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## Acute medical diagnoses are common in “found down” adult patients presenting to the emergency department as trauma

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### Abstract

**Background**—Patients often present to the ED as “found down” with limited history to suggest a primary traumatic or medical etiology.

**Objective**—The study objective was to describe the characteristics of “found down” adult patients presenting to the ED as trauma, specifically the incidence of acute medical diagnoses and major trauma.

**Methods**—Using an institutional trauma registry, we reviewed trauma activations with the cause of injury “found down” between January 2008 and December 2012. We excluded patients with cardiac arrest, transfers from other hospitals, and patients with a more than likely (>50%) traumatic or medical etiology on initial ED presentation. Inclusion and exclusion criteria were reviewed by two independent abstractors. We abstracted demographic, clinical, injury severity, and outcomes variables. Major trauma was defined as injury severity score  $\geq 16$ .

**Results**—659 patients were identified with the cause of injury “found down.” A total of 207 (32%) patients met inclusion criteria; median age was 67 years old (IQR 50–82 years old) and 110 (48%) were male. Among the included patients, 137 (66%, 95% CI 59–73%) had a discharge diagnosis of an acute medical condition, 14 (7%, 95% CI 4–11%) with major trauma alone, 21 (10%, 95% CI 6–15%) with both an acute medical condition and major trauma, and 35 (17%, 95% CI 12–23%) with minor trauma. The most common acute medical diagnoses were toxicological (56 patients, 35%; 95% CI 28–43%) and infectious (32 patients, 20%; 95% CI 14–27%).

**Conclusion**—Acute medical diagnoses were common in undifferentiated ED patients “found down” in an institutional trauma registry. Clinicians should maintain a broad differential diagnosis in the workup of the undifferentiated “found down” patient.

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## Keywords

wounds and injuries; triage; resource allocation; brain injuries

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## INTRODUCTION

Patients often present to the emergency department (ED) as “found down” with limited background history to suggest a primary traumatic or medical etiology. Because these patients typically have an abnormal mental status in the context of potential trauma, it is common to activate the trauma team prior to, or upon arrival to the ED.

Trauma team activation for the undifferentiated “found down” patient uses tremendous resources, both in manpower and costs.<sup>1,2</sup> Trauma team activation also leads to proceeding with a trauma-focused workup initially, potentially delaying the diagnosis of time-sensitive medical conditions such as acute myocardial infarction or acute stroke.

There is a paucity of literature describing the characteristics of “found down” patients presenting to the ED. Improved understanding of these patients may improve resource utilization and appropriate management. The objective of this study was to describe characteristics of “found down” adult patients presenting to the ED as trauma, specifically the incidence of acute medical diagnoses and major trauma.

## MATERIALS AND METHODS

### Study Design and Setting

The study is a retrospective, cohort study conducted at a Level 1 trauma center from January 1, 2008 to December 31, 2012. The trauma program at the study site collects trauma registry variables in accordance with the National Trauma Registry Data Dictionary.<sup>3</sup> At our study site, there are three levels of trauma activation: 933, 922 and 911 trauma codes. The emergency medicine team (resident and attending) primarily manages the 933 trauma codes. The trauma team is activated for 922 trauma codes with the emergency medicine team. The trauma team (nurse practitioners, resident and chief resident), a respiratory therapist, and a radiology technician all respond to the resuscitation bay. The highest level of activation, 911 trauma codes, includes all the same resources as a 922 with the addition of the attending trauma surgeon. Patients with suspected head injury and a Glasgow Coma Scale (GCS) score of 9 to 13 are coded as 922 trauma codes. Patients with a GCS score less than 9 are coded as 911 trauma codes.

### Selection of participants

We included adult ED patients (18 years and older) identified in our trauma registry with the cause of injury of “found down”. Patients with suspected drug or alcohol intoxication at presentation were included. We excluded patients that presented to the ED with cardiac arrest, patients that were transferred from an outside hospital, patients that present to the ED with a more than likely (>50%) traumatic (e.g., witnessed traumatic mechanism or

mechanical fall) or medical (e.g., non-traumatic syncope) etiology on initial ED presentation.

