Proposal for a New Scoring System in International Interhospital Air Transport

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Several advanced scoring systems have been established for the assessment of patients in clinical intensive care medicine.[1] Currently, the widespread use of these systems allows an assessment of outcome, as well as assisting in the optimal choice of treatment settings, for example, time point to admission to the ICU.[2] Furthermore, scoring systems can be an advantageous tool for purposes such as quality control and improvement of cost effectiveness.[3]

Some of these scores have been modified to provide a consistent scoring system in transport medicine, as for example, the rapid acute physiology scoring (RAPS). RAPS, a truncated version of the acute physiology and chronic health evaluation (APACHE II) score, has proved to be a reliable and predictive measurement of patient severity, and physiologic stability, in short distance helicopter transport systems.[4,5] As a modified ICU score, RAPS however, is naturally limited, as it solely ranks illness severity, whereas other transport related aspects, such as, specific risk factors, and limitations for aeromedical transport, are not considered.[6] RAPS therefore seems to be feasible for short helicopter transport between intensive care units, rather than for international transport.

In contrast, patients undergoing long distance interhospital transfer by air ambulance or commercial airline are, if at all, scored by the NACA (National Committee of Aeronautics) score system, which was introduced about 35 years ago during the Vietnam war (Table 1), and last modified in 1976.[7] The aim of this score system was a rapid triage of patients evacuated from battlefields, and not the ranking of patients transported between hospitals. Although also modified to accommodate patients suffering from internal diseases, the NACA score system poorly reflects the complex setting of modern interhospital transfer and travel medicine.

Interhospital Aeromedical Transport

A growing number of patients are transported between hospitals by air ambulance. These patients basically can be divided into two categories: Patients transported to tertiary care centers for advanced diagnosis or treatment, and on the other hand, patients repatriated from abroad to their home country, either while they need special diagnostic procedures or treatment which cannot be provided in the referring hospital, or because of a lengthy hospitalization incompatible with their stay in a foreign country.

In the first category, transportation is mainly a short distance helicopter flight, the second category almost uniformly requires transportation by long distance ambu-

Table 1 NACA Score

NACA Score Level	*Definition*
1	Not acute life threatening disease/injury
2	No acute intervention, but further diagnostic necessary
3	Severe, but not life threatening disease/injury, acute intervention necessary
4	Development of vital danger possible
5	Acute vital danger
6	Acute cardiac or respiratory arrest
7	Death

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Table 2 Interhospital Air Transport Score

Care Level		
Low care	L: Requires attention or assistance up to 3 times per day	
Intermediate care	I: Requires attention or assistance every 2 hours e.g., medication or feeding, all children younger than 4 years	
High care	H: Requires continuous surveillance	
Illness Severity Level		
Circulation	Rhythm	Pressure
	0: Sinus Rhythm	0: Stable
	1: Arrhythmia without hemodynamic impact	1: Stable, but requires support
	2: Arrhythmia with hemodynamic impact	2: Requires maximum support
Respiration	0: no impairment, SaO_2 > 95% on room air at ground level	
	2: Inhalation	
	4: Mechanical ventilation	
Cerebral function	0: Glasgow Coma scale 15	
	2: Glasgow Coma scale > 8	
	4: Glasgow Coma scale < 8	
Transport Ability Level		
Cooperation	0 = Full cooperative	
	2 = Partial cooperative or somnolent	
	4 = Noncooperative or unconscious	
Mobilization	0 = full mobilized and/or maximum 1 peripheral venous access	
	2 = partial mobilized and/or maximum 1 peripheral or central venous access plus urine catheter or oxygen mask	
	4 = nonmobilized and/or bulky bandages, extensions.	
Infectious	0 = Noninfectious	
	4 = Infectious by blood or specimen	
	8 = Infectious by aerosol or contact	
Mechanical ventilation	0 = No	
	4 = May become necessary	
	8 = Yes	
Airleak	0 = No	
	4 = May develop	
	8 = Yes	

lance jets, or in the moderately ill or injured, by regular scheduled airlines.[8,9] If repatriated by commercial airline, patients can be seated in the first or business class, or transported on a stretcher.

Transport teams, depending on the legal requirements in various countries, can consist of physicians, nurses, or paramedics, or any combinations of these.

Emergency call centers are responsible for the pretransport evaluation of the ill or injured patient. Based on information gained by telecommunication, the physicians of the emergency call centers are responsible for the decision of when to repatriate the patient. Furthermore, they have to choose between the various modes of transport vehicles and teams, to make up an optimal transport setting for each individual patient.

