

SHORT REPORT



The role of physician staffing of helicopter emergency medical services in prehospital trauma response

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Abstract

The crewing of Helicopter Emergency Medical Service (HEMS) for scene response to trauma patients is generally considered to be controversial, particularly regarding the role of physicians. This is reflected in HEMS in Australia with some services utilizing physician crewing for all prehospital missions. Others however, use physicians for selected missions only whilst others do not use physicians at all. This review seeks to determine whether the literature supports using physicians in addition to paramedics in HEMS teams for prehospital trauma care.

Studies were excluded if they compared physician teams with basic life support teams (BLS) teams rather than paramedics. Ambulance officers were considered to be paramedics where they were able to administer intravenous fluids and use a method of airway management beyond bag-valve-mask ventilation. Studies were excluded if the skill set of the ambulance team was not defined, the level of staffing of the helicopter service was not stated, team composition varied without reporting outcomes for each team type, patient outcome data were not reported, or the majority of the transports were interhospital rather than prehospital transports.

Key words: *doctor, helicopter, physician, prehospital, trauma.*

Methods

The databases MEDLINE, CINAHL and EMBASE were searched, from 1966 to December 2002, using the terms {helicopter and physician} and {helicopter and doctor}. Foreign language papers were not excluded. Reference lists of retrieved articles were also searched.

All papers that examined the survival rates of prehospital trauma patients treated by physician versus paramedic teams in the context of helicopter

transport, were identified and retrieved. Where no abstract was available but the title suggested that the paper was relevant, the original paper was reviewed.

Results

A total of 12 relevant papers were identified from the 126 papers produced by the search criteria. Four of these papers directly compared the outcomes of

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Conflicts of interests: None

Table 1. Studies comparing physician and non-physician helicopter crewing for prehospital trauma management

Author and year	Study design	Type of teams	Inclusion criteria	Results	Comments
Randomized, controlled trials: TRISS methodology					
Baxt 1987a (USA) ⁵	Randomized controlled trial	Helicopter randomized to either 'faculty' emergency physician/nurse or paramedic/nurse staffing. The nurse/paramedic team was trained to perform all the interventions used by the physician.	All trauma scene fights over a 2-year period.	Mortality in the physician group was 35% lower than that predicted by TRISS. Mortality in the non-physician group was as predicted.	The only randomized, controlled trial in the medical literature comparing physician and non-physician teams in prehospital trauma management (any transport mode). The non-physician team was considerably more procedurally capable than most Australian paramedics. Despite this, a better outcome was observed in the physician treatment group.
Cohort studies; TRISS methodology					
Hamman 1991 (USA) ¹¹	Retrospective observational cohort	First period: physician/nurse Second period: nurse/nurse or nurse/paramedic. Physician was 2nd year resident or greater.	Consecutive adult trauma patients over a 10-month period in 1985 and a second 10-month period in 1987.	No difference in procedures performed by the teams on scene or en route and no mortality difference.	Physician and non-physician teams using essentially the same protocols, achieved similar outcomes.
Schmidt 1992 (Germany and the USA) ¹²	Retrospective observational cohort	German helicopter: Physician and ambulance officer. Physician was a trauma registrar. US helicopter: Paramedic and flight nurse.	All trauma patients transported by the services over a 1-year period.	Higher rates of intubation, thoracic decompression and larger volumes of fluid infused in the German system. By TRISS, lower than predicted mortality in the German patients and as predicted in the American patients.	Differences in intervention rates were clearly documented but it is difficult to attribute the outcome difference solely to prehospital management when the groups received their in-hospital management in different countries.
Garner 1999 (Sydney and Newcastle, Australia) ²	Retrospective observational cohort	Two helicopter services, one with physician/paramedic staffing and the other with paramedic/paramedic staffing. Physician was a consultant or advanced trainee in anaesthesia, emergency or ICU medicine.	Patients with ISS > nine transported to three trauma centres over a 28-month period.	Higher rates of intubation, thoracic decompression and volume resuscitation in physician treated patients without increasing scene time. By TRISS, mortality in the physician group was lower than predicted. Mortality was as predicted in the paramedic group.	The only Australian study comparing the outcomes of physicians and paramedics in the context of the same transport vehicle.

