Civilian Use of Helicopters Improves Access to Trauma Care and Increases Chances of Survival

Avraham I. Rivkind MD FACS and Gidon Almogy MD

Department of General Surgery and Shock Trauma Unit, Hadassah University Hospital and Hebrew University-Hadassah Medical School, Jerusalem, Israel

Key words: trauma, helicopters, survival, emergency care

IMAJ 2006;8:56–57

…I have borne you on the wings of eagles and brought you to Me... *Exodus* 19:4

"Surviving severe injury depends very heavily upon the time it takes to receive trauma services. The risk of death increases three fold after one hour without the unique surgical care of a trauma center. This is often referred to as the 'golden hour'…" [1].

The advantage of helicopter transportation in trauma care is no longer a matter of debate. This compact airborne vehicle makes it possible to rapidly evacuate seriously injured patients from hazardous locations and circumstances, and deliver them to trauma units where optimal treatment offers the greatest possibility for patient survival. Controversy regarding the use of the helicopter concerns various issues, from noise to the risk of accidents. However, the real issue is that of cost – which explains why this advanced technology is not a standard resource of all modern trauma units [2].

The purpose of technology is to enhance the efficiency and effectiveness in the way we manage the challenges and chores of our professional and personal lives. A moment of reflection will reveal to each one of us that nothing is static; change is a continuous process with a momentum that transcends the objects and circumstances through which it is manifest. The great zoologist and philosopher Jean Piaget described life as a process of perpetual accommodation and adaptation to changing features in the environment [3]. The wonderful fact about human endeavor is that we can control the direction of change. By means of processes of evaluation and research we can ensure that change is synonymous with advancement however, we cannot stop it, rather than a random process.

The article by Masumoto et al. in this issue of *IMAJ* [4] deals with the use of air transportation in the management of trauma. The authors retrospectively studied 151 victims with Injury Severity Scores above 15, whose initial management was provided by the Chiba Prefecture "doctor-helicopter" system that has been in service in Japan since 2001. Effectiveness of the system was measured in terms of probability of survival based on age, ISS and Revised Trauma Score at the scene of the trauma compared with PS on arrival at the emergency department. They concluded that the system was indeed effective.

There is increasing evidence of the efficacy of air transportation in emergency care. In a 2005 retrospective study of 10,314 patients with head Abbreviated Injury Score above 3, including 3,017 who had been transported by aero-medical crews, Davis et al. [5] found significantly lower mortality and better discharge outcomes for air-transported patients, particularly the more severely injured patients. They also found improved survival for air-transported patients intubated at the trauma site, compared to ground-transported patients intubated in the hospital emergency facility. A retrospective review conducted by Shatney and associates [6] of all trauma patients (n=947) transported by helicopter to the Stanford University trauma center over an 11 year period (1990–2001) demonstrated that rapid transportation was advantageous for patients with an ISS > 9 who required early operation or hospitalization. Another retrospective study of trauma registry data collected from five urban level 1 adult and pediatric centers conducted by Thomas and co-workers [7] found helicopter transport to be associated with a significant reduction in mortality. The same researchers report that helicopters have proven invaluable in disaster relief, and recommend that they "constitute a part in disaster operations plans" [8]. Frankema et al. [9] evaluated the effect of a helicopter-transported medical team on the chance of survival of severely injured trauma victims and noted a marked survival benefit for patients suffering multiple trauma, especially those with blunt trauma.

Three crucial benefits of air transportation emerge from these studies, namely speed of access to the severely injured victims requiring immediate management, quality of management at the scene, and speed of transportation to a hospital. Each of these factors highlighted by scientific study substantiates a common sense evaluation of the efficacy of using the most updated technology for administering emergency care. The benefits of the helicopter itself, which has been termed "the most versatile vehicle known to man" [10], are self-evident: They can land in almost any open space – the most sophisticated crafts even on rooftops -– thereby reducing the time it takes to reach the victims; they avoid ground traffic; and traveling time is far less than of ground-bound vehicles. They also make it possible for expert management to be given in the shortest possible time at

ISS = Injury Severity Score
PS = probability of survival

the scene of trauma, which according to the studies can save lives, improve patient outcomes and reduce hospital stays.

Controversy surrounding the use of helicopters for transportation of trauma victims tends to focus upon the high cost of the system, risk of aircraft accidents, and the noise generated by helicopters. There are studies that suggest helicopters offer no benefit relative to ground transportation [11], and there are studies that support helicopter transportation but in fact do not seem to offer evidence. For example, in the Biewener study [12], mortality for patients transported by ambulance and patients transported by helicopter to a university hospital was identical, yet the author concludes that helicopter transportation reduced mortality markedly. And there are studies that claim helicopter transportation to be unquestionably faster than ground transportation [13]. However, Biewener's study – which found doubled mortality for a group of patients transported to an interim regional facility before being transferred to a university hospital – unwittingly indicates the important issue of quality of care, that might be regarded in the light of change and advancement discussed at the beginning of this editorial. Quality of care is a crucial factor in the management of prehospital emergency care. Helicopters are the means of getting physicians to patients, and patients to trauma centers as quickly as possible. Yet ill-equipped and understaffed helicopters are not likely to maximize the benefit of speedy transportation to the patient.