## Methods and Measurements

Data collection followed previously published guidelines on retrospective chart review.<sup>4</sup> Variables abstracted from the trauma registry included age, sex, mechanism of injury, initial ED GCS score, initial systolic blood pressure (SBP), heart rate, revised trauma score (physiological scoring system based on initial GCS, SBP, and respiratory rate),<sup>5</sup> blood alcohol level, drug screen results, initial hematocrit, computed tomography (CT) scans for head, cervical spine, abdomen, and chest, Abbreviated Injury Scale and Injury Severity Score (ISS) (anatomical scoring system),<sup>6</sup> ED intubation, ED disposition and admission service, hospital length of stay, and in-hospital mortality. Two independent abstractors reviewed patients' electronic medical records (EMR), blinded to the other's assessment, for inclusion and exclusion criteria. In cases of discrepancy, a third abstractor adjudicated after EMR review. All abstractors were emergency medicine physicians.

## Outcomes

Our primary outcome measures were: 1) an acute medical diagnosis and, 2) major trauma. The presence of an acute medical diagnosis was defined as a non-trauma primary hospital discharge diagnosis and excluded hospital acquired or chronic conditions. Acute medical diagnosis was further categorized into the subgroups of cardiac, neurological, infectious, toxicological, pulmonary, renal/electrolyte, or other etiologies. Major trauma was defined as an ISS of 16 or more.<sup>7</sup> Minor trauma was defined as an ISS less than 16.

## Analysis

Data formatting and recoding of variables were conducted using STATA 11.0 statistical software (STATA Corp, College Station, TX). The study population was characterized using descriptive statistics. Non-normal interval data were reported with medians and interquartile ranges (IQR) and proportions were presented with 95% confidence intervals (CIs). Inter-observer agreement of the inclusion and exclusion criteria was measured using the kappa statistic.

# RESULTS

## Characteristics of Study Subjects

There were 659 patients identified in the trauma registry with the cause of injury of "found down". Four-hundred fifty-two (69%) patients were excluded mostly for transfer from outside hospital and probable trauma or medical etiology. Two hundred seven (32%) patients remained for analysis (Figure). The mean age of the study cohort was 67 years (IQR 50–82 years old) and 110 were male. Median ED GCS score was 14 (IQR 12–14). See Table 1 for complete patient characteristics. There were 146 (71%) patients with a 911 or 922 trauma code activation. All patients received a cranial CT and the majority received a cervical spine (99%) and abdominal (87%) CT. See Table 2 for trauma resources used and injury severity.

## Main Results

A total of 137 (66%, 95% CI 59–73%) patients had a discharge diagnosis of an acute medical condition, 14 (7%, 95% CI 4–11%) with major trauma alone, 21 (10%, 95% CI 6–15%) with both an acute medical condition and major trauma, and 35 (17%, 95% CI 12–23%) with minor trauma. Of the 158 patients with an acute medical diagnosis, 117 (74%) had one acute medical diagnosis, 33 (21%) had two, and 8 (5%) had three. The most common subgroups of acute medical diagnoses were toxicological (56 patients, 35%; 95% CI 28–43%), other (48 patients, 30%; 95% CI 23–38%), and infectious (32 patients, 20%; 95% CI 14–27%) (Table 3). Common specific acute medical diagnoses for the various subgroups included acute alcohol intoxication, seizure, sepsis, and acute coronary syndrome. The percent agreement and kappa for meeting inclusion and exclusion criteria was 74% and 0.49 (95% CI 0.12–0.56).

## DISCUSSION

We have characterized several important features of the “found down” population. First, these patients tend to be older (mean age of 65), have an abnormal mental status (median ED GCS score 14), often require intubation in the ED (20%) and admission to the ICU (45%). Second, the majority of these patients require significant trauma resources with over 70% presenting with trauma team activation (922 and 911 trauma codes). Third, the majority of patients had an acute medical diagnosis without major trauma (66%) while a small proportion (7%) had isolated major trauma. Overall injury severity for these patients was minor, with a median ISS of 5.

Given the high proportion of acute medical conditions, our study suggests the need to maintain a broad differential diagnosis in the undifferentiated “found down” patients. While we were unable to evaluate if there were any delays in diagnosis or treatment of time sensitive acute medical conditions such as acute ischemic stroke or acute coronary syndrome, a narrow, trauma focused workup has the potential to lead to these delays.

