PREHOSPITAL CARE

Paramedic accuracy in using a decision support algorithm when recognising adult death: a prospective cohort study

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Background: Prolonged advanced life support for cardiac arrest victims who present with non-shockable arrhythmias in an out of hospital setting is associated with extremely poor survival rates. This and the risks associated with rapid ambulance transport to hospital have resulted in the development of decision support algorithms, enabling paramedics to recognise when adult death has occurred. The aim of the study was to assess the accuracy with which paramedics used such an algorithm.

Method: This prospective 16 month cohort study evaluated 188 events of recognition of adult death (ROAD) by paramedics in the period from November 1999 to February 2001.

Results: Of 188 ROAD applications, errors were made in 13 cases (6.9%, 95% CI 3.7 to 11.5. Additionally, there was one adverse clinical incident associated with a case in which ROAD was applied (0.5%, 95% CI 0.01 to 2.9%). ECG strips were unavailable for eight cases, although ambulance records indicated a rhythm of asystole for each of these. Assuming this diagnosis was correct, ROAD was used 174 times without errors (93%, 95% CI 88 to 96%). Assuming that it was not, the ROAD protocol was applied without errors in 166 cases (88.3%, 95% CI 82.8 to 92.5%). None of the errors made appeared to be attributable to poor clinical decision making, compromised treatment, or changed patient outcome. The mean on-scene time for ambulance crews using the ROAD policy was 60 minutes.

Conclusion: Paramedics can accurately apply a decision support algorithm when recognising adult death. It could be argued that the attendance of a medical practitioner to confirm death is therefore an inappropriate use of such personnel and may result in unnecessarily protracted on-scene times for ambulance crews. Further research is required to confirm this, and to determine the proportion of patients suitable for recognition of adult death who are actually identified as such by paramedics.

Historically, ambulance service protocols have indicated full resuscitation should be started for victims of cardiac arrest, with the exception of those patients where mutilation or decomposition of the body suggest it cannot support life.¹ This has led to ambulance paramedics administering advanced life support (ALS) to almost all cardiac arrest victims, culminating in rapid emergency ambulance transfer to hospital with ongoing resuscitation.

Outcome from out of hospital cardiac arrest with a non-shockable arrhythmia has been shown to be extremely poor. One study reported no survivors if bystander cardiopulmonary resuscitation (CPR) was not performed and ambulance response times exceeded 15 minutes.²

Ambulance transport using lights and sirens has been associated with a high incidence of traffic accidents with a significant risk of fatality and injury to pedestrians and other road users.³ Cardiac arrest victims without the return of a spontaneous circulation after ALS do not survive to discharge following transportation to hospital.⁴ Balancing the risk of emergency transportation against this poor prognosis it is inappropriate for these patients.

Following guidance from the Joint Royal Colleges Ambulance Liaison Committee (JRCALC) in 1998, the South East Region of the Welsh Ambulance Services NHS Trust implemented a recognition of adult death (ROAD) protocol (box). This aimed to assist paramedics in identifying cardiac arrest patients where beginning prolonged ALS and transportation would be futile, undignified, and potentially dangerous. The type of patients for which the ROAD policy could be applied was largely restricted to patients with a medical aetiology.

Criteria for recognition of adult death

Patients who may be recognised as dead

- Any adult patient in cardiorespiratory arrest where rigor mortis, putrefaction, decomposition, total body incineration, decapitation, total destruction of half body mass, evisceration of part or all of the brain, and or a valid do not resuscitate (DNAR) order was present.
- Any adult patient in cardiopulmonary arrest presenting in asystole where no bystander cardiopulmonary resuscitation has been commenced, and remaining in asystole after three cycles of advanced cardiac life support.

Exclusion criteria

- Children (defined as any patient below 18 years of age).
- Immersion (defined as any drowning where the submersion time was less than three hours in duration).
- Confirmed or suspected diagnosis of hypothermia.
- Confirmed or suspected diagnosis of overdose or poisoning with any substance and/or intoxication.
- Confirmed or suspected diagnosis of pregnancy
- Confirmed or suspected trauma aetiology for the cardiopulmonary arrest.
- Any presenting cardiac arrest arrhythmia other than asystole.

