

Proportion of out-of-hospital adult non-traumatic cardiac or respiratory arrest among calls for seizure

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ABSTRACT

Objectives To measure the proportion of adult non-traumatic cardiac or respiratory arrest among calls for seizure to an emergency medical dispatch centre and to record whether known epileptic patients present cardiac or respiratory arrest together with seizure.

Methods This 2-year prospective observational investigation involved the collection of tape recordings of all incoming calls to the emergency medical dispatch centre, in which an out-of-hospital non-traumatic seizure was the chief complaint in patients >18 years, in addition to the paramedics' records of all patients who presented with respiratory or cardiac arrest. The authors also recorded whether the bystander spontaneously mentioned to the dispatcher that the victim was known to have epilepsy.

Results During the 24-month period, the call centre received 561 incoming calls for an out-of-hospital non-traumatic seizure in an adult. Twelve cases were classified as cardiac or respiratory arrest by paramedics. In one case, the caller spontaneously mentioned that the victim had a history of epilepsy. The proportion of cardiac or respiratory arrest among calls for seizure was 2.1%.

Conclusion Although these cases are rare, dispatchers should closely monitor seizure patients with the help of bystanders to exclude an out-of-hospital cardiac or respiratory arrest, in which case the dispatcher can offer telephone cardiopulmonary resuscitation advice until the paramedics arrive. Whenever the activity of the centre allows it and no new incoming call is on hold, this can be achieved by staying on the line with the caller or by calling back. A history of epilepsy should not modify the type of monitoring performed by the dispatcher as those patients may also have an arrest together with seizure.

INTRODUCTION

In industrialised countries, the overall survival rate for an out-of-hospital cardiac arrest (OH-CA) does not exceed 8%.¹ Survival depends highly on the early initiation of life support manoeuvres and therefore on the ability of emergency medical dispatchers (EMDs) to identify an OH-CA and to offer dispatch-assisted cardiopulmonary resuscitation advice to bystanders.² Seizure may represent the initial clinical manifestation of cardiac or respiratory arrest, or trigger it.^{3,4} The vast majority of seizures are related to an epileptic seizure or a convulsive syncope. Knowing the proportion of cardiac or respiratory arrests among calls to dispatch centres for seizure patients may help

EMDs consider the possibility of a cardiac or respiratory arrest when answering such calls; if appropriate, the EMD can provide telephone cardiopulmonary resuscitation (T-CPR) advice to the bystander calling in.

The goal of this study was to measure the proportion of adult non-traumatic cardiac or respiratory arrest among emergency calls for seizure patients. A second objective was to record whether known epileptic patients present cardiac or respiratory arrest together with seizure.

METHODS

Setting

This study was a prospective observational investigation conducted throughout the State of Vaud in the French-speaking region of Switzerland, where a centralised prehospital medical dispatch centre serves a population of 670 000 and handles over 80 000 calls per year.

Two EMDs are on duty 24/7. They are paramedics or nurses with at least 5 years of field experience. They do not use the Medical Priority Dispatch System (MPDS) or any similar product; they rely on their medical background and personal experience to ask the questions they deem appropriate for the situation. The only medical information they must collect from the bystanders are the 'state of consciousness' and 'quality of breathing' of the victim, but not the presence or absence of a pulse. If in doubt, they ask bystanders to put the phone over the victim's mouth.

Once the EMDs have categorised the call (chest pain, dyspnoea, unconscious, seizure, etc) through their own personal interview, they use electronic dispatching software to help send the appropriate rescue vehicles (ambulance or rescue helicopter) and personnel (paramedics with or without an emergency physician) to the scene. The same dispatcher is in charge of both the interview and the rescue dispatching. EMDs are also trained to provide instructions for life-saving manoeuvres such as T-CPR.⁵

In the case of a seizure, our dispatchers do not systematically ask whether the victim has a history of epilepsy. This question is not required as the answer would have no impact on the vehicle and team dispatched. In our Emergency Medical System (EMS) all paramedics' teams are advanced life support (ALS) teams. If the EMD suspects cardiac or respiratory arrest, or if the paramedics, once on site, believe intubation or a supraglottic airway is necessary, an emergency physician is also dispatched.

Study design

Inclusion criteria

We prospectively collected tape recordings of all incoming calls with an out-of-hospital non-traumatic seizure as the chief complaint in patients >18 years during a 24-month period (1 May 2008 to 30 April 2010). All calls during which the caller used words such as 'fitting', 'convulsion', 'seizure' or otherwise described a seizure were included.