We found that despite a relatively low incidence of major trauma, undifferentiated “found down” patients required trauma team activation (911 or 922 trauma code) approximately 71% of the time with nearly all patients receiving multiple CT scans. Future work may better identify subsets of patients that are “found down” that do or do not require trauma team activation.

## LIMITATIONS

These results should be interpreted in the context of several limitations. Our study used an institutional trauma registry limiting the study cohort to patients requiring trauma service evaluation according to local practice patterns. Patients that never had trauma team evaluation were not included in the registry. Our goal was to identify patients who were truly “undifferentiated” found down. We understood that “undifferentiated” is likely subjective. To reduce the bias, we required two abstractors to review each chart with a third abstractor available to adjudicate any discrepancies. Despite the approach, there is still the potential for significant subjectivity in determining study inclusion/exclusion criteria. The

retrospective nature of the study design is subject to the limitations of a chart review. Finally, we used data from a single center, Level 1 academic hospital which may not be generalizable to other populations and settings.

## CONCLUSIONS

Acute medical diagnoses were common in undifferentiated patients presenting to the ED with the cause of injury of “found down” identified in an institutional trauma registry. Clinicians should maintain a broad differential diagnosis in the workup of the undifferentiated “found down” patient.

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**ARTICLE SUMMARY**

**1. Why is this topic important?**

Patients often present to the emergency department (ED) as “found down” with limited background history to suggest a primary traumatic or medical etiology. It is common to activate the trauma team prior to or upon arrival to the ED, potentially leading to increased costs and resource use and potentially delaying the diagnosis of time-sensitive medical conditions such as acute myocardial infarction or acute stroke.

**2. What does this study attempt to show?**

We described the characteristics of “found down” adult patients presenting to the ED as trauma, specifically the incidence of acute medical diagnoses and major trauma.

**3. What are the key findings?**

Acute medical diagnoses were common in undifferentiated patients presenting to the ED with the cause of injury of “found down” identified in an institutional trauma registry.

**4. How is patient care impacted?**

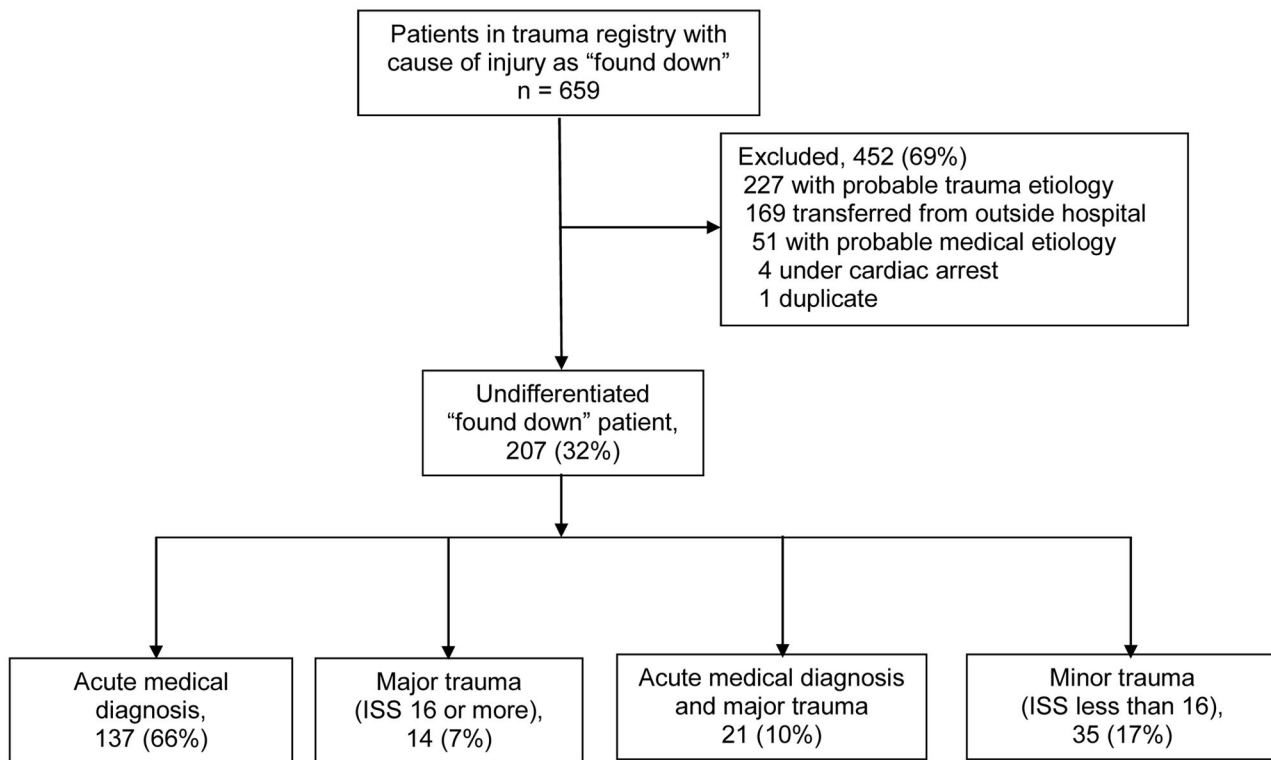
Given the high proportion of acute medical conditions, our study suggests the need to maintain a broad differential diagnosis in the undifferentiated “found down” patients. Because “found down” patients typically require significant trauma resources and have an overall low incidence of major trauma there is the potential to improve on identifying patients at risk for major trauma.

