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Original article

# Falls from height: orthopaedic and psychiatric evaluation

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**Summary.** *Background:* Fall from a height is one of the major causes of significant trauma with high morbidity and mortality rates. Traumatological damage control is often the primary treatment both for suicide attempt survivors and for accidental fall victims, but management of the hospitalization of psychiatric patients requires more resources than other patients. *Methods:* Retrospective multidisciplinary study (psychiatric and orthopaedic evaluation) and analysis of psychiatric and trauma characteristics of patients fallen from height admitted to our trauma centre. We analysed patterns of patients after suicidal jumps and accidental falls to look for possible trends that may trigger projects for further improvement of care. *Results:* 205 patients were analysed, 137 were included: 65 suicide attempt survivors and 72 accidental fall victims. Between these two groups there are no differences about the anaesthesiologic acute management or the number of damage control procedures. However, the psychiatric patients stay longer in hospital especially in intensive care unit with prolonged intubation ($p< 0.001$). Suicide attempt survivors are significant correlated with fractures of feet, but the orthopaedic lesions do not involve an increase of definitive interventions ($p< 0.05$). *Conclusion:* We showed that the suicide attempt survivors and accidental victims need the same acute management. The orthopedic definitive surgical procedures are similar between the two groups, but in spite of this patients with psychiatric disorder were associated with a statistically significant increase of care in intensive care unit and hospitalization. Our results allow to create a new multidisciplinary approach for these patients. (www.actabiomedica.it)

**Key words:** trauma, falls from a height, psychiatric disorder

## Background

Fall from height with intentional jumping is the most common mechanism of injury in psychiatric patients (1, 2). In the UK each year, 3 - 15% of the 140,000 suicide attempts are performed through intentional jumping (3) and they represent an emerging social and economic problem in many countries (4). Surgery is often the primary treatment but management of psychiatric patients requires a multidisciplinary approach and significant resources (5-7). However, limited literature is available about those trauma patients (1, 6, 7); only few published papers studied these injuries. Ohi K. et al. investigated factors influencing hospital stays for Japanese patients attempting suicide by jumping (8), while Muhr G. et al. compared the injury patterns after suicidal jumps and accidental falls (9). Both papers underlined the peculiarity of these patients.

Aims of this study are to evaluate the patterns of patients after suicidal jumps and length of hospitalization to look for possible trends that may trigger projects for further improvement of management and care of these patients

## Methods

We performed a retrospective multidisciplinary (psychiatric and orthopaedic evaluation) analysis. All

trauma patients admitted to our level I trauma centre (between January 2006 and December 2017) as a result of unintentional or intentional fallen from height were included. Our Data Platform revealed 205 records.

The orthopaedic group analysed the following parameters: age at the time of admission, gender, mechanism of injury, injury patterns, surgical interventions, complications, reinterventions, ventilator days, number of readmission, length of stay, compliance to physiotherapy, destination of discharge and mortality.

Psychiatric evaluation included: any psychiatric diagnosis (Inter-national Classification of Disease, ninth Revision, Clinical Modification (ICD-9CM)), season of event, history of attempted suicide, previous psychiatric consultation and psychiatric drug use, alcohol/drug abuse, intentional injury and the time of first physiatry evaluation.

We excluded patients falling from a height less than 3 meters, those who died prior to admission, patients without any kind of ortho-trauma lesion or surgical procedures and followed for less than 1 year. Patients were divided into two groups: suicide attempt survivors' group (group S) and accidental fall victims' group (group C) and data of the two groups were compared. Statistical analyses were performed using Stata 12.0 (Stata Corp, College Station, TX). Preliminary analyses were performed to compare injuries site, acute and post-acute surgical and not surgical management, complications and any diagnosed psychiatric disorder using Chi squared tests and analyses of variance (ANOVA). When differences were observed, analyses were completed with pairwise Chi-squared and Student's t tests. The variables "number of injuries" and "height of the fall" were simultaneously included. All data being adjusted for age and sex. We have asked the consent of patients for the use of all data.

