

Initial Versus Final Diagnosis in Patients Who Presented to the Emergency Department Without Trauma: A Prospective Cohort Study

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Abstract

Aim: In the emergency department (ED), some patients are discharged after their initial diagnosis and treatment, whereas others are hospitalized for treatment and/or further diagnostic examination. The ED physician usually does not receive feedback regarding diagnostic accuracy, treatment effectiveness, or morbidity or mortality of the patient. In this study, patients in the ED without trauma were followed up to obtain their data.

Materials and Methods: This prospective cohort study includes all patients without trauma who are admitted to the ED of a tertiary hospital during the two-month time frame and were hospitalized in various clinics. Data recorded for each patient are the following: demographic information, vital signs, diagnosis upon admission, diagnosis after hospitalization, length of stay, mortality, and complications.

Results: A total of 740 patients that met the inclusion criteria participated in this study. The mean age was 54 years, wherein 398 patients (53.8%) were male. The initial diagnosis of 22 patients (2.9%) changed after further examinations. The mean age of these patients were 42 years, and 11 patients were male (50%). Emergency invasive intervention was significantly more common among patients with changed diagnosis (cDx) (40.9% vs 4.1%, $p < 0.001$). Consequently, the incidence of complications was higher in cDx patients (31.8% vs 10.8%, $p = 0.01$).

Conclusion: Majority of patients hospitalized from the ED were treated according to their initial diagnosis until the initial department of hospitalization. We conclude that ED functions at an adequate accuracy despite their high workload.

Keywords: Emergency department, hospitalization, non-traumatic complications, mortality, diagnosis

Introduction

Emergency departments (EDs) are designed to provide continuous medical care to ensure that fast decisions are made in order to prevent patient death and disability. People come to EDs with a great variety of diseases, which translate in to differences in diagnosis and treatment of physical and behavioral problems.

Some patients are discharged following initial diagnosis and treatment, whereas others are hospitalized for treatment and/or further diagnostic examination (1-3). As the ED physician does not follow up with treatment after hospitalization, they usually do not receive feedback regarding the accuracy of their

diagnosis, the effectiveness of the treatment, or the morbidity/mortality of the patient. The literature review revealed several studies concerning changed and missed diagnoses among trauma patients (3-6). However, there are only a few articles that concern this issue. Therefore, we aimed to evaluate the demographic characteristics, complications and the initial and final diagnoses of non-traumatic patients that were hospitalized from ED.

Materials and Methods

This prospective cohort study was approved by the local ethics committee (decision no: 521, date:10.12.2014), and was conducted in a tertiary care university hospital ED in accordance with the



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Helsinki Declaration Principles. A total of 16,672 patients were treated in the ED during the two-month period, and 740 (4.4%) of these patients were hospitalized (Figure 1). The inclusion criteria were: (a) patients under 18 years old, (b) initial admission to ED, (c) hospitalization. The exclusion criteria were: (a) traumatic injury, (b) hospitalization in a different medical center due to hospital reaching capacity. A form was created for the follow-up and treatment of hospitalized patients, which was filled by the ED physician during treatment. Diagnostic evaluation was recorded by specialist doctors and residents with >3 years' experience. The following data were recorded for each patient: demographic information, vital signs, triage levels, diagnosis at the time of admission, diagnosis after hospitalization, length of stay, mortality and complications during treatment. The triage category of the patients was made (green, yellow, red, black) and the patients were grouped. A change in the initial diagnosis at follow-up was noted. Patients with and without diagnostic changes were compared in terms of parameters. However, the clinical diagnosis may differ from the initial diagnosis, and therefore the main diagnosis was targeted in these cases. The primary outcome of the present study was to determine the initial and final diagnoses of non-traumatic patients that were hospitalized from ED. The second outcome was to investigate the changes in diagnosis and the outcome of these patients.