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**Figure.**  
Flow of Patients in the Study  
Abbreviations: ISS, injury severity score



**Table 1**

Patient characteristics of included cohort, n=207

Characteristic	n (%)
<i>Demographics</i>	
Age, mean (SD)	65 (20)
Male	110 (53)
<i>Emergency department (ED) clinical findings</i>	
ED Glasgow Coma Scale score	
- Mild (13–15)	153 (74)
- Moderate (9–12)	33 (16)
- Severe (3–8)	21 (10)
ED systolic blood pressure, mean (SD)	138 (31)
ED heart rate, mean (SD)	89 (21)
<i>Laboratory findings</i>	
Blood alcohol level	
- negative	131 (63)
- 10 to <80	5 (2)
- 80 to < 200	6 (3)
- 200 or more	44 (21)
- not measured	21 (10)
Drug screen	
- negative	91 (44)
- positive	69 (33)
- not measured	47 (23)
Initial hematocrit, mean (SD)	38.0 (5.4)
<i>Admission service</i>	
- Trauma	169 (82)
- General medicine	24 (12)
- Medical Intensive Care Unit	4 (2)
- Cardiology	3 (1)
- Neurology	4 (2)
- Neurosurgery	1 (0)
- Obstetrics/gynecology	1 (0)
- Died	1 (0)
<i>ED disposition</i>	
- Floor	95 (46)
- Intensive care unit	94 (45)
- Operating Room	4 (2)
- Boarded in ED	13 (6)
- Died in ED	1 (1)

Characteristic	n (%)
Hospital length of stay, median (IQR)	3 (2–6)

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**Table 2**

Trauma resources used and injury severity, n=207

Characteristic	n (%)
Level of trauma code activation <sup>a</sup>	
- 933	40 (19)
- 922	108 (52)
- 911	38 (18)
- Not coded	21 (10)
Computed tomography (CT) scans obtained	
- cranial CT	207 (100)
- cervical spine CT	204 (99)
- abdominal CT	181 (87)
- chest CT	47 (23)
Required intubation in the ED	42 (20)
Revised trauma score, median (IQR)	7.84 (6.90–7.84)
Injury severity score, median (IQR)	5 (2–10)
In-hospital mortality	12 (6)

<sup>a</sup>933 codes are managed by emergency medicine resident and attending; 922 codes also include a trauma nurse practitioner, surgery resident and chief resident, a respiratory therapist, and a radiology technician; 911 codes also include the attending trauma surgeon.

**Table 3**

Subgroups of patients with an acute medical diagnosis, n=158

Subgroup	n (%) <sup>a</sup>
Toxicological	56 (35)
- Acute alcohol intoxication	40 (25)
Other	48 (30)
- Syncope	16 (10)
Infectious	32 (20)
- Sepsis	11 (7)
Neurological	27 (17)
- Seizure	15 (9)
Renal/electrolytes	24 (15)
- Hyponatremia	7 (4)
Cardiac	16 (10)
- Acute Coronary Syndrome	10 (6)
Pulmonary	4 (3)
- Pulmonary embolism	2 (1)

<sup>a</sup> some patients had more than one acute medical diagnosis

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