## Results

Demographic data of our population are summarised in Table 1. 205 patients were analysed; 27 patients were excluded because they were followed for less than 1 year. 41 patients were lost during the follow up. 137 were included, 65 resulting from an attempting suicide fall and 72 from an accidental fall. The

**Table 1.** Patient characteristics.

| | N° (%) | | | |
|---|---|---|---|---|
| **Total patients** | 205 | | | |
| **Patients included** | 137 | | | |
| **Patients exluded** | 27 | | | |
| | **Attempting suicide** | **Accidental fall** | **Value** | **p** |
| **Patients** | 65 | 70 | | |
| **Average age** | 37 | 46 | 1.7 | 0.046* |
| **Min age** | 14 | 14 | | |
| **Max age** | 87 | 80 | | |
| ***>18*** | 55 (84.62) | 66 (94.28) | | |
| ***<18*** | 10 (15.38) | 4 (5.71) | | |
| **Sex** | | | 2.37 | 0.01* |
| ***Male*** | 36 (55.38) | 60 (85.71) | | |
| ***Female*** | 29 (44.62) | 10 (14.29) | | |
| **Precipitation height (m)** | | | 1.99 | 0.024* |
| ***<5*** | 20 (30.77) | 42 (60) | | |
| ***5;10*** | 25 (38.46) | 16 (22.86) | | |
| ***>10*** | 20 (30.77) | 12 (17.14) | | |

* p<0.05 - p<0.001

males/female's rate was higher in group C (85.71%) then group S (55.38%) (p< 0.05). The average age of group S was lesser than others (37 years old) with an increased number of minors (15.38%) (p< 0.05). There was significant correlation in the height between suicidal and accidental falls (p< 0.05): 60% of no intentional victims fell from a height lesser than 5 metres.

The specifics of attempting suicide patients are summarised in Table 2. The seasonal distribution showed a summit of attempting suicide in spring (33.85%). 26.15% of psychiatric patient had a previous suicide attempt and 10.78% died after a new attempt. 76.92% was people with psychiatric disorders already followed from psychiatrists and 44.62% had diagnosis of major depressive disorder. Psychiatrist made their first post traumatic evaluation in an average of 9 (0-31) days. A similar number of psychiatric patients 87.79% took psychiatric drugs after the trauma compared to the proportion of patients before the fall (75.38%).

There was significant correlation between the attempting suicide patients (55.38%) and fractures of feet (p< 0.001) and also vegetative complications (p<

**Table 2.** Intentional fall group characteristics.

| | N° (%) |
|---|---|
| **Patients** | 65 |
| **Died after subsequent** | 7 (10.78) |
| **psychiatric diagnoses before attempt** | 50 (76.92) |
| **Nota t first attempt** | 17 (26.15) |
| **Psychiatric disorder** | |
| ***MDD (Major Depressive Disorder)*** | 29 (44.62) |
| ***BD (Bipolar Disorder)*** | 10 (15.38) |
| ***PD (Personality Disorder)*** | 3 (4.62) |
| ***Abuse*** | 2 (3.08) |
| ***Schizoaffective*** | 2 (3.08) |
| ***Psychosis*** | 2 (3.08) |
| ***No disorders*** | 3 (4.62) |
| **Mean time from trauma to the first psychiatric consultation** | 9 (0-31) |
| **Drugs before trauma** | 49 (75.38) |
| ***Antidepressants*** | 28 (49.23) |
| ***Antipsychotics*** | 32 (49.23) |
| ***Mood stabilizers*** | 12 (18.46) |
| ***Benzodiazepines*** | 35 (53.85) |
| **Drugs after the trauma** | 57 (87.69) |
| ***Antidepressants*** | 34 (52.31) |
| ***Antipsychotics*** | 35 (53.85) |
| ***Mood stabilizers*** | 13 (20.00) |
| ***Benzodiazepines*** | 36 (55.38) |