Statistical Analysis

The data were analyzed using SPSS version 20.0. Demographic data were assessed by descriptive tests, and expressed as percentages, mean ± standard deviation, or median and

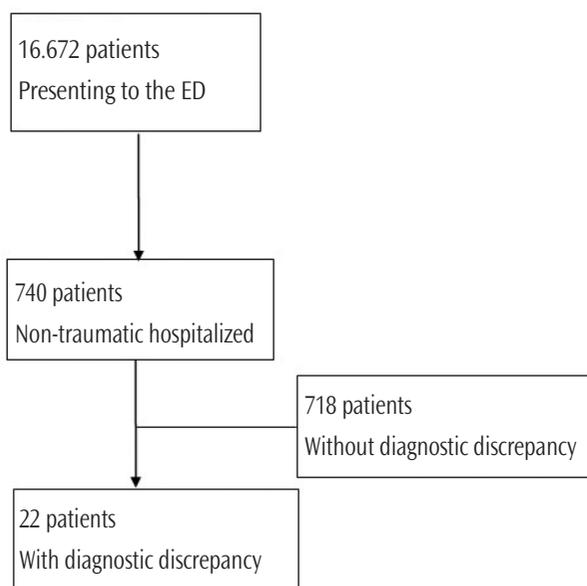


Figure 1. Patient flow chart
ED: Emergency department

interquartile range. Chi-square test was used for the comparison of categorical variables. All hypotheses were bi-directional, and significance level was set at 0.05.

Results

A total of 740 subjects were included in the study. Mean age was 54 years, 398 patients (53.8%) were male. Median GCS at the time of admission 14.5, and GCS was below 8 for 11 patients (1.4%). Mean hospital length of stay was 7.36±8.55 days, and there were 40 hospital deaths (5.4%). The general characteristics of the subjects are presented in Table 1.

The initial diagnosis of 22 patients (2.9%) was changed after further examinations (cDx). Mean age of cDx patients was 42, and

| Table 1. Demographics of study population | |
|--|----------------|
| Included patients | 740 |
| Age years (P25-75) | 54 (38-68.75) |
| Male sex, n (%) | 398 (53.8%) |
| GCS <8 at presentation, n (%) | 11 (1.4%) |
| Vital signs, initial | |
| Systolic blood pressure mmHg, (P25-75) | 126 (110-146) |
| Diastolic blood pressure mmHg, (P25-75) | 73 (60-85) |
| Heart rate beats per minute, (P25-75) | 96 (81-125) |
| Temperature °C, (P25-75) | 36.2 (36-36.8) |
| Oxygen saturation, % (P25-75) | 98 (95-99) |
| Concomitant disease, n (%) | 467 (63.1%) |
| Circumstantial factors | |
| Waiting time in ED, (min) | 188.26±168.76 |
| Time of arrival | |
| Daytime (08:00-16:00) | 304 (41.1%) |
| Evening (16:00-00:00) | 302 (40.8%) |
| Night time (00:00-08:00) | 134 (18.1%) |
| Emergency intervention | 39 (5.3%) |
| Triage category, n (%) | |
| 1 | 38 (5.1%) |
| 2 | 202 (27.3%) |
| 3 | 483 (65.3%) |
| 4 | 17 (2.3%) |
| Primary ICU admission | 106 (14.3%) |
| Medical outcomes | |
| Complications | 85 (11.4%) |
| In-hospital mortality, n (%) | 40 (5.4%) |
| Length of hospital stay (day) | 7.36±8.55 |
| GCS: Glasgow Coma Scale, ED: Emergency department, ICU: Intensive care unit, n: Number | |

11 were male (50%). Mean length of ED stay was 166.18±87.19 minutes, mean systolic blood pressure was 123.5 mmHg, mean diastolic blood pressure was 73.5 mmHg, and mean length of stay was 7.33±8.62 days. Emergency invasive intervention was significantly more common among cDx patients (40.9% vs 4.1%, p<0.001). Consequently, the incidence of complications was higher in cDx patients (31.8% vs 10.8%, p=0.01). There was no significant difference between the groups in terms of other parameters (p>0.05). The comparison of demographic and etiological data is presented in Table 2. For cDx patients, initial ED diagnosis, diagnosis at the time of discharge, and the clinics that the patients were treated in are presented in Table 3.

Discussion

Majority of ED patients are discharged following initial diagnosis and treatment, whereas others are hospitalized for treatment and/or further diagnostic examination. Since the ED physician does not follow up with the patient after hospitalization, they usually do not receive feedback regarding the accuracy of their

diagnosis, the effectiveness of the treatment, or the morbidity/mortality of the patient. The literature review revealed several studies concerning changed and missed diagnoses among trauma patients (4-8). Therefore, we chose to study non-traumatic patients. We aimed to evaluate the demographic characteristics, complications and the initial/final diagnoses of non-traumatic patients that were hospitalized from ED.

