Original Research Article

Adult Inpatient Hospital Falls with Injury: A Retrospective Analysis

Abstract

Background: Understanding what factors contribute to fall-related injuries is essential for developing and implementing interventions aimed at eliminating such incidents in a tertiary hospital in Saudi Arabia.

Purpose: This study aims to determine the factors that contributed to patient falls resulting in injury among all adult admitted patients in a tertiary hospital in Saudi Arabia.

Methods: We conducted a retrospective study of 89 adult patient falls incidents that resulted in injuries between January 2019 and September 2021. We evaluated demographic, patient, provider, environmental, organizational, and sociocultural variables. Included in the analysis were descriptive statistics, frequency, median, and interquartile range (IQR). The relationships between injury levels and key variables were evaluated using the chi-square test where $P \leq 0.05$ was considered statistically significant.

Results: A high percentage of patient falls resulting in injury were unwitnessed/unassisted (87.64%). Patients who sustained injuries from the fall have an age range of 38 years and older and are predominantly male (61.80%). All serious injuries were sustained by those aged 58 years and older (100%). The majority of patients had low levels of hemoglobin (92.13%). The association between the environment and injury level was found to be highly statistically significant ($x^2=21.12$, P value=0.002).The median time between physician was notified and physician's response was 20 minutes, with an interquartile range of 1 hour and 7 minutes.

Conclusion: We emphasize the importance of including the older age, gender, and hemoglobin in screening and preventative measures aimed at preventing fall-related injuries. In addition, a physician's prompt response is essential for preventing the initial injury from deteriorating further.

Keywords: Falls with injury, unwitnessed fall, unassisted falls

INTRODUCTION

The National Database of Nursing Quality Indicators (NDNQI) defines patient fall as a sudden, unintentional descent, with or without injury to the patient, that results in the patient coming to rest on the floor, on or against some other surface (e.g., a counter), on another person, or on an object (e.g., a trash can). Fall-related injuries are classified as minor, moderate, major, and death (NDNQI, 2020). Patient falls and associated injuries are regarded as nursing-sensitive indicators because the prevention of falls is contingent on the quantity and quality of nursing care. The National Database of Nursing Quality Indicators (NDNQI) published a report on adult inpatient fall rates between 2018 and 2020, revealing that the mean injury fall rate per 1,000 patient days ranged between 0.46 and 0.60.

Injuries caused by patient falls are a serious problem in hospitals around the globe. It affects the patient's quality of life. Even soft tissue injuries and minor fractures can cause significant functional impairment, discomfort, and distress in frail and functionally vulnerable individuals. These ostensibly "minor" injuries, or falls resulting in no physical harm, can mark the beginning of a negative cycle in which a senior's dread of falling causes him or her to limit activity, resulting in further loss of strength and independence (Oliver et al., 2010). There are numerous evidence-based falls prevention measures and risk assessments, however, there is little evidence that helps identify and intervene with patients who are more likely to sustain an injury from a fall. In Saudi Arabia, understanding what factors including the predictors prior to injurious falls

remains unclear. The treatment of fall injuries is extremely expensive, further increasing the burden on the healthcare economy. What is more concerning are the debilitating effects of the injury to the lives of the patients wherein they suffer lifelong disabilities and psychological trauma after sustaining a moderate to major fall injury.

In King Faisal Specialist Hospital & Research Center (KFSH&RC), Riyadh, Saudi Arabia, the falls with injury rate per 1,000 patient days for the previous eight quarters (3Q2019 – 2Q2021) ranged from 0.10 to 0.22, outperforming the NDNQI's eight-quarter benchmark of 0.40 to 0.51. KFSH&RC is a Magnet-designated hospital, requiring the organization to accomplish five out of eight quarters of superior performance for falls with injury indicator. Although these numbers do not affect the hospital's performance in sustaining Magnet standards, they continue to represent the number of patients who sustained injuries from the fall. This study's objective is to investigate and determine the factors that contribute to adult inpatient falls resulting in injury. This study utilized the Quality Information System (QIS), the Integrated Clinical Information System (ICIS), and the Fall Event Review Tool to collect the data and identify pertinent factors regarding why certain adult patients are more likely to sustain an injury from a fall. This study included all adult patients admitted in an adult inpatient units aged 18 years old and above who sustain injuries from a fall, regardless of injury severity.

