Assessment and Clinical Outcomes of Fall Related Injuries at Emergency

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ABSTRACT

Background and objectives: Falls are significant cause of mortality and morbidity with a considerable burden on societies, families and victims. The study aims to determine the interventions and outcomes of fall-related injuries, and the association between injury severity and fall height.

Methods: A descriptive cross-sectional study was conducted among 322 fall-related injured persons in West and East emergency hospitals in Erbil City from September 2020 to February 2021. Study sample demography, location of injury, place of affected body regions, outcome, and hospital stay were analyzed.

Results: Of the 322 patients studied, 68.9% were males, and 31.1% were female. Less than half of the samples (48.8%) were between the ages 18 to 36 years old. The most common location for fall-related injuries was residential facilities (44.1%) followed by the place of work (35.1%). According to the type of fall, fall from ground was 38.4%, and fall from a fall height of 1-3 meters was 48.8%. Finally, according to the injury classification, more than half (56.5%) of the study sample had a significant degree of severity. The discharged status of disposition at the emergency room had the highest percentage (64.9%) of the study sample. There was a significant difference between the scores of the items of fall consequences and outcomes regarding to type of ground (soft or hard). There was a significant relationship between injury severity and fall height (p-value = 0.00).

Conclusion: Fall-related injuries are the most common cases at emergency departments in Erbil city. Among ages 18 to 36, men are more frequently exposed to falls than women. The highest risk of fall is occupation with construction laborers at the greatest risk. Fall-related injury is a burden on the health care system, particularly on emergency services in developing countries like Iraq in relations cost of care and resources.

Key words: Fall, Unintentional fall, Injury severity, Fall height, Outcome.
Third. leading cause of non-fatal injuries [7]. Although fall-related injuries are usually reported in older age groups, other studies have shown that younger people (15-49 years) have been recognized as the most vulnerable group affected by fall-related injuries. In addition, men are twice as likely to as women to be affected by falls [8]. Two of the three significant causes of injury deaths – fall and road traffic injuries – are expected to increase in rank compared to other causes of death, with falls increasing to become the 17th leading cause of death [9]. In Kurdistan, Iraq, there is no current study about falls in all circumstances, including settings and injury-prone environments. The environmental, personal, and equipment risk factors for falls change in different communities. It is essential to know the severity of injuries and outcome of patients who sustain injuries by falls to be better prepared to manage these emergencies and to provide appropriate recommendations for prevention. This study will have a fundamental role in refining knowledge and will be recognized as a source of nurses and emergency staff. The finding of this study may help nurses and other healthcare professionals expand their knowledge and improve their practice related to fall-related injuries. This study aimed to explore the socio demographic characteristics, severity, interventions, and health outcomes associated with fall-related injuries and determine the association between injury severity and fall height.

METHODS

A descriptive cross-sectional study of 322 fall-related injured persons in West and East emergency hospitals in Erbil City was conducted from September 2020 to February 2021. The sample size was determined by \( Z^2 \frac{p(1-p)}{d^2} \), \( z = \) confident interval 95% (1.96), \( p = \) prevalence (0.30), \( q = (1-p) = (0.70), \ d = \) sampling error (0.05) [10].

Patients who died upon injury or those who died in the emergency rooms (9) were omitted because there was no complete data regarding the circumstances of death and to avoid potential bias due to outcome measurement. The researcher obtained an approval letter from the Ethics Committee at Hawler Medical University/College of Nursing on September 2020 (number 833). The official approval was taken as well. The researcher prepared a questionnaire for collecting data based on the review literature. The questionnaire was reliable and accessible to the public. The questionnaire was checked by a panel of experts who have extensive experience from different specialties. Based on their comments, the questionnaire was corrected and modified for appropriate data collection. A pilot study was conducted on 30 fall-related injured persons selected purposively from East and West emergency hospitals in September 2020. The pilot study was beneficial to determine the reliability, clarity, acceptability and time estimation for each participant to give full data which was 20-30 minutes. Reliability was determined using the Spearman-Brown formula. The following procedures were used in data analysis: descriptive statistical data analysis (frequency and percentage) and inferential statistical data analysis (independent sample t-test and Chi-square test). Data were analyzed using SPSS version 21.