All patients served by the EMS in our state are classified by paramedics using the National Advisory Committee for Aeronautics (NACA) scores (box 1). This score is commonly used throughout Switzerland, Germany and Austria in the field of emergency medicine and enables the categorisation of the severity of injury in patients being treated by paramedics and physicians outside of the hospital. It also allows for statistical reviews of the type of patients treated and therefore the activity of prehospital healthcare professionals. The NACA score represents the most serious clinical state experienced at any given time during the mission and does not always correspond to the victim's clinical state at arrival to the hospital.

We also collected all records of adult patients of non-traumatic cardiac or respiratory arrest classified by paramedics as NACA 6 or 7. The NACA score was always collected on the day of the event.

Exclusion criteria

Calls from medical institutions requesting a patient be transferred to another hospital (secondary mission) were excluded.

Data collection

Once a day, all rescue missions involving a victim with a NACA score of 6 or 7 were automatically extracted from the EMS database.

In parallel, all missions categorised as an event with a non-traumatic seizure in an adult were manually extracted from the database. To ensure that we did not miss any cases where seizure might have been misclassified, records of all missions were checked daily for any comments the dispatcher might have noted. This review was carried out by the first author of this publication who is a senior physician in the Emergency Department at Lausanne University Hospital and is responsible for the training and quality control of the EMS dispatch centre.

These two lists were then cross-checked. Tape recordings from rescue missions present in both lists were transmitted to the EMS medical director.

Box 1 Categorisation of injuries based on the National Advisory Committee for Aeronautics (NACA) score

NACA 0 No injury or disease

NACA 1 Injuries/diseases without any need for acute physicians care

NACA 2 Injuries/diseases requiring examination and therapy by a physician but hospital admission is not indicated

NACA 3 Injuries/diseases without acute threat to life but requiring hospital admission

NACA 4 Injuries/diseases which can possibly lead to deterioration of vital signs

NACA 5 Injuries/diseases with acute threat to life

NACA 6 Injuries/diseases transported after successful resuscitation

NACA 7 Lethal injuries or diseases (with or without resuscitation attempts)

The following data were collected from the tape recordings:

- verification that a non-traumatic seizure in an adult was the main complaint;
- medical history of epilepsy only if spontaneously mentioned by the bystander.

All tapes were reviewed only by the EMS medical director who collected all the data and listened to all the tape recordings daily for 1 h dedicated to 'audio quality control'.

All data were de-identified and entered into a computerised database (Microsoft Access, Microsoft Corp., Redmond, Washington, USA). Categorical data are presented as a proportion with a 95% CI.

RESULTS

During the 24-month period, the EMS received 561 incoming calls for an out-of-hospital non-traumatic seizure in an adult. Twelve cases were classified as NACA 6 or 7 by paramedics. Therefore, the proportion of cardiac or respiratory arrest represented 2.1% (95% CI 0.9% to 3.3%) of all calls for seizure.

Out of the 12 cases classified as NACA 6 or 7, only one bystander (8.3%; 95% CI 0 to 27%) spontaneously reported that the victim had a history of epilepsy.

Over the same period, paramedics classified 679 adult patients as NACA 6 or 7 from a non-traumatic cause. Therefore, the proportion of cardiac or respiratory arrest presenting as a seizure represented 1.8% (95% CI 0.8% to 2.8%) of all adult non-traumatic cardiac or respiratory arrests.

DISCUSSION

Our data shows that OH-CA rarely presents as a seizure: only 12 cases out of the 561 incoming calls (or 2.1%) for non-traumatic adult seizure were confirmed as cardiac or respiratory arrest by paramedics. In a recent publication using an MPDS, Sporer *et al* reported that 0.6% of calls for seizure patients were in fact cardiac arrests.⁶ This rate is much lower than what we found but does not include respiratory arrests. Our study also demonstrates that OH-CA presenting as a seizure represents a small proportion of all adult non-traumatic arrests (1.8%), and supports the earlier work of Heward *et al* who found that 3% of cardiac arrests presented as a seizure using the MPDS.⁷ Therefore, the absolute number of these types of patients is far from negligible. Using Heward's rate and based on the incidence of OH-CA of approximately 1/1000 per year in the USA,⁸ 9300 patients per year in the USA alone could have such a clinical presentation. It has been long demonstrated that a cardiac arrest is sometimes difficult to diagnose over the phone.⁵⁻⁹ Seizure patients may be at greater risk of not being identified as having an OH-CA or respiratory arrest and of not receiving T-CPR advice if considered as 'just another seizure'. One way to reduce this risk is to keep bystanders online as has been proposed before¹⁰ or to call them back after 2 min to check that the victim is not displaying agonal breathing or has stopped breathing altogether while the rescue vehicles are underway. This additional task should only be performed by the dispatchers if all incoming calls have been answered. This can be done without supplementary personnel or costs and with no harm done to other callers (or patients). This allows the dispatcher to provide T-CPR advice to a bystander when necessary and/or to decide to send supplementary skilled personnel (a physician or an ALS team) to the site. Otherwise, OH-CA might only be suspected once the first rescue team has arrived on site.

