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Pre-hospital ambulance care of patients following a suspected seizure: A cross sectional study

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ABSTRACT

Purpose: We aimed to investigate the characteristics of patients presenting to the ambulance service with suspected seizures, the costs of managing these patients and the factors which predicted transport to hospital.
Methods: We employed a cross-sectional design using routine clinical data from a UK regional ambulance service. Logistic regression was used to identify predictors of transport to hospital from ambulance response times, demographics, clinical (physiological) findings and treatments.
Results: There were 177,715 emergency incidents recorded in 2011/12 of which 2.9% (5139/177,715) were classified as seizures by ambulance call handlers and 2.7% (4884/177,715) by paramedics on the scene. Suspected seizures were the seventh most common call type. The annual cost of managing these incidents was £890,148. Clinical and physiological variables were normal for most patients. 59.3% (2894/4884) of patients were transported to hospital. 1/4884 (0.02%) patient died. Administration of diazepam, insertion of an airway and pyrexia perfectly predicted transport to hospital, tachycardia had a modest association, but other variables were only weak predictors of transport to hospital.
Conclusions: This study shows that most patients after a suspected seizure are not acutely unwell but nevertheless most patients are transported to hospital. Further research is required to determine which factors are important in decisions to transport to hospital and to create evidence-based tools to help paramedics identify patients who could be safely managed without transport to hospital.

1. Introduction

Pre-hospital ambulance care for patients after a suspected seizure is an important step in the emergency care pathway but until recently there has been little research in this area [1]. Suspected seizures are one of the most common causes of emergency calls to ambulance services comprising approximately 3.3% of all emergency incidents [2]. Approximately 75% of suspected seizures are epileptic seizures; the two other most frequent causes are psychogenic non-epileptic seizures (PNES) and cardiogenic syncope (most often vasovagal episodes) [3]. In England (mid-2011 population 53.11 million, 41.77 million adults (≥16 years old) [4]), it is estimated that suspected seizures give rise to approximately 211,000 calls to ambulance services [2], 60,000 seizure-related Emergency Department (ED) attendances (2–3% of all attendances) [5], and 40,000 hospital admissions each year [5,6].

Status epilepticus is a medical emergency requiring rapid treatment with benzodiazepines. Although current national guidelines for paramedics in the United Kingdom (UK) on management of seizures focus on status epilepticus [7], the majority of suspected seizures self-terminate within 90 s and are not medical emergencies. Most people after a self-terminating epileptic seizure would fully recover without medical treatment and do not need transport to hospital [2]. However, there are important exceptions [8] and post-ictal patients present multiple challenges for emergency call-handlers and paramedics. One of the main factors which determines transport to hospital is lack of confidence, lack of training, lack of access to medical history and medico-legal concerns amongst ambulance clinicians [9–11]. There are currently no criterion-based systems to help paramedics make decisions about leaving these patients safely at home [12,13] and therefore, most patients are transported to hospital generating significant and often avoidable health-care costs [14].

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We aimed to investigate the characteristics of patients presenting to a regional ambulance service in the UK with suspected seizures, the costs of managing these patients and the factors which predicted transport to hospital.

2. Methods

2.1. Design and setting

We undertook a cross-sectional study of routine ambulance service clinical data from East Midlands Ambulance Service NHS Trust (EMAS) between 1 August 2011 and 31 July 2012, where the diagnosis of the incident was suspected seizure and to which an ambulance or rapid response vehicle (RRV) was dispatched. EMAS is one of ten National Health Service (NHS) ambulance trusts serving the population of England (one of the devolved nations of the UK) (population 53.11 million, 41.77 million adults (≥16 years old) [4]). Each ambulance trust covers a mean area of 5151 square miles (range 620–7500 m^2) serving a mean population of 5.5 million (range 2.6–7 million). EMAS covers 6425 square miles and has a population of 4.8 million (3.9 million adults). Emergency (999) calls are initially dealt with by trained but non-clinical emergency call handlers who, based on computerised algorithms, make decisions about dispatch of ambulances and their priority. The two systems in the UK are the Advanced Medical Priority Dispatch System (AMPDS) and NHS Pathways. EMAS call handlers use AMPDS. AMPDS is an international system, based on 33 protocols tailored to a range of clinical conditions/presentations. AMPDS code (protocol) 12 is used for suspected seizures in which call-handlers asking predetermined questions assign incidents to specific 'determinant descriptors', which determine the response priority and target response times.