**Table 3.** Comparisons of injuries sites and complications.

| | N° (%) | | | |
|---|---|---|---|---|
| **Injuries site** | **Attempting suicide** | **Accidental fall** | **Value** | **p** |
| **Humerus** | 15 (23.08) | 11 (15.71) | 1.26 | 0.26 |
| **Forearm** | 17 (26.15) | 22 (31.43) | 0.06 | 0.79 |
| **Hand** | 8 (12.31) | 8 (11.43) | 0.04 | 0.85 |
| **Pelvis** | 32 (49.23) | 27 (38.57) | 1.73 | 0.18 |
| **Femour** | 25 (38.46) | 23 (32.86) | 1.75 | 0.41 |
| **Leg** | 28 (43.07) | 36 (51.43) | 1.11 | 0.29 |
| **Foot** | 36 (55.38) | 19 (27.14) | 11.54 | 0.00* |
| **Spine** | 36 (55.38) | 28 (40) | 3.46 | 0.06 |
| **Head** | 18 (27.69) | 18 (25.71) | 0.10 | 0.75 |
| **Face** | 24 (36.92) | 18 (25.71) | 1.62 | 0.20 |
| **Thorax** | 28 (43.08) | 20 (28.57) | 3.30 | 0.07 |
| **Abdomen** | 16 (24.62) | 11 (15.71) | 1.77 | 0.18 |
| **Neurological system** | 9 (13.85) | 6 (8.57) | 1.01 | 0.31 |
| **Urological system** | 6 (9.23) | 1 (1.43) | 4.25 | 0.04 |
| **Complications** | | | | |
| **Periferical nerve** | 5 (7.69) | 6 (8.57) | 0.026 | 0.87 |
| **Pulmonary** | 9 (13.85) | 7 (10) | 0.52 | 0.47 |
| **Urological** | 2 (3.08) | 4 (5.71) | 0.53 | 0.47 |
| **Abdominal** | 1 (1.53) | 2 (2.86) | 0.26 | 0.61 |
| **Sepsis** | 7 (10.77) | 11 (15.71) | 0.66 | 0.42 |
| **Cerebral** | 4 (6.15) | 1 (1.43) | 2.158 | 0.14 |
| **Medullary** | 2 (3.07) | 0 | 2.22 | 0.13 |
| **Vegetative state** | 4 (6.15) | 0 | 4.50 | 0.03* |
| **Other** | 2 (3.08) | 0 | 2.21 | 0.14 |
| **Infections with coltural positive** | 4 (6.15) | 2 (2.85) | 0.87 | 0.34 |
| **Soft tissue** | 4 (6.15) | 2 (2.85) | 2.55 | 0.28 |

0.05) (Table 3). Furthermore, patients with psychiatric disorders stayed longer in intensive care and also in hospital (respectively p< 0.001 and p< 0.05). Instead, most of who fell accidentally was discharged at home in smaller times (70%) (p< 0.05) (Table 4). We identified that the lesion of the feet did not involve an increase of orthopaedic interventions (p< 0.05), but it increased the recovery period (p< 0.05) and decreased the compliance to physiotherapy (p< 0.001) (Table 5). The patients followed by the psychiatrist before the trauma stay in hospital a shorter time than the psychiatric patients not previously followed (p< 0.05).

## Discussion

Only few articles evaluated the trauma patient population with psychiatric disorder (1, 9) and showed that the psychiatric patients generate large volumes of multidisciplinary workloads (3, 14, 15) with high hospital costs (16-18).

In this study we compared the characteristics of victims in self-inflicted and unintentional falls. The attempting suicide group was composed of large number of minors with similar subdivision between males and females. The control group was mainly male, and their accident usually occurred from a height less than