Methods

Purpose

This study aims to determine the factors that contributed to patient falls resulting in injury among all adult patients admitted to King Faisal Specialist Hospital & Research Center in Riyadh, Saudi Arabia.

Study Design and Sampling:

A retrospective study was a design used to analyze the case series of patient falls with injury incidents in King Faisal Specialist Hospital & Research Center in Riyadh, Saudi Arabia. The inclusion criteria were adult patients aged 18 years old and above admitted across all adult inpatient areas that sustained injury from the fall. On the other hand, the exclusion criteria were from pediatric patient population aged 17 years and below from across all inpatient areas, including pediatric and adult Outpatient and Emergency Department. This retrospective study included all adult patient falls with injury incidents that occurred from January 2019 – September 2021. All of the 89 incidents were eligible samples of the study.

Data Collection

The data collection procedure commenced with the electronic entry of a patient fall incident into the Quality Information System (QIS). A QIS report and the patient's medical record were reviewed by a Nursing Quality Analyst and a Nursing Quality Improvement Coordinator who were trained and experienced in defining falls and fall-related injuries after a clinician entered a fall incident. On the Integrated Clinical Information System (ICIS), the Medical Record Number (MRN) for each incident has been validated via a review of demographics and documentation. The Analyst and Coordinator validated the report's veracity, including the severity level of the

injury according to National Database for Nursing Quality Indicators (NDNQI) definition and guidelines for patient falls. Each incident report's investigation progress notes, document attachments, findings, and conclusion were stored in the QIS. The accounting for all validated and closed patient falls with injury incidents are linked to the Organization's Zero Harm Scorecard Dashboard.

In this investigation, we retrospectively examined all patient falls closed incidents resulting in injuries that occurred between January 2019 and September 2021. All required medical record data was collected retrospectively without direct patient contact using the Fall Event Review Tool, a hospital-specific adaptation of the Agency for Healthcare Research and Quality's patient falls data collection form. This instrument included demographic, patient, provider, environmental, organizational, and sociocultural independent variables. The QIS, ICIS, and Zero Harm Scorecard Dashboard were the hospital electronic systems utilized to collect all of the necessary information and data, including validation results.

Statistical Analysis

Data collected in the fall event review tool were entered in Redcap app, and the final data were extracted in Microsoft Excel (version 2016) sheet. Data analysis was carried out in STATA 17.0 (StataCorp LP, College Station, TX, USA) software package. Analysis included descriptive statistics, frequency tables in numbers and percentages, when considered necessary, the median and interquartile range (IQR) were used. The associations between variables were tested through the chi-square test, a suitable test for significance where $P \leq 0.05$ was regarded as statistically significant difference in all statistical tests.

