

Delayed Diagnosis of Injury in survivors of the February 2009 crash of flight TK 1951

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ABSTRACT

Introduction: On 25th February 2009, a Boeing 737 crashed nearby Amsterdam, leaving 126 victims. In trauma patients, some injuries initially escape detection. The aim of this study was to evaluate the incidence of Delayed Diagnosis of Injury (DDI) and the tertiary survey on the victims of a plane crash, and the effect of ATLS[®] implementation on DDI incidence.

Patients and methods: Data from all victims were analysed with respect to hospitalisation, DDI, tertiary survey, ISS, Glasgow Coma Score (GCS), injuries (number and type) and emergency intervention. Clinically significant injuries were separated from non-clinically significant injuries. The data were compared to a plane crash in the UK (1989), which occurred before ATLS[®] became widely practiced. **Results:** All 126 victims of the Dutch crash were evaluated in a hospital; 66 were hospitalised with a total of 171 clinically significant injuries. Twelve (7%) clinically significant DDIs were found in 8 patients (12%). In 65% of all patients, a tertiary survey was documented.

The incidence of DDI in patients with an ISS ≥ 16 ($n = 13$) was 23%, vs. 9% in patients with ISS < 16 . Patients with > 5 injuries had a DDI incidence of 25%, vs. 12% in patients with ≤ 5 injuries. Head injury patients had a DDI incidence of 19%, patients without head injury 10%. Fifty percent of patients who needed an emergency intervention ($n = 4$) had a DDI; 3% of patients who did not need emergency intervention.

Eighty-one survivors of the UK crash had a total of 332 injuries. DDIs were found in 30.9% of the patients. Of all injuries 9.6% was a DDI. The incidence of DDI in patients with > 5 injuries was 5%, vs. 8% in those with ≤ 5 injuries.

Conclusion: DDI in trauma still happen. In this study the incidence was 7% of the injuries in 12% of the population. In one third of the patients no tertiary survey was documented. A high ISS, head injury, more than 5 injuries and an emergency intervention were associated with DDI. The DDI incidence in our study was lower than in victims of a previous plane crash prior to ATLS implementation.

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Introduction

On February 25th 2009, a commercial aircraft crashed nearby Schiphol International Airport, in the Netherlands. One hundred and twenty six people survived the crash and nine people died.¹ This mass casualty incident (MCI) warranted evaluation of medical treatment and other procedures.

The diagnosis of all injuries in trauma patients can be a challenge, especially in large-scale accidents, with numerous poly-traumatised patients.

Missed, or delayed, diagnosis of, injuries may cause increased morbidity, longer stay in hospital, higher costs, and can affect the patient–doctor relationship.^{2–5}

Since the development of the Advanced Trauma Life Support (ATLS[®]) course by the American College of Surgeons, trauma resuscitation and care has been based on the principle of “treat first what kills first”, with a primary survey in order to detect immediate life-threatening injuries and a secondary survey consisting of a ‘head to toe’ examination.⁶ However, primary and secondary surveys alone are not sufficient for detecting all injuries. In 1991 Enderson et al. reported an increase from 2% to 9% of injuries diagnosed late when they actively looked for new

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diagnoses of injury in patients with blunt trauma, after the primary and secondary surveys. As a consequence, they introduced a tertiary survey, comprising a complete repetition of the physical examination performed during the previous surveys.^{7,8} This was later completed with a review of all diagnostic tests that had been carried out at primary and secondary survey.^{3,9,5}

The reported incidence of Delayed Diagnosis of Injury (DDI) ranges from 1.3% to 65%.^{2–5,7–11} This wide range is attributable to heterogeneous study groups as well as the differences in definitions of DDI. Associated factors in the incidence of DDI are, for example, impaired consciousness, or a high Injury Severity Score (ISS).^{7,3,9}

Although DDI are now often discovered because of the introduction of the tertiary survey, DDIs are still common, even after tertiary survey. The effect of a mass casualty incident on the incidence of DDI is not clear.

The aim of this study was to examine the incidence of DDI and tertiary survey in the victims of the 2009 Turkish airlines plane crash in the Netherlands.

We were interested in associated factors such as ISS, number of injuries, type of injury, GCS and emergency interventions. The effects of 20 years of ATLS[®] doctrine and evolving trauma care on this incidence rate caught our interest because of a similar plane crash in the UK in 1989 that happened short before ATLS became widely practiced.