Abbreviations: ROAD, recognition of adult death; ALS, advanced life support; CPR, cardiopulmonary resuscitation

Relevant HM coroners, police services, local medical committees, and the Paramedic Steering Committee were consulted before the implementation of the ROAD protocol and all supported it. After a period of in-service training, ROAD was introduced in November 1999.

Quality review has been identified as a key factor in measuring efficacy and safety of prehospital resuscitation termination protocols.³ In light of this recommendation, a prospective study of the trust's ROAD protocols was designed. This research aimed to determine if paramedics accurately utilised a decision making algorithm when recognising adult death.

METHODS

Study design

This prospective cohort study was undertaken over a 16 month period from November 1999 to February 2001.

The study was located in the South East Region of the Welsh Ambulance Services NHS Trust. This area receives about 155 000 emergency and urgent calls per annum and provides services to a population of about 1.3 million.

Officers with responsibility for clinical governance collected ambulance patient records and ECG data for each ROAD application during the study period. These were examined and assessed for correct application of the protocol, including correct diagnosis of asystole from a six second ECG trace of leads I, II, and III.

The outcomes of the study were restricted to determining if the protocol was applied correctly whenever it was used. It was not designed to detect cases where the ROAD protocol should have been used but was not.

Outcome measures

For all cases where the ROAD procedure was used:

- 1 The proportions of correct and incorrect uses of the procedure;
- 2 Mean on scene times of ambulance staff (defined as the interval from arrival at scene to departure from the incident, both recorded by use of radio status signals);
- 3 Cause and nature of adverse incidents during the study period relating to either recognition of adult death protocols or associated resuscitation attempts.

Ethics approval was not considered necessary for this study as it involved the collection of routine data as part of the trust's normal audit procedures. All information pertaining to both patients and paramedics was held in confidence by the researchers.

Statistical analysis

Data were entered into an Access database (version 2000, Microsoft Corporation, USA), which was used to calculate means and medians. Confidence intervals for proportions were calculated using the software package StatsDirect (version 1.9.8, CamCode, Ashwell, UK).

RESULTS

Demographic data

The ROAD protocol was applied during 188 times the study period. The age range of patients was 22 to 98 years (median 74 years). Seventy seven were women (41%) and 111 were men (59%).

Over the 16 month study period the ROAD procedure was used 137 times in the Bro Taf Health Authority area and 51 times in the Gwent Health Authority area, which have a population of 746 023 and 557 386 respectively.

The mean on scene time for paramedics when ROAD protocols were applied was 60 minutes.

Accuracy of application

Errors were made in 13 cases (6.9%, 95% CI 3.7 to 11.5%). Additionally, there was one adverse clinical incident associ-

Figure 1 Errors made in using the ROAD policy.

ated with a case in which ROAD was applied (0.5%, 95% CI 0.01 to 2.9%).

ECG strips were unavailable for eight cases (4.3%, 95% CI 1.9 to 8.2%). Two ECGs were destroyed during facsimile transmission, doctors attending incidents retained three ECG recordings, and three ECG recordings were missing and unaccounted for at the end of the study. Although the ambulance clinical records documented a rhythm of asystole for all of these cases it was not, therefore, possible to confirm if this diagnosis was correct. Assuming that it was not, the ROAD protocol was applied without errors in 166 cases (88.3%, 95% CI 82.8 to 92.5%). Assuming that the diagnosis of asystole was correct for the cases with missing ECGs, ROAD was applied 174 times without errors (93%, 95% CI 88 to 96%).