RESULTS

Table 1 shows the socio demographic characteristics of the sample. Nearly half of the sample (48.8%) were aged 18 – 36 years old, and a majority were male was (68.9%). 31.7% graduated from primary school, and 49.1% lived in urban areas. The majority of the sample (86% ) were Iraqi, more than a third (37.9%) .
identified their occupation as a worker, and more than half (57.1%) reported a social income status of Sufficient daily needs.

**Table 1:** Distribution of socio demographic data of the study sample (n=322)

| The Characteristics | Subgroups                  | F.  | %     |
|---------------------|----------------------------|-----|-------|
| **Age groups**      | 1 – 18 Years               | 91  | (28.3)|
|                     | 18 -36 Years               | 157 | (48.7)|
|                     | 36-54 Years                | 44  | (13.7)|
|                     | > 54 Years                 | 30  | (9.3 )|
| **Gender**          | Male                       | 222 | (68.9)|
|                     | Female                     | 100 | (31.1)|
| **Education level** | Illiterate                 | 57  | (17.7)|
|                     | Able to read and write     | 70  | (21.7)|
|                     | Primary school             | 85  | (26.4)|
|                     | Secondary school           | 33  | (10.3)|
|                     | College or institute       | 22  | (6.8 )|
|                     | Post graduate              | 11  | (3.4 )|
|                     | Child (N. A.)              | 44  | (13.7)|
| **Residence**       | Urban                      | 158 | (49.1)|
|                     | Rural                      | 95  | (29.5)|
|                     | Suburban                   | 69  | (21.4)|
| **Nationality**     | Iraqi                      | 277 | (86)  |
|                     | Others                     | 45  | (14)  |
| **Occupation**      | Manual employee            | 9   | (2.8 )|
|                     | Office (Government) employee | 14  | (4.3 )|
|                     | Unemployed (house wife)    | 75  | (23.3)|
|                     | Retired                    | 10  | (3.1 )|
|                     | Worker                     | 122 | (37.9)|
|                     | Student                    | 48  | (14.9)|
|                     | Child (N. A.)              | 44  | (13.7)|
| **Income**          | Exceeds daily needs        | 3   | (0.9 )|
|                     | Sufficient for daily needs | 184 | (57.1)|
|                     | Insufficient for daily needs | 135 | (42)  |
Table 2 shows information regarding fall-related injuries. The primary mode of arrival was by none-ambulance mode (87%). Nearly half of the samples (44.1%) were injured at a residential facility, followed by the workplace (35.1%). Almost all falls (92.5%) were unintentional, and 89.1% of falls were falls to a hard ground.

The most common mechanism of fall was fall from ground 38.4%, and the most common fall height was fall from 1-3 meters (48.8%). On the pain scale, 54.3% of the sample reported, and on the Glasgow Coma Scale, 91.3% reported no head injury, and 79.2% received radiological investigation.

Table 2: Distribution of information regarding fall of the study sample (n= 322)