A total of 16,672 patients were treated in the ED during the two-month period. This study concerns non-traumatic patients that were treated in an adult ED, thus it does not include patients aged below 16 years. A total of 740 patients were included in the study, overall hospitalization rate was 4.4%. The hospitalization rate of the same hospital was 12.5% in previous years (9). Akpınar et al. (10) found this rate to be 12.8%. Another study conducted among patients hospitalized in the intensive care unit from the ED of a university hospital in the same country found average duration of ED stay to be 300 minutes (11,12). In our study, average stay in ED was 188.26±168.76 minutes. This relatively short average length of stay might be due to the low number of

Table 2. Characteristics of non-trauma patients with- and without changed of diagnosis

| | Patients with changed of diagnosis (n=22) | Patients without changed of diagnosis (n=718) | Univariate OR (95% CI) | p-value |
|----------------------------------|---|---|------------------------|---------|
| Age (years) | 42 (32-65) | 50.5 (30-67) | - | 0.778 |
| Male sex, n (%) | 11 (50%) | 387 (53.9%) | 0.962 (0.412-2.247) | 0.829 |
| GCS <8 at presentation | 3 (13.6%) | 8 (1.1%) | 0.801 (0.203-3.291) | 0.694 |
| Vital signs, initial | | | | |
| Systolic blood pressure (mmHg) | 123.5 (106.25-140.5) | 125 (110-143.25) | - | 0.852 |
| Diastolic blood pressure (mmHg) | 73.5 (69.75-80) | 73 (60-85) | - | 0.783 |
| Heart rate (beats per minute) | 91.5 (79.5-109) | 96 (80-112.25) | - | 0.532 |
| Temperature (°C) | 36.5 (36-37.08) | 36.1 (36-36.7) | - | 0.121 |
| Oxygen saturation | 98 (96-99) | 98 (97-99) | - | 0.137 |
| Time of arrival | - | - | 0.340 (0.120-0.872) | 0.537 |
| Daytime (08:00-16:00) | 10 (45.5%) | 292 (40.2%) | - | - |
| Evening (16:00-00:00) | 10 (45.5%) | 294 (40.9%) | - | - |
| Night time (00:00-08:00) | 2 (9%) | 132 (18.4%) | - | - |
| Emergency intervention | 9 (40.9%) | 30 (4.1%) | - | <0.001 |
| Primary ICU admission | 4 (18.1%) | 102 (14.2%) | 0.579 (0.136-2.563) | 0.579 |
| Medical outcomes | | | | |
| Complications | 7 (31.8%) | 78 (10.8%) | 3.722 (1.473-9.402) | 0.01 |
| In-hospital mortality, n (%) | 3 (13.6%) | 37 (5.1%) | 0.377 (0.108-1.320) | 0.104 |
| Length of hospital stay (day) | 7.33±8.62 | 8.55±6.23 | - | 0.061 |

GCS: Glasgow Coma Scale, ICU: Intensive care unit, CI: Confidence interval, OR: Odds ratio, n: Number

Table 3. Analysis of patients whose diagnosis was changed

| First diagnosis in ED | Last diagnosis | Mortality | Clinics |
|----------------------------|-------------------------------|-----------|----------------------------|
| ACS | Brain tumour + pulmonary mass | No | Cardiology |
| ACS | Intestinal perforation | Yes | Cardiology |
| Cerebrovascular disease | Metabolic disorder | No | Neurology |
| Cerebrovascular disease | Hypertensive encephalopathy | No | Neurology |
| Bradycardia | Exacerbations of COPD | No | Cardiology |
| Cholecystitis | Pneumatosis carcionmatosa | No | General surgery |
| Choledocholithiasis | Liver cancer | Yes | Internal medicine |
| Acute renal failure | Acute adrenal insufficiency | No | Internal medicine |
| Abortion | Ectopic pregnancy | No | Obstetrics and gynaecology |
| Submandibular abscess | Brain tumour | No | Ear nose throat |
| Anemia etiology | Mantle cell lymphoma | No | Internal medicine |
| Etiology of fever | Infective arthritis | No | Infectious diseases |
| Asthma attack | Bronchiectasis | No | Chest diseases |
| Anemia etiology | Hemarthroses | No | Infectious diseases |
| Pulmonary edema | Breast cancer | Yes | Cardiology |
| Transverse myelitis | Multiple sclerosis | No | Neurology |
| Lumbar disc herniation | Spinal tumour | No | Neurosurgery |
| Exacerbations of COPD | Pulmonary mass | No | Chest diseases |
| Renal abscess | Renal mass | No | Urology |
| Nonspecific abdominal pain | Portal vein thrombosis | No | Internal medicine |
| Pyelonephritis | Hemorrhagic ovarian cyst | No | Internal medicine |
| Acute appendicitis | Inflammatory bowel disease | No | General surgery |