Further studies should be conducted to measure EMDs' ability to recognise cardiac or respiratory arrest, in particular in patients

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with seizure. It is well established nowadays that this can be done by checking the state of consciousness and quality of breathing of the victim.^{11 12} As done by other dispatch centres, we too monitored our performance in recognising cardiac arrests.⁵ We have a work in progress that will make it mandatory for all cases of adult seizure that the dispatcher calls the bystander back after 2 min once paramedics are on their way but only if the dispatching centre's activity allows for this. This may help to identify cardiac or respiratory arrest in patients with fits. In most of these cases, this will do nothing more than allow dispatchers to reassure the bystander (who is often quite stressed by the situation) as 98% of those patients will not require T-CPR advice.

Only one of the 12 patients was spontaneously described by the bystander as having a history of epilepsy. Some dispatch centres may ask about a personal history of epilepsy and in the absence of which, only a basic life support (BLS) unit is sent to the site, as there is a lower probability of a cardiac or respiratory arrest. We agree with this protocol. Nevertheless, EMDs should continue monitoring seizure patients when logistically possible. Whereas our numbers are too small to draw definitive recommendations, they suggest that it may be inappropriate to stop monitoring the victim as sudden unexpected death in epilepsy cases account for up to 17% of deaths in this group of patients and affect predominantly the young or middle-aged.¹³ It is therefore reasonable to suggest that patients with a known history of epilepsy should be monitored by dispatchers and bystanders in the same manner as non-epileptic patients, which contradicts recommendations based on previous studies.¹⁰ On the other hand, knowing whether a patient with fits has a history of epilepsy may influence which unit (first responder, ALS unit, BLS unit) the EMS sends to the site (in the event the EMS has more than one type of paramedic team, which ours does not).

This study has some limitations. Although respiratory and cardiac arrests have different aetiologies, treatments and prognoses, the NACA score does not allow for the differentiation between these two groups. However, the first link in the survival chain can make a dramatic difference in the outcome for both types of arrest, and therefore both deserve similar attention from the EMD. The use of the NACA score does not limit the internal validity of our findings but may restrict the generalisability to other EMSs. Another limitation is the small number of cardiac or respiratory arrests among our calls for seizure patients, yet our findings are within the range described in larger studies. The lack of a unique database for our dispatch centre, EMS and hospital activities did not allow us to collect the patient outcome, but our study objectives did not include this parameter. Finally, the competencies of our paramedics and EMDs may differ from those in other EMSs, but analysis of the bystander interview or the management of the victim on site was not among the objectives of this study.

CONCLUSION

Approximately 2% of all incoming calls to our dispatch centre for non-traumatic adult seizure are cases of cardiac or respiratory arrest. It is therefore important that dispatchers, whenever the activity of the centre allows it, consider OH-CA as a cause of seizure and monitor these patients with the help of bystanders until the paramedics arrive. In the event the dispatcher suspects

an OH-CA, he may offer T-CPR advice to the bystander. While a history of epilepsy may influence the dispatching decisions, it should not change the dispatcher's type of monitoring as epileptic patients may also have a cardiac arrest together with the seizure.

Improving the diagnosis accuracy of cardiac arrest remains a challenge in emergency medical dispatching.¹² Our study suggests that for the EMD to systematically stay on the line with the bystander or to call back when dealing with a seizure victim may constitute a small step in the right direction. This is an example of the 'dispatcher's window', the time during which the dispatcher can make a dramatic difference to the prognosis of the victim.¹⁴

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Competing interests FD, the main investigator, is employed part-time as the EMS Medical Director and part-time as senior physician at the Emergency Department of the University Hospital of Lausanne (CHUV).

Ethics approval All the data were obtained from a specific call aggregate database of the EMS which does not contain any identifying information. This kind of observational study, without any intervention, does not require approval from our Ethics Board.

Contributors FD is the main author, who is fully responsible for the article. AOR and OH participated in the conception, drafting and final approval of the manuscript. VF was involved in data collection. BY provided general support.

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