| The characteristics       | Subgroups                          | F. | %   |
|---------------------------|------------------------------------|----|-----|
| Mode of Arrival           | Ambulance                          | 41 | (12.7)|
|                           | None-ambulance mode                | 281| (87.3)|
| Location of fall Occurrence | Residential facility              | 142| (44.1)|
|                           | Sports facility                    | 26 | (8.1)|
|                           | Work place                         | 113| (35.1)|
|                           | Public / Commercial area           | 41 | (12.7)|
| Intentionality of fall    | Unintentional                      | 298| (92.5)|
|                           | Intentional                       | 24 | (7.5)|
| Ground of fall            | Soft                               | 35 | (10.9)|
|                           | Hard                               | 287| (89.1)|
| Fall Height               | < 1 Meter                          | 109| (33.8)|
|                           | 1 – 3 Meters                       | 157| (48.8)|
|                           | 3 – 6 Meters                       | 51 | (15.8)|
|                           | > 6 Meters                         | 5  | (1.6)|
| Level of Consciousness    | Conscious                          | 299| (92.9)|
|                           | Unconscious and or altered mental status | 23 | (7.1)|
| Pain Scale                | Mild pain                          | 7  | (2.2)|
|                           | Moderate pain                      | 132| (41)|
|                           | Severe pain                        | 175| (54.3)|
|                           | Unconscious                        | 8  | (2.5)|
| Total of Glasgow Coma Scale (GCS) | No head injury GCS 15/15      | 294| (91.3)|
|                           | Severe head injury GCS 3-8         | 8  | (2.5)|
|                           | Moderate head injury GCS 9-12      | 18 | (5.6)|
|                           | Miner head injury GCS 13-15        | 2  | (0.6)|
| Radiology investigation   | No                                 | 32 | (9.9)|
|                           | X-Ray                              | 255| (79.2)|
|                           | X-Ray with other radiology test    | 35 | (10.9)|

| Mechanism of fall         | F | %   |
|---------------------------|---|-----|
| Fall from ground          | 124| (38.4)|
| Fall from stairs and scaffold | 111| (34.5)|
| Fall from building or structure | 45 | (14)|
| Sport activity            | 27 | (8.4)|
| Others                    | 15 | (4.7)|
| Total                     | 322| (100)|
was received back slab or cast for the affected area, 24.8% was received advice and giving medication, 22.4% was received open reduction and internal fixation, 15.6% was received wound dressing and suturing, 3.4% was received traction, others, craniotomy 2.8%, surgical debridement and external fixation 2.5%, laparotomy 1.2%.

Table 3 shows the characteristics of injuries. Of the sample, 53.1% has no soft tissue injury, 41.3% had no fracture, 99.1% had no spinal cord injury, and 97.3% had no visceral injury. More than half (56.5%) of study sample had major degree of severity. Table 4 shows the frequencies and percentages of the treatment type and interventions of the study sample, 27.3% was received back slab or cast for the affected area, 24.8% was received advice and giving medication, 22.4% was received open reduction and internal fixation, 15.6% was received wound dressing and suturing, 3.4% was received traction, others, craniotomy 2.8%, surgical debridement and external fixation 2.5%, laparotomy 1.2%.

Table 3: Distribution of the injury characteristics among study sample (n= 322)

| The Characteristics                  | Subgroups     | F.  | %    |
|--------------------------------------|---------------|-----|------|
| Soft tissue injury                   | None          | 171 | (53.1) |
|                                      | Yes           | 151 | (46.9) |
| Skull and neck fracture              | None          | 133 | (41.3) |
|                                      | Upper limb    | 57  | (17.7) |
|                                      | Lower limb    | 68  | (21.1) |
| Site of fracture                     | Back fracture | 11  | (3.4)  |
|                                      | Chest fracture| 5   | (1.6)  |
|                                      | Pelvis fracture| 15  | (4.7)  |
|                                      | Multiple      | 13  | (4)    |
| Spinal cord injury                   | None          | 319 | (99.1) |
| SCI                                  | Yes           | 3   | (0.9)  |
| Visceral Injury                      | No            | 313 | (97.3) |
|                                      | Yes           | 9   | (2.7)  |
| Injury Severity                      | None          | 0   | (0.0)  |
| Classification                       | Minor         | 104 | (32.3) |
|                                      | Moderate      | 29  | (9)    |
|                                      | Major         | 183 | (56.8) |
|                                      | Death         | 6   | (1.9)  |

