducted from December 21, 2021, to June 21, 2022, on all undiagnosed fractures or injuries in polytrauma patients admitted to Imam Khomeini Hospital. The initial examination was performed by an orthopedic specialist or resident. Cases of undiagnosed injuries (secondary assessment) were reviewed by orthopedic faculty members whom patients visited after discharge. Patients admitted to the ICU and those who underwent surgery and were subsequently transferred to the ward or ICU were also followed up and examined.

For patients where suspected but undetected injuries arose during examinations, radiographic imaging was performed. Additionally, with the cooperation of ward officials, any potentially overlooked injuries during treatment were identified through radiographs, surgeries, or examinations by other specialists and were documented. After completing initial evaluations and treatments and stabilizing the general condition of the patients, a comprehensive examination was conducted at the bedside by a single orthopedic specialist to identify any overlooked musculoskeletal injuries, which were then recorded. Demographic data, including patients' age, gender, occupation, and place of residence, were collected alongside information about the mechanism and timing of injury, the number of examinations performed, the number of undiagnosed injuries, previously identified injuries, the duration of hospitalization, and the admission timing of trauma patients at the treatment center.

Data Analysis Method

Descriptive statistics, including mean \pm standard deviation, were used to analyze the data. The analysis was performed using SPSS version 16 for Windows.

Ethical Considerations

The study commenced after receiving approval from the university's ethics committee. It was conducted prospectively, and all patient data were extracted from archived records without including any identifiable information. Ethical considerations regarding patient rights and confidentiality were strictly observed. Patients were entered into the software using identification codes. Given the prospective nature of the study, no additional costs were imposed on the patients. Ethically, any missed injuries were addressed with appropriate treatment to ensure patient recovery, including surgical interventions if necessary.

Results

In this study, all undiagnosed fractures and injuries in polytrauma patients admitted to Imam Khomeini Hospital from December 21, 2021, to June 21, 2022, were investigated. Among a total of 339 polytrauma patients, 21 cases (approximately 6.2%) had undiagnosed fractures or soft tissue injuries.

Gender Distribution

The frequency distribution of undiagnosed fractures and soft tissue injuries shows that 71.4% of cases were male, and 28.6% were female.

Age Distribution:

The mean age of patients with undiagnosed fractures and soft tissue injuries was 39.3 ± 8.5 years. The frequency distribution of age groups revealed that:

- 9.5% were under 20 years old,
- 38.1% were between 20 and 40 years old,

- 42.9% were between 40 and 60 years old, and
- 9.5% were over 60 years old.

Residence Distribution:

The analysis of residence distribution indicated that 42.9% of cases lived in urban areas, while 57.1% resided in rural areas. The analysis of the number of examinations conducted indicates that 80.9% of undiagnosed fractures and soft tissue injuries in polytrauma patients were identified after only one examination, while 19.1% required two examinations (Table 1). The frequency distribution of missed injuries indicates that 38.1% of undiagnosed fractures and soft tissue injuries involved one injury, 52.4% involved two injuries, and 9.5% involved three injuries (Table 2). On average, there were 1.7 missed injuries per patient in these polytrauma cases. The distribution of previously diagnosed injuries shows that 23.8% had two injuries, 52.4% had three injuries, 14.3% had four injuries, and 9.5% had five injuries (Table 3).

On average, there were 3.1 previously diagnosed injuries per patient. The average duration of hospitalization for undiagnosed fractures and soft tissue injuries in polytrauma patients was 4.4 ± 2.3 days.

- **Clavicle:** 22.2% of the undiagnosed injuries were located in the clavicle.
- **Metacarpals and Femoral Neck:** Each accounted for 16.7% of undiagnosed injuries.
- **Scaphoid:** Represented 13.9% of cases.
- **Acetabulum and Intertrochanteric Region:** Each contributed 11.1% of injuries.
- **Lateral Malleolus:** Accounted for 8.3% of undiagnosed injuries (Table 4).

Table 1: Frequency of Examinations for Undiagnosed Fractures and Soft Tissue Injuries in Polytrauma Patients

Number of Examinations	Frequency	Percentage (%)
1 Examination	17	80.9
2 Examinations	4	19.1
Total	21	100

Table 2: Frequency of Missed Injuries Among Undiagnosed Fractures and Soft Tissue Injuries in Polytrauma Patients

Number of Injuries	Frequency	Percentage (%)
1 Injury	8	38.1
2 Injuries	11	52.4
3 Injuries	2	9.5
Total	21	100

Table 3: Frequency of Previously Diagnosed Injuries in Polytrauma Patients

Number of Injuries	Frequency	Percentage (%)
2 Injuries	5	23.8
3 Injuries	11	52.4
4 Injuries	3	14.3
5 Injuries	2	9.5
Total	21	100

Table 4: Distribution of Undiagnosed Fractures and Soft Tissue Injuries in Polytrauma Patients