2.2. Data extraction

Calls were categorised as suspected seizures using two methods: 1) when AMPDS code 12 was applied to the incident by the ambulance call handler 2) when the primary 'chief complaint' (or other complaint) of 'convulsions/fitting' was selected by the ambulance clinician at the scene (paramedic, emergency medical technician etc.). Or if the chief complaint was a free text entry consistent with this (free text entries were included/excluded after review by one author (JMD)). Case ascertainment using both APMDS and chief complaint were analysed initially to allow comparison but chief complaint alone was used throughout the rest of the study to define the study cohort. The chief complaint, which is determined by a paramedic after a face-to-face clinical assessment, is likely to be a more accurate diagnostic indicator than AMPDS codes.

Clinical data were extracted from the clinical record, whether electronic Patient Report Forms (ePRFs) or electronically scanned paper Patient Report Forms (PRFs). Data from all electronically scanned PRFs was subsequently verified by a trained data clerk. The overall use rate of ePRFs in EMAS at the time of the study was 55.7% with the remainder comprising paper PRFs; both were included in the analysis.

2.3. Analysis

We used descriptive statistics to summarise available data for ambulance service processes, ambulance response times, demographic data, clinical (physiological) findings and treatments. Continuous data from physiological variables ('first vital signs') including respiratory rate, oxygen saturation, temperature, systolic blood pressure and heart rate were transformed into categorical variables according to National Early Warning Score (NEWS) categories [15]. NEWS is a national UK scoring system, assessing the severity of acute illness using 7 parameters, where scores are allocated according to the extent to which parameters differ from normal values. A normal value is allocated a score of zero and the maximum score for each parameter is 2 or 3. The rate of repeat incidents (the same patient generating more than one incident) was estimated using the patients' date of birth, gender and postcode as identifiers for individual patients.

We used logistic regression to identify predictors of transport to hospital. The dependent variable was transport to hospital (yes/no). Independent variables were selected from the full list of variables where there were clinical or other theoretical reasons to believe that they may predict transport to hospital.

UK ambulance service costs are based on individual agreements between the ambulance services and the contracting CCGs (who negotiate collectively with their local ambulance service). Ambulance services have three tariff bands for managing incidents. Tariffs are applied regardless of the urgency of the ambulance response. Tariffs were obtained from EMAS: calls (C) £5.57, hear and treat/refer (HTR) £32.65 (for managing an incident exclusively with telephone advice), see and treat and convey (STC) £197.99 (for dispatch of an ambulance or RRV plus transport to hospital) and see and treat/refer (STR) £229.00 (for dispatch of an ambulance or RRV without transport to hospital). The total cost of their activity for managing the series of incidents in the study was calculated.

2.4. Ethics

This study was a service evaluation and only used anonymised data so NHS Research Ethics Committee permission was not required. We received permission from the Research and Management Governance committee of EMAS and from the ethics committee of the University of Lincoln.

3. Results

3.1. Ambulance calls for seizures or convulsions

Between 1 August 2011 and 31 July 2012 EMAS dealt with 211,317 separate incidents. Of these, 23,305 involved children (<16 years old) or had missing data for age and were excluded from the analysis. Another 10,297 calls were not classed as an

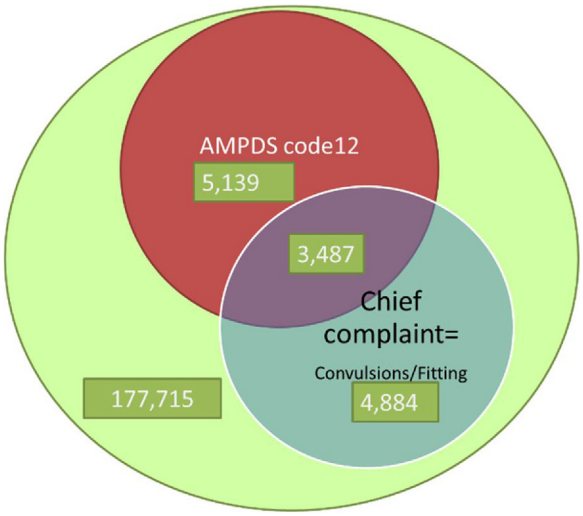

Fig. 1. A Venn diagram to show the interaction between the total number of emergency incidents (177,715), the number of incidents assigned AMPDS code 12 by the ambulance call handlers (5139) and the chief complaint recorded by the paramedic on arrival at the scene (4884).