Table 4: Distribution of interventions of fall among the study sample (n= 322)

| The Outcomes                          | Subgroups     | F.  | %    |
|---------------------------------------|---------------|-----|------|
| Open Reduction and Internal Fixation  | No            | 250 | (77.6) |
|                                      | Yes           | 72  | (22.4) |
| Laparotomy                            | No            | 318 | (98.8) |
|                                      | Yes           | 4   | (1.2)  |
| Surgical debridement and external fixation | No   | 314 | (97.5) |
|                                      | Yes           | 8   | (2.5)  |
| Craniotomy                            | No            | 313 | (97.2) |
|                                      | Yes           | 9   | (2.8)  |
| Wound dressing and suturing           | No            | 285 | (88.5) |
|                                      | Yes           | 50  | (15.6) |
| Back slab or cast for affected area   | No            | 234 | (72.7) |
|                                      | Yes           | 88  | (27.3) |
| Traction                              | No            | 311 | (96.6) |
|                                      | Yes           | 11  | (3.4)  |
| Advice and giving Medication          | No            | 242 | (75.2) |
|                                      | Yes           | 80  | (24.8) |
Table 5 shows the differences between the fall consequences and outcomes regarding the ground of fall (soft or hard). There was a significant difference between the scores of the fall consequences and outcomes regarding ground of fall. A high significance was reported for open reduction and internal fixation (p=0.00), advice and giving medication (p=0.00), and disposition at emergency hospitals (p=0.00) with back slab or cast for the affected area (p=0.01), traction (p=0.01) and significant association for open reduction and external fixation (p=0.04). There was no significance at the p ≤ 0.05 with craniotomy, laparotomy, wound dressing, and suturing. A significant relationship between injury severity and fall height was observed (p= 0.00).

**Table 5:** Distribution of the fall consequences and outcomes based on (Ground of fall) of the study sample (n=322)

| Fall outcomes                                      | Ground of fall (f.) | Sig. p value | Sig. Level at p. value ≤ 0.05 |
|----------------------------------------------------|---------------------|--------------|------------------------------|
| 1- Open reduction and internal fixation            | Soft (35)           | 0.000        | H.S.                         |
|                                                    | Hard (287)          |              |                              |
| 2- Laparotomy                                      | Soft (35)           | 0.156        | N.S.                         |
|                                                    | Hard (287)          |              |                              |
| 3- Surgical debridement and external fixation      | Soft (35)           | 0.041        | S.                           |
|                                                    | Hard (287)          |              |                              |
| 4- Craniotomy                                      | Soft (35)           | 0.963        | N.S.                         |
|                                                    | Hard (287)          |              |                              |
| 5- Wound dressing and suturing                     | Soft (35)           | 0.289        | N.S.                         |
|                                                    | Hard (287)          |              |                              |
| 6- Back slab or cast for affected area             | Soft (35)           | 0.019        | S.                           |
|                                                    | Hard (287)          |              |                              |
| 7- Traction                                        | Soft (35)           | 0.015        | S.                           |
|                                                    | Hard (287)          |              |                              |
| 8- Advice and giving medication                    | Soft (35)           | 0.000        | H.S.                         |
|                                                    | Hard (287)          |              |                              |
| 9- Disposition at emergency room                   | Soft (35)           | 0.000        | H.S.                         |
|                                                    | Hard (287)          |              |                              |
RESULTS [15]. Residential facility was the most common place of fall followed by the workplace as reported in the same study [16]. A higher proportion of falls were unintentional, and majority of fall ground was hard. Injuries from fall height of 1–3 meters were the highest which is similar to the results by İçer et al. [17]. Falls from the ground were highest among the sample which agrees with the study done by Alfredsson [18]. The present study disagrees with the study by Grivna et al., which showed more patients had fallen from higher heights compared to ground level [19]. Most of the sample population were conscious and had a Glasgow coma score of 15. Most of the patients were stabilized and after primary care discharged directly from the emergency department, similar to study results [15]. Residential facility was the most common place of fall followed by the workplace as reported in the same study [16]. A higher proportion of falls were unintentional, and majority of fall ground was hard. Injuries from fall height of 1–3 meters were the highest which is similar to the results by İçer et al. [17]. Falls from the ground were highest among the sample which agrees with the study done by Alfredsson [18]. The present study disagrees with the study by Grivna et al., which showed more patients had fallen from higher heights compared to ground level [19]. Most of the sample population were conscious and had a Glasgow coma score of 15. Most of the patients were stabilized and after primary care discharged directly from the emergency department, similar to study results [15]. Residential facility was the most common place of fall followed by the workplace as reported in the same study [16]. A higher proportion of falls were unintentional, and majority of fall ground was hard. Injuries from fall height of 1–3 meters were the highest which is similar to the results by İçer et al. [17]. Falls from the ground were highest among the sample which agrees with the study done by Alfredsson [18]. The present study disagrees with the study by Grivna et al., which showed more patients had fallen from higher heights compared to ground level [19]. Most of the sample population were conscious and had a Glasgow coma score of 15. Most of the patients were stabilized and after primary care discharged directly from the emergency department, similar to study results.