	Frequency	Percentage (%)
Clavicle	8	22.2
Metacarpals	6	16.7
Scaphoid	5	13.9
Acetabulum	4	11.1
Femoral Neck	6	16.7
Intertrochanteric	4	11.1
Lateral Malleolus	3	8.3
Total	36	100

Discussion

Undiagnosed injuries and delayed diagnoses remain significant challenges in the treatment of polytrauma patients. Understanding the causes of undiagnosed injuries is crucial in minimizing their occurrence⁽²¹⁻²⁶⁾. A study similar to ours reported that 64 out of 786 patients (incidence of 1.8%) had 86 missed injuries, with an average of 1.3 injuries per patient. Among these, 45 were male and 19 were female, with an average age of 33 years (ranging from 12 to 81 years)⁽²⁷⁾. Multiple factors, such as clinical inexperience and assessment errors, contribute to undiagnosed injuries, which could be improved in trauma centers.

Houshian et al. reported a 12.8% rate of missed fractures of the foot and ankle⁽²⁷⁾, while Guly et al. found a rate of 25.8%⁽²⁸⁾. With improvements in standards and protocols in emergency departments, the incidence of undiagnosed injuries has decreased over the past decades. In the present study, the rate of undiagnosed injuries was 2.6%, although in other studies, the incidence of undiagnosed injuries ranged from 6% to 12.4%^(25,29,30). Detecting hidden injuries is vital, as failure to do so can lead to functional impairments, cosmetic issues, and in severe cases, such as liver lacerations, it can even result in death⁽³¹⁾. Shaeze Azar et al. in their study on the prevalence of undiagnosed orthopedic injuries in polytrauma

patients found that 82% of the patients were male, and their ages ranged from 7 to 28 years. The frequency of missed injuries was 5.8%. These included fractures of the clavicle, metacarpals, scaphoid, acetabulum, femoral neck, intertrochanteric, heel, lateral malleolus, Lisfranc joint, and hip dislocations⁽²⁰⁾.

Fitschen-Oestern et al. emphasized that special attention should be given to patients involved in traffic accidents or those who have fallen from great heights. Suicide victims also require close monitoring. Patients undergoing early surgery also need thorough examination, and secondary assessments are highly recommended⁽²¹⁾. Another study showed that complete and accurate physical examinations, along with selective radiographs according to standard diagnostic protocols, can prevent many injuries from going undiagnosed. Serial physical examinations during hospitalization and after discharge were also found to be helpful in detecting hidden injuries⁽²²⁾.

Some studies have reported injuries to the ears, nose, and throat in polytrauma patients. Among 54 cases, 12^(22%) had nasal fractures, and 4 had septal hematomas that led to infections and severe deformities⁽²³⁾. The researchers recommended that complete physical examinations be conducted after stabilizing polytrauma patients. These examinations require precise training of medical staff and timely consultations. Many trauma patients in the emergency department are unconscious, which can cause other problems to go undiagnosed, resulting in

the loss of valuable time needed to start appropriate treatments.

Stevens et al. examined undiagnosed injuries in polytrauma patients and the role of orthopedic surgeons in secondary assessments. They found that up to 81% of missed injuries in the initial evaluation of trauma patients were orthopedic in nature, and 35% of these injuries required surgical intervention⁽²⁴⁾.

Metak et al. studied undiagnosed musculoskeletal injuries in polytrauma patients and identified several reasons for missed diagnoses: inadequate or missed radiographs, incomplete or ongoing diagnostic procedures, incorrect or insufficient clinical examinations, and external injuries in polytrauma patients⁽²⁵⁾. Matuszak et al. explored undiagnosed periarticular injuries and diagnostic delays, showing a moderate correlation between the patient's age at the time of injury and the time to diagnosis. Specifically, as the patient's age increased, the time to diagnosis decreased⁽²⁶⁾.

Nearly all previous studies have found that hidden injuries are more common in male patients than in females, and our study confirmed this finding. Given the higher incidence of polytrauma in males, it is expected that undiagnosed injuries would also be more frequent in this group. The primary reason for diagnosing many of these hidden injuries is the patient's complaints (such as pain, deformity, etc.), which are often detected during hospitalization. This suggests a gap in secondary and tertiary evaluations, further highlighting the importance of repeated physical examinations during hospitalization. Studies show that missed injuries can occur at any stage of managing major trauma patients. Frequent evaluations, both clinical and radiological, are essential to reduce this issue.

Conclusion

The results of the study indicated that the highest incidence of undiagnosed injuries in polytrauma patients occurred in the 40 to 60 age group, with the clavicle being the most common site of undiagnosed injuries. Therefore, based on the findings of this study, it appears that re-evaluation of polytrauma patients plays a crucial role in reducing undiagnosed injuries, particularly orthopedic injuries, which may require changes to the treatment plan.

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