Schmidt and colleagues [13] compared trauma patients transported by helicopter in Germany and the United States. The emergency crew in Germany comprised a trauma surgeon and a paramedic, while the medical crew in the United States consisted of a paramedic and a nurse. Interventions in the German sample were more sophisticated, and resulted in a decrease in early mortality as well as improved outcome compared to patients in the Major Trauma Outcome Study. A study conducted by Liberman et al. [14] in the 1990s and reported in 2003 recommends that resources be allocated for the rapid transportation of trauma victims to highly specialized trauma hospitals. The interesting point in this belatedly published study is that they recommend limiting prehospital management, because at the time of the study on-site treatment was perhaps not as developed as it is today. In fact they found that Advanced Life Support administered at the site was not beneficial. According to more recent studies, things have changed.

Matsumoto et al. [4] provide a clear picture of the present and the future. State-of-the-art emergency trauma care comprises a helicopter and an expert airborne medical team. Another issue that needs to be considered in this debate is rapid retrieval and transportation of organs for transplantation. The desirability of air transportation and on-site expertise is unquestionable for this purpose. Introduction of the rotary wing craft represents advancement of trauma care [15]. Finally, the most powerful indication that the helicopter is here to stay can be found in Bledsoe's attempt to undermine the efficacy of air transportation in trauma care [3]. After a long article intended to expose the "mythology that medical helicopters save lives and are cost effective," he concludes that "..helicopters do help severely injured patients..."

Organization of trauma care was introduced into the civilian setting by the innovative pioneer R. Adams Cowley. In Maryland, USA and Germany, which have highly developed civilian systems, helicopters are strategically located to facilitate rapid access to trauma services. Currently in Israel, emergency air evacuation is provided by the military. However, the system does not serve civilian trauma services well. Frequently helicopters are not available for civilian purposes, bureaucratic delays are common, and the training of medical teams, which tend to comprise military reservists, are not always optimal. In a mass casualty terrorist event at the Hebrew University in Jerusalem in the summer of 2002, it took 5 hours to move the wounded to the local trauma care hospital. Undoubtedly the cost in human life and treatment outcomes were affected, and the need to differentiate military and civilian services was clearly indicated. Hence, the Chiba Prefecture system for emergency medical care presented by Matsumoto et al, and the Maryland and German systems comprising fleets of dedicated aircraft, provide models for Israel's future trauma system.

References

1. Branas CC, ReVelle CS, MacKenzie EJ. To The Rescue: Optimally Locating Trauma Hospitals and Helicopters. LDI Issue Brief 2000:6.
2. Meier B, Saul S. Crashes Start Debate on Safety of Sky Ambulances. *New York Times*, 28 February 2005.
3. Piaget J. Structuralism. London: Routledge & Kegan Paul, 1971.
4. Matsumoto H, Mashiko K, Hara Y, et al. Effectiveness of a "doctor-helicopter" system in Japan. IMAJ 2006;8:8–11.
5. Davis DP, Peay J, Serrano JA, et al. The impact of aeromedical response to patients with moderate to severe traumatic brain injury. *Ann Emerg Med* 2005;46:115–22.
6. Shatney CH, Homan SJ, Sherck JP, Ho CC. The utility of helicopter transportation for trauma patients from the injury scene in an urban trauma system. *J Trauma* 2002;53:817–22.
7. Thomas SH, Harrison TH, Buras WR, Ahmed W, Cheema F, Wedel SK. Helicopter transport and blunt trauma mortality: a multicenter trial. *J Trauma* 2002;52:136–45.
8. Thomas SH, Harrison RN, Wedel SK, Thomas DP. Helicopter emergency medical services: roles in disaster operations. *Prehosp Emerg Care* 2000;4:4.
9. Frankema SP, Ringburg AN, Steyerberg EW, Edwards MJ, Schipper IB, van Vugt AB. Beneficial effect of helicopter emergency medical services on survival of severely injured patients. *Br J Surg* 2004;91:1520–6.
10. Bartolomeo S, Sanson G, Nardi G, Scian F, Michelutto V, Lattuada L. Effects of 2 patterns of pre-hospital care on the outcome of patients with severe injury. *Arch Surg* 2001;136:1293–300.
11. Biewener A, Aschenbrenner U, Rammelt S, Grass R, Zwipp H. Impact of helicopter transport and hospital level on mortality of polytrauma patients. *J Trauma* 2004;56:94–8
12. Diaz MA, Hendy GW, Bivins HG. When is the helicopter faster? A comparison of helicopter and ground ambulance transport times. *J Trauma* 2005;58:148–53.
13. Schmidt U, Frame SB, Nerlich ML, et al. On scene helicopter transport of patients with multiple injuries: comparison of a German and an American system. *J Trauma* 1992;233:548–55.
14. Liberman M, Mulder D, Lavoie A, Denis R, Sampalis JS. Multicenter Canadian study of prehospital trauma care. *Ann Surg* 2003;237:153–60.
15. Bledsoe BE. EMS Myth #6: Air medical helicopters save lives and are cost effective. *Emerg Med Serv* 2003;32:88–90.

Correspondence: Dr. A. Rivkind, Head, Shock Trauma Unit, Hadassah University Hospital, P.O. Box 12000, Jerusalem 91120
Phone: (972-2) 677-8800
Fax: (972-2) 644-9412
email: avir@hadassah.org.il