Due to inconsistent information of the clinical status of the patient, biased by the motivation of the treating physician to transport or to keep the patient, decision making can be difficult, and transport can be delayed, or become impossible, as in 5 of 95 cases in one retrospective study.[8]

The use of a standardized score system which can be also used "at the scene" may improve quality control and cost effectiveness of these centers.[10]

Interhospital Air Transport Score

The hereby introduced interhospital air transport score (IATS) (Table 2) refers to the unique situation of interhospital air transport, and can be used in both, pretransport evaluation in emergency call centers (e.g., optimal mode of transport, ambulance jet/scheduled airline), as well as for assessment by the transport team in the referring hospital, prior to transport.

In the IATS, the patient is evaluated on three levels:

(1) Care level: The scoring in a care level category reflects the work load for the transport team during the interhospital transport. We choose to score the care level, as well as the illness severity level, as moderately ill

patients can require intensive observation during transport, and lead to a work load which requires a two person transport team. The patient is scored in one of three categories, L, I, or H.

(2) Illness severity level: In this level the acute illness or injury severity is evaluated. As the score should be useable in small rural hospitals in Third World countries as well as in a tertiary care center, we did not integrate extensive laboratory or other sophisticated assessments. In this level, the vital functions, circulation, oxygenation, and cerebral function, are covered. The patient can reach a maximum of 12 (worst) and a minimum of 0 points (normal).

(3) Transport ability level: Transport ability is the key word in choosing between the various modes of transportation in interhospital air transport. The range is 0 (easy) to 32 points (complicated).

Discussion

Further studies should show the predictive value of the IATS; however, based on our experience of the retrospective scoring of 300 international aeromedical transports with the new tool, we would suggest the following cut-off levels as a basis for further discussion.

Cut-Off-Level between Transport-No Transport

Taking into account that IATS is a score for interhospital transport, and not emergency/rescue medicine, we feel that an illness severity level above 6 should be a no-go criterion, if the referring hospital is a well-equipped tertiary care center (this means that the indication for interhospital transfer is not a medical one). An illness severity level above 8 seems to be a challenge for an experienced transport team even in evacuation from rural hospitals in Third World countries.

Cut-Off Level between Ambulance Jet-Scheduled Airline

The contraindications for transport in commercial airlines are mechanical ventilation, infectious diseases, and airleaks/trapped air.[11] As these are ranked with 8 in the transport ability level, we would suggest a score below 8 as a precondition for transport by sceduled airline. However, long distance transport of patients with a transport ability level of 8 or higher might be possible, even in regular airliners, with the recently introduced patient transport compartment. This closed compartment set up, in a regular airliner, accommodates patient and medical team with equipment, and allows ICU procedures, including mechanical ventilation, without being disturbed by other passengers on board.

Cut-Off Level between One- and Two-Person Transport Team

Provided a transport time is shorter than 4 hours, including the ground transport to and from the airport, a one-person transport team might be capable of accompanying a patient requiring intermediate care. On long distance transports (Singapore-Frankfurt, for example, might easily come up to 20 hours or more, including stop over and ground transport), all patients requiring intermediate and high care should be escorted by a transport team consisting of two persons.

Cut-Off Level between Physician - Nonphysician Transport Team

Unlike the US, in Germany a physician is required by law on board an ambulance jet. Several studies were not able to show a clear advantage of one of these systems. In contrast, medical escorts on board regular scheduled flights by nurses, paramedics, or physicians, are common practice throughout Europe and the US. However, we consider nurses, or paramedics trained in aviation and emergency medicine, to be able to cope alone with patients up to an illness severity level of 4, regardless of the mode of transport.

Summary

We found the IATS in our first experience of scoring 200 patients prior to transport to be superior to existing scoring systems in aeromedical transport/travel medicine for the following reasons:

(1) The score can be used by all medical disciplines.

(2) Patients can be scored rapidly, without the need of extensive laboratory or other diagnostic work up, so that the scoring can also be done in a rural Third World hospital.

(3) Scoring can be performed in emergency call centers as well as by the transport team "at the scene."

(4) Not only the severity of the patients illness or injury is ranked, but also other important factors for choosing the optimal transport setting (care level, transport ability level).

(5) Aviation related risk factors for the patient (air leaks), as well as specific limitations for different modes of aeromedical transport are considered.

The next and most necessary step will be the foundation of a multicenter research agenda to optimize and validate the score.

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View of Cathedral, Strasbourg, France. Submitted by CD Ericsson, MD.