Results

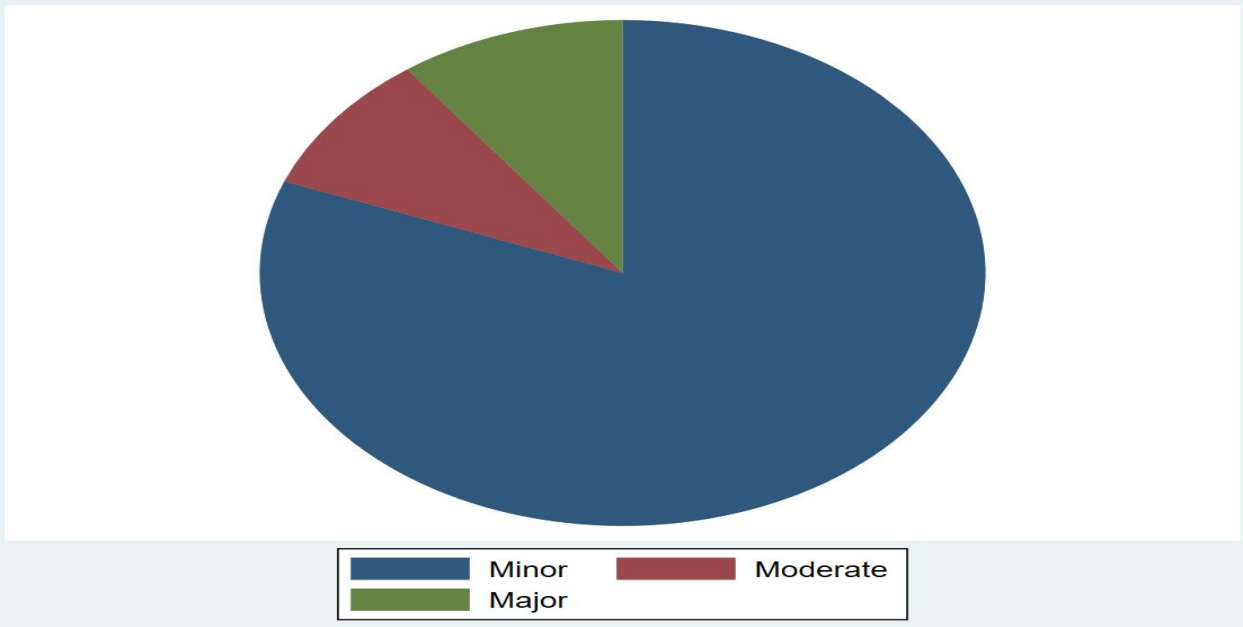

Figure (1): Displays the distribution of injured patients according to the severity of their injuries.

In this study, the vast majority of patients (N= 72, 81%) sustained minor injuries, followed by major (N= 9, 10%) and moderate (N=8, 9%) injuries.

Figure (2): Represents the sociodemographic age characteristic based on the severity of injuries. Patients' ages ranged from 38 and above, and patients aged 58 and older sustained all serious injuries.

Table (1): Displays the distribution of sociodemographic gender characteristics of patients. Males (N=55, 61.80%) sustained more injuries regardless of severity than females (N=34, 38.20%).

Table (2): The distribution of the unit population is illustrated. The population of patients admitted to the Medical/Surgical unit sustained the highest percentage of fall-related injuries (N=20, 22.47%).

Table (3): Indicates patient falls with associated injury factors. The majority of falls resulting in injury were unwitnessed (N=78, 87.64%) and occurred with a sitter present (N=55, 62.50%), while history of falls (N=8, 8.99%) and physiologic falls (N=11, 12.36%) were less common.

Table (4): Displays patient vital signs prior to fall. Prior to fall occurrence, the majority of patients have normal vital signs, including normal Oxygen Saturation (N=88, 98.88%), normal temperature (N=77, 86.52%), normal pulse rate (N=72, 80.90%), normal respiration (N=72, 80.90%), and normal blood pressure (N=73, 82.02%).

Table (5): Reveals patients' blood test results. Majority of patients had low hemoglobin count (N=82, 92.13%), and low Red Blood Cell Count (RBC) (N=74, 83.15%), whereas more than three quarters (N=68, 76.40%) had normal albumin level.

Table (6): Shows the exact location of the falls. The highest frequency of patient falls based on exact location was in the patient's room (N=52, 58.43%) and in the bathroom (N=37, 41.57%), whereas there were no occurrence of falls in the hallway or nursing station.

Table (7): Shows distribution of factors related to involved patients attempting to do before fall. The highest percentage was patients who were going to the bathroom (N= 19, 21.5%), followed by getting out of bed (N=18, 20.22%) and walking (N=16, 17.98%), whereas the lowest was reaching for object (N=1, 1.12%) and standing still (N=5, 5.62%).