### Table 6: Association between injury severity and fall height among the study sample (n=322).

| Injury severity classification | Fall height | Total | \(\chi^2\) value | Sig. value at p. value |
|------------------------------|-------------|-------|-----------------|----------------------|
|                              | Less than one meter f. | >1-3 m F. | >3-6 m F. | >6 m F. |                      |
| None                         | %           | %     | %               | %                    |                      |
| Minor                        | 0           | 0     | 0               | 0                    | 0.000                |
| Minor                        | 0.0         | 0.0   | 0.0             | 0.0                  | 0.000                |
| Moderate                     | 57          | 38    | 9               | 0                    | 0.000                |
| Moderate                     | 17.7        | 11.8  | 2.8             | 0.0                  | 0.000                |
| Major                        | 18          | 11    | 0               | 0                    | 0.000                |
| Major                        | 5.6         | 3.4   | 0.0             | 0.0                  | 0.000                |
| Major                        | 82          | 60    | 38              | 0                    | 3.000                |
| Major                        | 25.5        | 18.6  | 11.8            | 0.0                  | 0.900                |
| Death                        | 0           | 0     | 0               | 4                    | 2.000                |
| Death                        | 0.0         | 0.0   | 0.0             | 1.2                  | 0.600                |
| Total                        | 157         | 109   | 47              | 4                    | 5.000                |
| Total                        | 48.8        | 33.8  | 14.6            | 1.2                  | 1.600                |

### DISCUSSIONS

This study shows that majority of the sample as between 18 – 36 years old, which aligns with the Lohanathan et al. retrospective study in South India [11]. The sample had a larger proportion of males than females, which aligns with the Ahmad et al. study results of fatal falls [12]. Usually, men are exposed to falls more frequently than women because boys are more active at early ages than girls, and men are more physical workers than women. Based on the occupation, workers were more than a third of the study sample and aligns with Dong et al., Meena, and Punia, which reported that the highest risk of fall was occupation with construction laborers as the largest occupation at risk [13] [14]. The primary mode of arrival was by none-ambulance mode, consistent with earlier studies by Fayyaz et al. that demonstrated similar results [15]. Residential facility was the most common place of fall followed by the workplace as reported in the same study [16]. A higher proportion of falls were unintentional, and majority of fall ground was hard. Injuries from fall height of 1–3 meters were the highest which is similar to the results by İçer et al. [17]. Falls from the ground were highest among the sample which agrees with the study done by Alfredsson [18]. The present study disagrees with the study by Grivna et al., which showed more patients had fallen from higher heights compared to ground level [19]. Most of the sample population were conscious and had a Glasgow coma score of 15. Most of the patients were stabilized and after primary care discharged directly from the emergency department, similar to study results.
Observational data-based study by Dickinson et al. which showed the same result [25].

Conclusion

Fall-related injuries are the most common cases at emergency departments in Erbil city. Men are exposed to falls more frequently than women among ages 18 to 36 years old. The highest risk of fall is occupation with laborers of construction at the highest risk. Fall-related injuries have serious implications on the burden of the health care system, particularly on emergency services in developing countries like Iraq in relation to cost of care and resources.

Recommendation

Falls at work can be prevented by safety instruction to different groups, and proper regulation and legislation. Environmental variation based on architectural design may prevent falls among susceptible risk groups.

Conflict of interest

The author reports no conflict of interests.

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