ED: Emergency department, ACS: Acute coronary syndrome, COPD: Chronic obstructive pulmonary disease

intensive care unit hospitalizations. The most important factor affecting duration of stay in ED is specialist consultations (13-16). Increasing age and comorbidities require the inclusion of more clinical departments in the treatment. In addition, comorbidities that concern different clinics bring about the requirement of choice between these clinics for hospitalization, leading to prolonged length of stay. In our study, there were 38 (5.1%) Level 1 and 483 (65.3%) Level 3 triage patients, thus, the majority of the subjects were Level 3 triage patients. This factor also contributes to the relatively short average length of ED stay.

The initial diagnoses of 22 subjects (2.9%) were different that the diagnosis at discharge (cDx). Giannakopoulos et al. (4) conducted a similar study, in which they found this rate to be 8.2%, whereas Chen et al. (17) found it to be 12.1%. They also found that 89.6% of cDx patients had life-threatening conditions. In our study, 11 (50%) of cDx patients were male, and the mean age was 42 years. One study found the mean age of cDx patients to be 38.6, and that 69.5% were male (17). Another study found that age and gender were not significant factors in diagnosis change (4).

In our study, the mean length of ED stay (from admission until hospitalization) of cDx patients was 166.18±87.19 minute, and mean length of stay was 7.33±8.62 days. Another study of 976 patients, found the mean length of ED stay and mean length of stay to be 18.5 minutes and 4.3 days, respectively. We believe that the difference in length of ED stay is due to the difference in patients' comorbidities and hospital policies. In our study, most cDx patients had applied between 08:00-16:00 (n=10, 45.5%). However, Chen et al. (17) reported that the most common application time for cDx patients was between 16:00-24:00 (41.5%). In both studies, the smallest number of applications was between 00:00-08:00, as consistent with the literature (18).

Emergency invasive intervention was significantly more common among cDx patients (40.9% vs 4.1%, p<0.001). Also, the incidence of complications was higher in cDx patients (31.8% vs 10.8%, p=0.01). One study found this rate to be 23.9% (17); however, the shorter length of ED stay in this study may have led to the comparatively low rate. Another study found the rate of

complications to be 5.9% in cDx patients; however, unlike our study, this difference was not significant (17).

The symptom that is the most difficult to distinguish is abdominal and chest pain. Therefore, patients with epigastric pain should be examined for acute coronary syndrome (ACS) (19). In our study, one patient was admitted to the cardiology clinic with potential ACS; however, further examinations revealed intestinal perforation, and the patient died during surgical intervention.

Study Limitations

The limitations of our study are as follows: (a) the limited time frame and the relatively small sample size, (b) exclusion of physical examination findings and symptoms, (c) differences between the diagnosis and treatment methods among clinicians, despite being specialists or senior residents, (d) different treatment and protocols after hospitalization, and not standardizing the physicians making the final diagnosis. The scarcity of relevant literature requires multicenter and prospective studies.

Conclusion

EDs provide intensive medical care, and make up a significant source of hospitalizations. In our study, majority of patients that were hospitalized from the ED were treated with their initial diagnosis and in the initial department of hospitalization. We conclude that the ED performs physical examination, imaging, laboratory and consultation functions at an adequate accuracy despite their high workload.

Ethics

Ethics Committee Approval: Prior to implementation, this study's protocol was approved by Akdeniz University Ethics Committee (decision no: 521, date: 10/12/2014).

Informed Consent: An informed consent form was obtained from each patient.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: H.M., S.S., Concept: H.M., M.K., S.S., C.B., Design: H.M., M.K., S.S., C.B., Data Collection or Processing: H.M., M.K., S.S., Analysis or Interpretation: H.M., S.S., C.B., Literature Search: H.M., M.K., S.S., C.B., Writing: H.M., M.K., S.S., C.B.

Conflict of Interest: No conflict of interest was declared by the authors.

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