Table (8): Shows association between environment and injury level. There was highly significant association between environment and injury level (x^(2)=21.12, P value=0.002).

Table (9): Shows the duration of time between physician was notified and response. The median duration for 50 cases was twenty minutes.

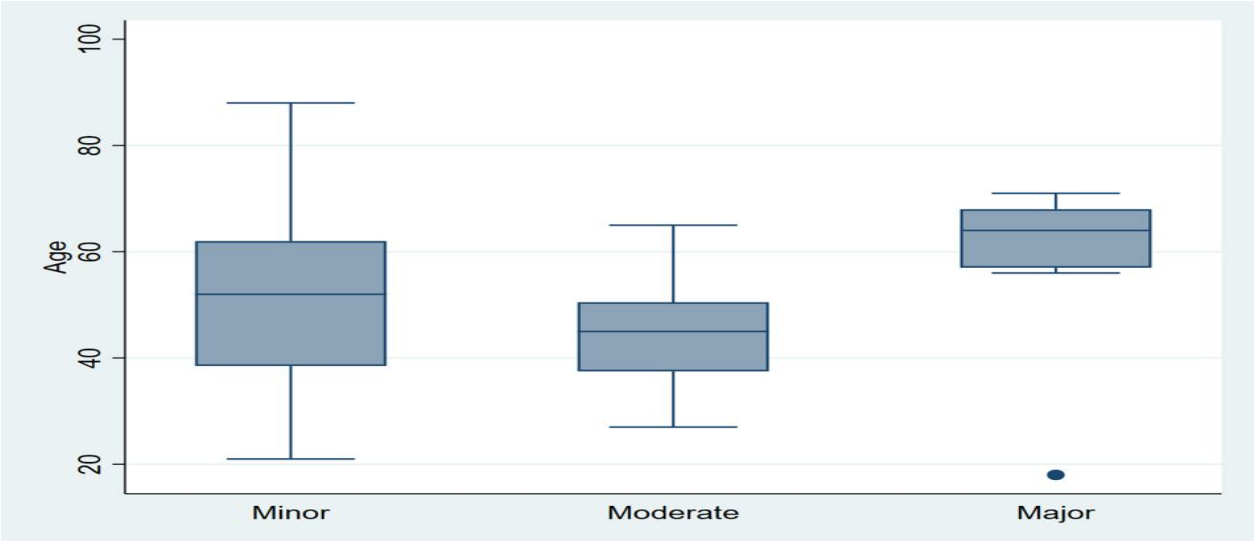

Figure 2: Sociodemographic age characteristic

Discussion

In this study, we determined specific variables that contributed to adult patients from sustaining injury from a fall in a tertiary hospital in Riyadh, Saudi Arabia. It was determined that patients who sustained injuries from fall incidents were 38 years of age and older. All major injuries were sustained by older adults 58 years and older. (Gray- Miceli, 2014) cited that visual impairment, gait or mobility impairment, and balance impairment have all been associated with advancing age that are common causes of patient falls for older age patient population. Chronic illnesses, decreased muscle strength from arthritic joints, physical frailty in which walking speed is reduced, sarcopenia associated with loss of muscle mass and strength, and the dangers of immobility are common factors affecting gait in older adults. In addition, the older person's ability to regulate posture and avoid falling after an unexpected slip decreases with age (Gray-

Miceli, 2014). In a separate study conducted in Saudi Arabia has cited that vision, hearing, and memory impairments associated with aging tend to increase the number of trips and falls (Yamani & Alaama, 2018). Considering these factors associated with aging, our findings indicate that elderly patients aged 58 years and older who fall are more likely to sustain serious injuries than younger patients.