**Table 4.** Comparison of hospitalization, treatments and discharges.

| | N° (%) | | | |
|---|---|---|---|---|
| | **Attempting suicide** | **Accidental fall** | **Value** | **p** |
| **Mean hospitalization** | 42.26 | 24 | 37.598 | 0.00* |
| **Min** | 0 | 3 | | |
| **Max** | 153 | 129 | | |
| **Damage Control** | 55 (84.62) | 61 (87.14) | 0.11 | 0.19 |
| **Definitive surgical procedure (not included damage control)** | 12 (18.46) | 13 (18.57) | 0.08 | 0.38 |
| **Intensive care** | | | 16.12 | 0.05* |
| **1-7 days** | 24 (36.92) | 16 (22.86) | | |
| **7-15 days** | 7 (10.77) | 13 (18.57) | | |
| **>15 days** | 15 (23.08) | 9 (12.86) | | |
| **Orthopedic procedures** | | | 0.10 | 0.26 |
| **1-2 surgical procedure** | 34 (52.31) | 52 (74.29) | | |
| **3 surgical procedure** | 7 (10.77) | 8 (11.43) | | |
| **> 3 surgical procedure** | 9 (13.85) | 4 (5.71) | | |
| **Non orthopedic procedures** | | | 0.01 | 0.87 |
| **1-2 surgical procedure** | 20 (30.77) | 10 (14.29) | | |
| **3 surgical procedure** | 1 (1.54) | 2 (2.86) | | |
| **> 3 surgical procedure** | 1 (1.54) | 0 | | |
| **Time from trauma for first definitive surgical procedure** | | | 0.03 | 0.74 |
| **1-7 days** | 46 (70.77) | 24 (34.29) | | |
| **7-15 days** | 10 (15.38) | 21 (30) | | |
| **>15 days** | 4 (6.15) | 9 (12.86) | | |
| **Time from trauma for first physiatrics visit** | | | 0.13 | 0.12 |
| **1-7 days** | 30 (46.15) | 29 (41.43) | | |
| **7-15 days** | 12 (18.46) | 14 (20) | | |
| **>15 days** | 13 (20) | 13 (18.57) | | |
| **Physiotherapy compliance** | 56 (86.15) | 65 (92.86) | 0.14 | 0.12 |
| **Discharge** | | | 56.78 | 0.00* |
| **Home** | 19 (29.23) | 49 (70) | | |
| **Rehabilitation center** | 16 (24.62) | 14 (20) | | |
| **Psychiatric ward** | 8 (12.31) | 2 (2.86) | | |
| **Other hospitals** | 15 (23.08) | 5 (7.14) | | |
| **Other** | 2 (3.08) | 2 (2.86) | | |

5 meters. The higher incidence in males may reflect the higher prevalence of males in jobs like farmers or construction worker (3, 4, 19-21).

According to another report (22), almost a quarter of the psychiatric patient had previous suicide attempt and a tenth died after a new attempt. In our study more than seventy percent of the patients was already followed by psychiatrists and took psychiatric drugs, especially antipsychotic, before the attempt.

To our knowledge, only one study compared risk factors and the pattern of injury between suicidal jumps and accidental falls (3). Our researches showed similar findings regarding the patterns of fractures (feet fractures are the most common lesions in patient with mental disorders) and the duration of staying in hospital for psychiatric patients (9-11).

**Table 5.** Correlations details. * p<0.05 - p<0.001

| | Value | p |
|---|---|---|
| **Foot injuries Number of ortho surgical procedure** | 0.07 | 0.45 |
| **Foot injuries Average days of stay in hospital** | 0.2 | 0.02* |
| **Foot injuries Physiotherapy compliance** | 0.31 | 0.00* |
| **Already known psychiatric patients Physiotherapy compliance** | 0.01 | 0.93 |
| **Already known psychiatric patients Average days of stay in hospital** | 0.28 | 0.00* |

On the other hand, our data showed that intentional falls undergo a lower number of surgical procedures than unintentional falls. The latter may be explained by the low compliance of psychiatric victims to physiotherapy. Psychiatric patients also showed a longer hospital stays because they often usually cannot be discharged at home. This statement is confirmed by the lower hospitalization time in patients who were supervised by psychiatric staff before the attempt when compared to patients who were not followed.

## Conclusion

Falls from a height are one of the major causes of major trauma and are burden by high morbidity and mortality rates (9, 24). One of the most common method for suicide in patients with psychiatric disorder is jumping from a height (25).

We compared suicidal jumps and accidental falls and showed that patients with psychiatric disorder were associated with a statistically significant increase of hospitalization. The latter is not supported by an increase of number of orthopaedic surgical procedures and may be justified by the poor compliance to physiotherapy.

In our opinion, our results have a clinical relevance for the creation of a specialized multidisciplinary approach after the orthopaedic acute management. We believe that a long-term standardised patient management protocol may improve the clinical outcomes of those patients and reduce hospital costs.

There is no commercial association (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

The Authors confirm that neither the manuscript nor any part of it has been published or is under consideration for publication elsewhere.

**Conflict of interest:** Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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