Table 2. Studies comparing physician staffed helicopters with ground paramedics in prehospital trauma management

Author and year	Study design	Type of teams	Inclusion criteria	Results	Comments
Cohort studies: TAISS methodology					
Baxt, 1983 (USA) ⁸	Prospective observational cohort	Emergency physician staffed helicopter vs. paramedic staffed road ambulance.	Consecutive trauma patients transported over a 30-month period to one trauma centre.	In the physician group mortality was 52% lower than that predicted by TRISS methodology. Mortality in the paramedic group was as predicted.	The first study to use TRISS methodology to compare outcomes in this context.
Schwartz 1990 (USA) ¹³	Retrospective observational cohort	Helicopter team: physician, flight nurse and respiratory therapist. Ambulance: Paramedic and another ambulance officer.	All multisystem trauma patients admitted to a single rural trauma centre.	No difference in scene times but higher rates of intubation and IV placement in the physician group. By TRISS, physician team had lower than predicted mortality and ambulance team had higher than predicted mortality.	Rural patients only.
Nicholl 1995 (UK) ⁶	Prospective observational cohort	Registrar/paramedic staffed helicopter vs. ambulance paramedics.	Patients with severe injuries transported to one of 20 hospitals in an urban area over a 2-year period.	No difference in mortality compared with TRISS methodology prediction in either group.	In the physician group, lower than predicted mortality in more severely injured patients was largely offset by higher than predicted mortality in less severely injured patients. Study was performed in an urban context with very short transport times, and wide availability of ground paramedics.
Bartolacci 1998 (Sydney, Australia) ¹	Retrospective observational cohort	Helicopter with physician/paramedic staffing vs. ground paramedics. Physician was a consultant or advanced trainee in anaesthesia, emergency or ICU medicine.	Patients transported by physician staffed helicopter over a 9-year period to a single trauma centre compared with a group of matched paramedic ambulance patients taken to the same hospital.	All physician patients with GCS < 9 were intubated at the scene compared with 43% in the paramedic group. Paramedic patients required significantly more procedures after arrival in the emergency department. By TRISS, mortality was lower than predicted in the physician group. Predicted mortality could not be calculated in the paramedic group due to missing data.	First Australian study to demonstrate better than predicted survival relative to the MTOS cohort (calculated in the physician treatment group only).

Table 2. Continued

Author and year	Study design	Type of teams	Inclusion criteria	Results	Comments
Cohort studies; CRISS methodology					
Oppe 2000 (Netherlands) ¹⁴	Prospective, observational cohort	Helicopter with physician/nurse staffing vs. road ambulance.	All multiple trauma patients injured in a defined geographical region over 20 months during daylight hours.	Mortality 11–27% lower in the helicopter group by CRISS methodology. Largest benefit was seen in patients from motor vehicle accidents with moderately severe injury. Patients with minor injuries survived and patients with very severe injuries died, regardless of level of care.	Based on the results of this study, a national system of physician staffed helicopters has been implemented in the Netherlands for trauma patients.
Cohort studies; ASCOT methodology					
Osterwalder 2002 (Switzerland) ⁹	Prospective observational cohort	Helicopter or road ambulance staffed by anaesthetists vs. road paramedics, anaesthetic nurses or BLS ambulance officers.	All blunt trauma over a one year period treated in the resuscitation room of one hospital with minimum AIS ≥ 2 in at least two body regions, admitted to the ICU, or died.	Significant predictors of improved survival on multivariate analysis were prehospital time > 60 min, prehospital treatment by a doctor, helicopter transport and lower severity of injury as measured by ASCOT scoring.	Suggests that in patients with unavoidably prolonged prehospital times, presence of a physician significantly improved survival rates.
Cohort studies examining physician staffed helicopters compared with ground paramedics in prehospital head injury management					
Baxt 1987b (USA) ⁴	Prospective observational cohort	Helicopter staffed by consultant emergency physician, vs road paramedics.	All patients with a GCS < 9 from road blunt trauma transported by either team over a 50-month period.	Mortality was 40% in the paramedic group and 31% in the physician group ($P < 0.001$). Glasgow Outcome Scores were significantly better in the survivors treated by the physician team also ($P < 0.05$).	There was a better outcome in the physician treated patients despite a total prehospital time that was more than twice as long as the paramedic group. (Physician treated patients came from rural areas and the paramedic patients from an urban area surrounding the trauma centre).
Garner 2001 (Sydney, Australia) ³	Retrospective observational cohort	Helicopter staffed with consultant anaesthetist, emergency physician or intensivist, or advanced trainee, vs road paramedics.	Patients with a GCS < 9 from road trauma who survived initial resuscitation, over an 11-year period.	On multivariate analysis, the physician team was associated with a better functional outcome as measured by Glasgow Outcome Score (OR 2.70, 95% CI 1.48–4.95, $P = 0.0013$).	As with the study by Baxt (1987b), the total prehospital time in the physician group was more than twice as long as the paramedic group, but outcomes were significantly better.

