Helicopter Emergency Ambulance Service (HEAS) transfer: an analysis of trauma patient case-mix, injury severity and outcome

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ABSTRACT

INTRODUCTION A retrospective review of all patients transferred by helicopter ambulance to the Great Western Hospital over a 20-month period between January 2003 and September 2004 was undertaken to establish the case-mix of patients (trauma and non-trauma) transferred and the outcome.

PATIENTS AND METHODS Details of all Helicopter Emergency Ambulance Service (HEAS) transfers to this unit in the study time period were obtained from the three HEAS providers in the area and case notes were reviewed.

RESULTS There were 156 trauma patients transferred (total 193) in the study period with 111 cases identified for analysis with a mean age of 33 years (range, 1–92 years). Average Injury Severity Score on admission was 12 (range, 1–36). Forty-five patients were discharged home from the emergency department, 24 cases had operation, 10 patients required ICU care and 2 were pronounced dead in the emergency department. Average hospital stay following HEAS transfer was 2.97 days (range, 0–18 days).

DISCUSSION Helicopter ambulance transfer in the acute setting is of debated value. Triage criteria are at fault if as many as 41% of patients transferred are being discharged home from casualty having incurred the financial cost of helicopter transfer. We suggest that the triage criteria for helicopter emergency transfer should be reviewed.

KEYWORDS

Helicopter emergency ambulance transfer – Case-mix – Injury severity – Outcome

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Helicopters were used very successfully for the transfer of wounded soldiers from the battlefields in the Korean and Vietnam wars and this model of patient transfer was then put into use in a civilian setting, initially in the US. In 1987, the first helicopter-based ambulance service in the UK was introduced in the Greater London region.¹ Although this service carries an emergency physician as crew, it is unique in that respect. All other 15 dedicated HEAS providers in the UK are usually manned by one pilot and two paramedics.²

Advanced trauma and life-support (ATLS) teaching is that there are three peaks of mortality following major trauma. An early peak is due to patients who will die immediately with fatal injuries, a second peak of patients who will die in the 60 min following trauma and a third peak representing patients who will die of delayed complications of their injuries such as organ failure and sepsis. The second peak of mortality within 60 min of injury (the so-called 'golden hour' in ATLS teaching) represents the patients for

whom rapid transfer to an emergency medical care facility from the scene of injury is potentially life-saving.³ The perceived benefit of helicopter transfer is the faster speed of transfer to hospital. This will maximise the proportion of the 'golden hour' spent in a hospital setting where potentially reversible conditions such as tension pneumothorax or cardiac tamponade can be treated. The most commonly used helicopter for HEAS in the UK is the Eurocopter 'Bolkow' 105,² which has a maximum speed of 252 km/h, clearly faster than ground ambulance. However, when factors such as mobilisation time, weather conditions, ease of access and the availability of helipad for landing at destination hospitals is considered, quicker transfer by helicopter is not always guaranteed. Many studies have found that patient transfer by helicopter is often not faster than by ground ambulance transfer overall except when large distances (over 45 km) are involved or when roads are poor or traffic conditions bad. These studies have questioned which

trauma cases are likely to benefit from faster transfer with HEAS.⁴⁻⁸ This review aims to establish the case-mix, injury severity and outcome for patients transferred to this unit by HEAS.

Patients and Methods

The data were collected by retrospective review of case notes for patients transferred in the acute setting by helicopter ambulance to the accident and emergency department. The details of patients transferred by helicopter were obtained by a variety of different methods. The records of Wiltshire, Berkshire and Oxfordshire air ambulance services were reviewed and patient details provided. Casualty records also provided details of patients brought in by helicopter. There were some patients for whom inadequate details were available and who, therefore, could not be included in the data analysis. A spreadsheet was made and all patient data were entered. The case-mix was analysed and the mechanisms of injury assessed. The injury severity was calculated using the Injury Severity Score (ISS) and the short-, medium- and long-term outcomes were assessed.

Results

A total of 193 patients were transferred in the acute setting to this hospital by helicopter ambulance (non-doctor crew). Of these, 156 patients had been involved in trauma and 37 were medical patients. The case notes of 111 trauma patients were reviewed and 45 cases were excluded from the data analysis. Eighteen of these cases had incorrect information provided by the air ambulance services; in a further 25 cases, insufficient information was available to identify the patients involved in transfer. Seven further

Table 2 Injury Severity Score (ISS)

ISS	Number of patients
1–3	48
4–8	33
9–13	18
14–22	6
23–36	6

Mean ISS = 12.37.

patients had insufficient information in the case notes to allow calculation of the injury severity and outcome.

Of the 111 trauma patients remaining, there were 73 males and 38 females with a mean age of 33 years (range, 1–92 years). The patients had been transferred from accident scenes up to 48 miles away from the hospital from Wiltshire, Berkshire, Oxfordshire, Gloucestershire and Hampshire. The mechanisms of injury are shown in Table 1; the commonest mechanisms were road traffic accidents ($n = 59$), horse riding injury ($n = 24$) and mechanical falls ($n = 16$).

The ISS was calculated for each patient based on the injuries recorded in the medical notes. The scores recorded are shown in Table 2 and the mean ISS was 12 (range, 1–36).