Gender	Frequency (N)	%
Male	55	61.80%
Female	34	38.20%
Total	89	100%

Table 1: Sociodemographic gender characteristic

Majority of patients who sustained higher number of injuries were men compared with women. This finding is consistent with another study in Jeddah, Saudi Arabia that the occurrence of falls with injury occurred mostly in men than women (Yamani & Alaama, 2018). A 2018 study related to understanding sex differences in fall circumstances revealed that men were likely than women to fall from loss of support with an external object, like a cane or chair (Yang, Yijian, et. al, 2018). The outcome of patient fall with injury for men in Saudi Arabia could be attributed to socio-cultural views on gender as men being perceived as gender of physical strength who are less likely inclined to ask for help or assistance compared with women. Because of this notion in their society, male patients tend to disregard support for walking or choose not to call for assistance when they attempt to ambulate. Without using any support, it could contribute to more fall with injury frequency among men than women.

Unit Type	Injury level			Total
	Minor	Moderate	Major	

Adult Bone Marrow Transplant	7	1	2	10
Cardiovascular	6	0	0	6
Oncology	13	4	2	19
Organ Transplant	12	1	1	14
Medical/Surgical	15	2	3	20
Neurosciences	10	0	0	10
Orthopedics	1	0	0	1
Others	8	0	1	9
Total	72	8	9	89

Table 2: Demonstrates the distribution of patient fall with injury incidents per unit type.

In terms of patient population, adult patients admitted in the medical/surgical and oncology units sustained higher number of patient fall with injury incidents compared with other units. This finding correlates with another study wherein medical/surgical units have higher patient fall with injury incidents in USA. Twenty percent of medical/surgical unit falls result in some injury, while 2% result in serious injuries (Cuttler, S et., al, 2017). Another study found that many patients with cancer have higher risk for falls and injury due to multiple and specific risk factors because of cancer symptoms and treatment side effects (Yesilbalkan, O. & Ustundag, S., 2019).

Factor	Yes N (%)	No N (%)	Unknown N (%)	Total
History of Falls	8 (8.99%)	79 (88.76%)	2 (2.25%)	89 (100%)
Physiologic Falls	11 (12.36%)	73 (82.02%)	5 (5.62%)	89 (100%)
Witnessed Falls	9 (10.11%)	78 (87.64%)	2 (2.2.25%)	89 (100%)

Sitter is present	55 (62.50%)	5 (5.68%)	28(31.82%)	89 (100%)

Table 3: Related factors

Vital sign	Low N (%)	Normal N (%)	High N (%)	Known N (%)	Total N (%)
Blood sugar	0 (0%)	16 (17.98%)	26 (29.21%)	43 (52.81%)	89 (100%)
Oxygen Saturation	1(1.12%)	88(98.88%)	0(0%)	0(0%)	
Temperature	2 (2.25%)	77(86.52%)	10(11.24%)	0(0%)	89 (100%)
Pulse	6 (6.74%)	72 (80.90%)	11 (12.36%)	0(0%)	89 (100%)
Respiration	0 (0%)	72 (80.90%)	17 (19.10%)	3 (3.37%)	89 (100%)
Blood pressure	2 (2.2.25%)	73 (82.02%)	14 (15.73%)	0(0%)	89 (100%)

Table 4: Patient vital signs before falls

Blood test	Low N(%)	Normal N(%)	High N(%)	Known N(%)	Total N(%)
WBC	13 (14.61%)	61 (68.54%)	15 (16.85%)	0 (0%)	89 (100%)
RBC	74 (83.15%)	14 (15.73%)	1 (1.12%)	0 (0%)	89 (100%)
Hemoglobin	82 (92.13%)	6 (6.74%)	1 (1.12%)	0 (0%)	89 (100%)