The table excludes studies that have compared physician staffed helicopters with ground basic life support (BLS) teams, studies in which the level of staffing of the helicopter service varied or was not stated, or where patient outcome data are not reported. All quoted differences in outcome were statistically significant.

MTOS, Major Trauma Outcome Study. This US study of more than 20 000 trauma patients established normative data against which trauma system outcomes are compared.

TRISS methodology, Trauma Score-Injury Severity Score methodology. Uses normative values from the MTOS combined with Trauma Score (TS) or Revised Trauma Score (RTS), Injury Severity Score (ISS) and the patients age to predict probability of survival.

CRISS methodology, Combined RTS and ISS methodology. Uses RTS, ISS, plus all their component subscores, combined with age, sex and mechanism of injury in a regression model to provide a more accurate prediction of probability of survival than TRISS methodology.

prehospital trauma patients in the context of helicopter transport where only the crewing varied. These studies are listed in Table 1. Table 2 has studies that compare physician staffed helicopters with ground paramedics. Differences in transport platform may introduce confounding variables for which it is difficult to control, so these papers have been considered separately. No papers were identified that compare paramedic staffed helicopters to physician ground teams.

Of the 12 papers, 10 papers, including the only randomized controlled trial (RCT), demonstrated a survival benefit associated with physician prehospital management. The other two found no difference in outcome. No paper identified a higher mortality in physician treated patients. All Australian studies (all conducted in NSW) have found a benefit associated with physician prehospital management,¹⁻³ as did both studies that specifically examined the outcomes (survival and disability) of patients with head injury.^{3,4}

Discussion

The majority of studies support inclusion of physicians in HEMS teams for prehospital trauma care, including the only RCT. The RCT trial is noteworthy in that the flight nurse who accompanied the paramedic in the non-physician team was trained to perform the same procedures, and could employ the same drugs as the physicians.⁵ For this reason the lower mortality found in the physician treatment group was attributed to physician judgement, rather than procedural capability.

The study by Nicholl *et al.* of the London HEMS system is frequently quoted in discussions on the role of physicians in HEMS crewing.⁶ The study was conducted in a densely populated urban environment with short transport times. There are no HEMS services operating routinely in this context in Australasia. In Australasia HEMS are generally used in situations where prehospital times will predictably be prolonged such as rural trauma and difficult entrapment. It would be expected that if a higher level of prehospital care resulted in improved survival rates, this patient group would be the most likely to benefit. Additionally it was postulated in the Nicholls *et al.* study that the increase in deaths over predicted in the patients with low injury severity may have been artifactual. Another study of the London HEMS which used a modified TRISS methodology appeared to confirm this, with the overall outcome being a small but significant decrease

in the death rate of severely injured patients compared with the predicted mortality rate.⁷

There were no foreign language papers identified that met the search criteria. Use of HEMS outside of first world countries is rare, effectively confining their use to Europe, North America and Australasia. In much of Europe, use of physicians in prehospital trauma care is considered the standard of care, and few comparative studies have been conducted, accounting for the absence of foreign language papers.

Definitions of advanced life support vary between studies. However paramedics in all studies identified were able to administer intravenous fluids, and in all but one study they were able to perform endotracheal intubation. In the other study paramedics used obturator airways for unconscious patients.⁸ Access to neuromuscular blocking agents and sedative/anaesthetic adjuvants is not defined in the majority of studies. One European study included anaesthetic nurses in the non-physician group,⁹ but access to medications was again not defined.

The training and experience of physicians could also be expected to affect outcome, and this varied between studies. The RCT utilized only specialist grade staff.⁵ A combination of specialist grade staff with specialty trainees was the most common staffing pattern.

Australasian College for Emergency Medicine standards mandate appropriately trained physicians form part of the retrieval team in the interhospital critical care transport context, but leave staffing levels for prehospital trauma response to be determined by ambulance services.¹⁰ It is inconsistent to mandate the use of physicians in one context but deny an equivalent level of care to the same patients in the other. Based on available evidence, review of both College standards and staffing levels of HEMS in prehospital trauma care in many parts of Australasia is warranted.

Accepted 10 May 2004

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