Ten patients in total were admitted to the intensive care unit (ICU), all of whom required intubation. There were 7 cases that required assisted ventilation and the mean stay in ICU was 3.2 days. Only 24 patients required operation (18 orthopaedic, one general surgical, two combined orthopaedic and general surgical, one combined orthopaedic and maxillo-facial, one ENT operation). The mean in-patient hospital stay of all 111 patients transferred was 2.97 days (range, 0–18 days).

The immediate outcomes for all patients were analysed and are presented in Table 3. Forty-five patients (41%) were

Table 1 Mechanism of injury

Mechanism of injury	Number of patients
RTC (car & motor cycle)	59
Horse riding injury	24
Mechanical fall	16
Sports injury	4
Paragliding injury	2
RTC pedestrian injury	2
Injury building site	1
Hanging	1
Burn	1
Assaulted	1

Table 3 Immediate outcome

Immediate outcome	Number of patients
Discharge	45
ITU	5
Ward	37
Theatre to ward	14
Theatre to ITU	2
Ward to theatre	4
Transfer to JRH	2
Death	2

Table 4 Long-term outcome

Long-term outcome	Number of patients
No follow-up in GWH	58
Follow-up at other hospital	8
Complete recovery	37
Finger stiffness	1
Painful hip	2
Mal-union humerus	1
AVN talus	1
Delayed union humerus	1
C6 radiculopathy	1
Infected metalwork in humeral nail	1

discharged home directly from casualty without the need for admission, 37 patients were transferred to in-patient wards and four of those underwent operation at a later stage. Five patients went straight to ICU and two more required ICU following operation. Two patients were transferred out immediately to a tertiary referral hospital and two patients were pronounced dead in the emergency department.

The long-term outcomes were analysed and the data are presented in Table 4. Thirty-seven patients were followed up and made a complete recovery; 66 patients did not require follow-up or were followed up in a different hospital. There were eight cases with on-going morbidity at the time of data analysis which included stiffness, pain, mal-union, delayed union, radiculopathy and one case of infected metalwork in a humeral nail.

Discussion

The value of patient transfer by helicopter ambulance in the acute trauma setting is still debated. Although a helicopter can travel much faster than ground ambulance,² the mobilisation and preparation times for helicopter ambulances are clearly more lengthy and previous studies have failed to show a consistently faster total transfer time from accident to arrival in casualty if the distances involved are less than 45 miles.⁷ Studies from the US and Europe have provided evidence both supporting⁹⁻¹¹ and disputing^{12,15} the outcome benefit and cost benefit of helicopter transfer of patients in a civilian setting with doctor-staffed aircrews and non-doctor crews. Although data to support the use of medically staffed helicopter transfer service in Greater London have been published, there is very little data regarding patient outcomes

following initial transfer with non-medical HEAS transfer in the UK. Some studies do support the use of HEAS arguing that outcome benefit can be shown.¹⁴⁻¹⁶ The helicopter has clear advantages in accessing remote rural areas and areas where traffic congestion is a problem. There are, however, certain scenarios where air ambulance transfer is contra-indicated. These include hazardous environmental conditions (such as fog or high winds), aggressive or uncooperative patients and patients who have been contaminated with chemicals which may compromise safety by incapacitating helicopter pilots.¹⁷ There are also relative contra-indications to helicopter transfer which include any degree of airway difficulty or obstruction as the loss of an airway on board the helicopter is both difficult to recognise and to treat.¹⁷

Accepting that there are some limitations to the use of helicopter ambulances, the issues of cost effectiveness are still not resolved. The average cost of mobilisation of a UK helicopter ambulance staffed with paramedics and pilot is in the region of £6000.² There are few who would argue with the clinical effectiveness of helicopter transfer of the critically ill from the scene of accident to hospital if faster transport and earlier treatment can improve outcome. However, the cost effectiveness of HEAS transfer for those patients with injury severity scores of 12 and below is debatable. In this study, the mean ISS was only 12. Previous studies have shown no outcome benefit in those patients with an ISS of less than 15 and mean ISS of as high as 36.^{18,19} The low average ISS of the patients in this study implies that there is a degree of over triage by the local ambulance services leading to inappropriate mobilisation of the air ambulance. Forty-five patients (41%) in this study were discharged home directly from casualty (mean ISS of 1). If the average mobilisation cost is £6000, this represents £270,000 of expenditure transporting patients who essentially represent the 'walking wounded'. There is often minimal accurate information available when the decision to mobilise the helicopter ambulance is made and, therefore, a certain degree of over triage is inevitable. Although no national or regional standards exist as to acceptable rates of 'over triage', literature reviews have estimated that an 'over triage rate of no more than 25%' is an achievable standard.²⁰ Each individual decision to use HEAS is a difficult judgement call; however, if other services in the UK have similar 'over triage' rates as demonstrated in this study, more detailed triage criteria are clearly required if unnecessary helicopter deployment is to be avoided.

Chappell *et al.*²¹ found that the termination of a hospital-based air ambulance service had no measurable negative impact on trauma patient outcomes. Whilst we do not suggest that HEAS programmes are of no clinical value, we do suggest that more stringent triage criteria should be formulated and applied by the trauma organisations and societies

to ensure that valuable resources are deployed appropriately to ensure clinical and cost effectiveness. As previously stated, it is important to remember that the helicopter is not a mode of therapy, it is merely a method of transport.

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