Platelet	36 (40.45%)	50 (56.18%)	2 (2.25%)	1 (1.12%)	89 (100%)
Potassium	12 (13.48%)	73 (82.02%)	3 (3.37%)	1 (1.12%)	89 (100%)
Sodium	25 (28.09%)	64 (71.91%)	0 (0%)	0(0%)	89 (100%)
Calcium	36 (40.45%)	38 (42.70%)	2 (2.25%)	13 (14.61%)	89 (100%)
Magnesium	19 (21.35%)	60 (67.42%)	1 (1.12%)	9 (10.11%)	89 (100%)
Albumin	11 (12.36%)	68 (76.40%)	10 (11.24%)	0 (0%)	89 (100%)

Table 5: Patient's blood test before falls

Previous studies have identified that history of falls is one of the risk factors for patient falls. Some fall risk assessment tools included fall history as one of the variables being assessed in determining the patient level of risk. However, our finding showed that majority of the patients who sustained injury from the fall had no history of fall. This is an evidence that history of fall is not a reliable variable to determine the injury risk in particular. Although the aim of fall risk assessment tools is to prevent patient falls regardless of the outcome, this finding suggests that history of fall has no significance in determining the level of injury risks from a fall.

However, the majority of patient falls resulting in injury were not witnessed. Unwitnessed falls were falls that occurred when the patient was alone and no other person was present to observe the fall or assist the patient. A 2014 study concluded that unassisted falls are more likely to result

in injury than assisted falls and should be the focus of future prevention efforts (Staggs, V et al., 2014).

Prior to falling, the majority of patients' vital signs were normal, according to an analysis of their measurements. Gray-Miceli (2014) provided evidence that orthostatic hypotension is a common intrinsic factor that may result in loss of balance and increase the patient's risk of collapsing. However, our investigation revealed that vital signs are unrelated to patient falls with injuries.

The majority of patients had insufficient hemoglobin and Red Blood Cell (RBC) counts, which was indicative of anemia, as determined by the blood test results. Interestingly, numerous studies have only linked patient injuries to anemia in old age. However, our study indicates that patients with anemia, regardless of age in the maturity stage, are more likely to sustain a fall-related injury. This finding is consistent with the findings of a previous study conducted in Jeddah, Saudi Arabia, in which researchers discovered that a significant proportion of patients who sustained a fall-related injury had a history of anemia (Yamani & Alaama, 2018).

Exact Location of Incident:	N	%
Patient's Room	52	58.43%
Bathroom	37	41.57%
Hallway	0	0%
Nursing Station	0	0%
Total	89	100%

Table 6: Exact location of the falls

What was the involved patient attempting to do?	N	%
Getting out of bed	18	20.22%
Standing Still	5	5.62%
Wheeling in wheelchair	0	0%
Walking	16	17.98%
Reaching for object	1	1.12%
Transferring to/from chair or wheelchair	6	6.74%
Going to the bathroom	19	21.35%
Unknown	14	15.73%
Other	10	11.24%
Total	89	100%

Table 7: Involved patients attempting to do before fall

Environment:	Injury level				Chi-square test
	Minor	Moderate	Major	total	
Wet floor	9	0	2	11	Person chi2 (6) = 21.1233
Footware	0	0	1	1	Pr=0.002*
IV Lines attached	0	1	0	1	
Unknown	63	7	6	76	
Total	72	8	9	89	

Table 8: Association between environment and injury level Footnote: p-value ≤ 0.05*, x^2= chi-square

The majority of patient falls resulting in injuries occurred in patient rooms as patients attempted to get out of bed and use the bathroom. The bathroom is another location where patient falls with injuries occur more frequently. This finding indicates that the environment is statistically highly significant in association with the injury level. Patients admitted to hospitals or residing in long-term care facilities are susceptible to falls in their environment. It may be necessary to modify the environment in order to prevent severe injury (Gray-Miceli, 2014).