In the cases for which ECGs were available, none of the errors were attributable to misdiagnosis of asystole or an inappropriate use of the ROAD procedure, and the patient inclusion criteria allowing paramedics to recognise that adult death had occurred were met in each. The 13 errors were all attributable to administrative mistakes (fig 1). There was also one adverse clinical incident, although this was related to the treatment of the patient before the diagnosis of death rather than any error in using the ROAD protocol.

Completion of ambulance patient clinical record

Response time data were missing from two of the ambulance records: it is unclear why the crew did not attempt to retrieve these data from ambulance control. Age was missing from two further forms, and one form did not include the attending doctor's name.

Adverse clinical incidents

An adverse clinical incident was reported for one patient. This related to the use of an intraosseous needle in an adult patient, which was not permitted by Welsh Ambulance Service protocols. This was not thought to have adversely affected the patient's outcome or the correct use of the ROAD policy.

DISCUSSION

The data from this study have shown that paramedics can accurately use a decision support algorithm when recognising adult death. Of the 188 ROAD applications, all patients for whom an ECG strip was available for review were correctly selected in accordance with the policy's inclusion criteria. Of the 13 errors made during use of the ROAD protocol, all were attributable to administrative errors and none adversely affected the outcome of a patient. There was one adverse clinical incident that did not result from use of the ROAD protocol.

ROAD in South East Wales has reduced the dangers associated with the unnecessary emergency ambulance transport of patients with no prospect of survival.^{3,4} Hospital admission rates of asystolic cardiac arrest victims receiving ALS and who had not regained an output at the scene were reduced, as trust policy formerly required that these patients were transported to accident and emergency departments for confirmation of death before resuscitation attempts were terminated.

The proportion of errors in our study compares favourably with the results of previous research carried out by a large UK ambulance service.⁶ In this study of 397 cases of recognition of adult death, 158 ambulance patient report forms had been incorrectly completed (40%). ECG recordings did not meet the standards required in 92 cases (14%). This study also reported a number of clinical errors, and in particular that CPR was not given for one minute for 34 patients (9%). We were unable to determine if staff in our study made this particular error. However, all patients recognised as dead after resuscitation was begun had the performance of three cycles of ALS documented, and it can be reasonably assumed that this intervention included CPR.

In our study, the mean on-scene time for paramedics using the ROAD policy was 60 minutes. This represents 8% of an ambulance crew's 12 hour shift and adversely affects the trust's ability to meet government performance targets. These protracted on-scene times seemed largely to occur as a result of the time taken for a medical practitioner to attend the incident to confirm death. By contrast, in a study examining the use of nalbuphine in the same ambulance service, the mean on-scene time was 21 minutes (unpublished data).

On the basis of this research, the ROAD procedure has been amended to permit its application after three cycles of ALS in asystolic patients even if bystander CPR has been started. Further work is being undertaken to revise the ROAD policy to reduce on-scene times and minimise its impact on NHS resources. The Welsh Ambulance Trust is currently consulting with local police forces, coroners, and local medical committees to produce an amendment to existing procedures. This will eliminate the requirement for the attendance of a medical practitioner to confirm death for most cases. It will also be necessary to provide adequate training to ambulance staff and police officers to enable them to support bereaved relatives and friends.

Study limitations

The study was limited to an examination of compliance to the ROAD policy used by one ambulance service. However, we believe that our research is generalisable as it suggests that paramedics can accurately apply a well designed ROAD algorithm with appropriate training and support. We did not attempt to determine the number of cases in which the ROAD policy could have been utilised but was not.

Conclusion and recommendations

Paramedics can accurately use a decision support algorithm when recognising adult death has occurred. It could be argued, therefore, that the attendance of a medical practitioner to confirm death is an inappropriate use of resources and may result in unnecessarily protracted on-scene times for ambulance crews. This practice might be safely discontinued. Further research is required to confirm this, and to determine the proportion of patients suitable for recognition of adult death who are actually identified as such by paramedics.

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Contributors

Tim Jones conceived the idea for the study, managed data collection, and wrote the first draft of this paper. Malcolm Woollard assisted in analysing the data and edited all drafts of the paper.

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