This study was approved by the Medical Ethical Committee of the Academic Medical Centre, Amsterdam.

Patients and methods

Setting Turkish airplane crash 2009, in the Netherlands

On February the 25th 2009, at 10:26 a.m., a Turkish Airlines Boeing 737-800 crashed in a field approximately 1.5 km short of the runway of Schiphol International Airport, Amsterdam. The aircraft broke into 3 sections and both engines ended up dozens of metres away. Schiphol International Airport is situated in a densely populated area of the Netherlands, where everybody lives less than 10 min from a hospital.¹² Fifteen different hospitals received one or more patients, resulting in all 126 survivors being evaluated in a hospital.

Data collection and outcomes

The demographic and medical data of all patients, at each of the 15 receiving hospitals, were collected retrospectively, using a Microsoft Access[®] database. The medical charts of the hospitalised patients were reviewed for documentation of a tertiary survey and for DDI, as primary outcomes.

DDI was defined as an injury diagnosed after primary and secondary survey, meaning this injury could be found at tertiary survey, or later. Secondary outcomes were possible risk factors for DDI, including ISS, number of injuries, head injury, Glasgow Coma Score (GCS) on arrival at the Emergency Department (ED) and an emergency intervention. An emergency intervention was defined as an intervention such as operation, angiography, or intubation, for any acutely life-threatening injury, within 6 h after the trauma. A distinction was made between clinically significant injuries and DDIs, and clinically non-significant injuries and DDIs. Clinically significant was defined as an injury that, if unnoticed, would possibly lead to delayed or poor, healing, and could have consequences for a patients' recovery and return to daily activities. Thus, this definition is not based on severity as a threat to life but more as a chance to disability or impairment. This therefore means any injury that needs treatment, or at least one check-up after

diagnosis. In our results we have only considered clinically significant injuries, unless stated otherwise.

Statistical analysis

Because of the small study population, only descriptive statistics are calculated using SPSS 16 for Windows[®].

Comparison with UK crash 1989

Setting

On January the 8th 1989, at 08:30 p.m, a Boeing 737-400 crashed on the M1 motorway about 900 m short of the threshold of the runway of East Midlands Airport, near Kegworth, Great Britain. The aircraft broke in 3 sections and came to a rest on the embankment of the M1 motorway. The nearest hospital was approximately 16 km from the crash site and two other hospitals where at approximately 19 km and 32 km from the crash site.¹³

Data collection

The Nottingham, Leicester, Derby, Belfast Study group published the data of this crash in several articles and a book.^{14–20} We collected the demographic and medical data from the published articles and compared the relevant data to the outcome measures of the Dutch crash, as described above. The data from the UK crash consider only 'major injuries', the definition of which is comparable to the one we used as 'clinically significant injury'.¹⁹

Results

Demographic data

Nine of the 135 occupants died at the scene of the Dutch crash. There were no later deaths on the way to, or in, hospital. Sixty-six percent were male and the mean age was 38 years (range 11 months to 76 years). Thirteen hospitals hospitalised a total 66 patients (range 1–19) (Fig. 1). The Academic Medical Centre (AMC) in Amsterdam and VU Medical Centre (VUMC) in Amsterdam, both major trauma centres, hospitalised the most patients, respectively 19 and 18.

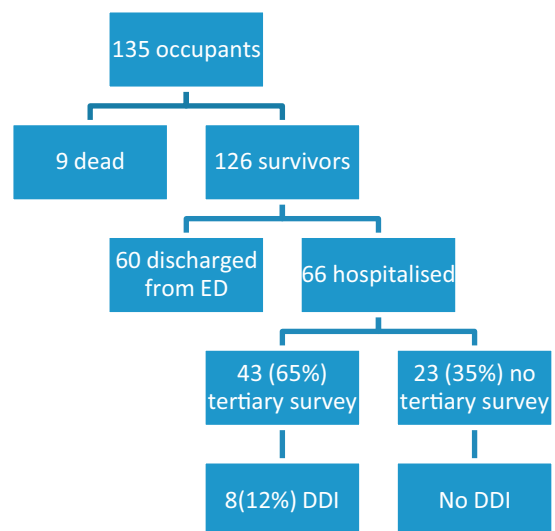


Fig. 1. Documentation of a tertiary survey in relation to DDI in patients admitted following the Dutch crash.

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