Time physician was notified	Time physician responded	Duration of time
09:30	10:57	01:27
11:10	11:35	00:25
8:05	8:15	00:10
13:30	13:40	00:10
00:00	00:25	00:25
11:05	11:05	00:00
01:11	02:02	00:51
15:45	15:55	00:10
16:00	16:36	00:36
22:00	23:18	01:18
02:00	02:20	00:20
21:15	22:08	00:53

12:19	15:35	03:16
00:25	00:25	00:00
07:35	08:19	00:44
12:00	13:30	01:30
13:00	14:16	01:16
16:50	17:19	00:29
16:04	16:04	00:00
09:51	09:51	00:00
08:55	08:55	00:00
03:20	03:21	00:01
03:00	03:00	00:00
16:35	16:35	00:00
06:00	12:40	06:40
22:30	22:32	00:02
13:31	13:31	00:00
06:00	06:46	00:46
01:20	01:30	00:10
07:25	07:25	00:00
03:40	04:00	00:20
22:10	22:13	00:03
16:45	16:45	00:00
19:30	21:00	01:30
10:05	10:29	00:24

07:31	08:07	36:00
17:00	18:05	01:05
10:05	10:30	00:25
05:00	05:00	00:00
02:00	03:40	01:40
02:51	02:55	00:04
07:00	07:00	00:00
16:50	17:00	00:10
09:30	10:00	00:30
13:00	13:00	00:00
01:00	14:17	13:17
04:51	04:53	00:02
07:35	08:07	32:00
23:10	01:30	02:20
04:51	05:00	00:09

N	Median	Interquartile Range
50	0:20	1:07

Table 9: Duration of time between physician was notified and response

Also, the median time between notifying the physician and receiving a response from the physician was 20 minutes. As the patient's condition may alter rapidly, a timely and accurate assessment of fall and/or injury risk remains crucial (Constantinou, E., & Spencer, J., 2020). In this study, there was no worsening of the patient condition after the initial fall-related injury.

This finding demonstrated that 20 minutes of response time is sufficient to manage the patient from the initial injury and prevent the injury from becoming more severe.

The findings of this study is significant in terms of understanding the associated factors related to falls with injury, more so in Saudi Arabia patient population. The variables determined in this study such as older age, male gender and anemia provides us clarity as to what factors contribute to the likelihood of adult patients admitted to King Faisal Specialist Hospital & Research Center to sustain injuries from the fall. In addition, this study will aid us in forming policies, project improvements and other initiatives for fall-related injuries prevention in the hospital.

Nursing Implications

Fall risk assessment (FRA) tools utilized by nurses are specifics in assessing patients who are most likely to fall and categorized according to risk levels. However, it does not determine who are most likely to be injured from a fall. Although the aim for FRAs is to prevent a fall, this study provides us clear understanding as to what factors that would make the patient most likely to be injured from the fall. The finding of this study indicates an important need to implement fall injury screening and prevention programs in consideration with variables such as older age, male gender and anemia.

Research Limitations:

We examined the case series of patient falls with injuries incidents that occurred in the past. This rendered the evidence of this study inferior compared to prospective studies in which exposure is assessed at baseline and subjects are followed over time to examine the incidence of falls with

injury. The study does not represent the general Saudi Arabian population as it was only conducted in one tertiary hospital.

Ethical considerations

This research endeavor did not inflict any harm on the participants. Patients' information is kept strictly confidential during and after the duration of the study. As there was no direct patient contact, no consent was necessary. This research was conducted with the approval of the Research Ethics Committee of the Research Ethic Council (REC) at King Faisal Specialist Hospital & Research Centre (KFSH&RC), Riyadh, Saudi Arabia, dated February 21, 2022. The information was used exclusively for scientific and academic investigation.

Conclusion

Older age 58 years old and above are more susceptible to major injury. Anemia, male patients and unwitnessed/unassisted falls can increase the likelihood of patients from sustaining injuries from the fall. Timely physician’s response time is integral in preventing further deterioration of the initial injury. We highlight the urgent need for initiating interventions focused on preventing injuries from the fall, especially to include age, gender and hemoglobin in screening and preventative measures.

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