

Briefing notes on emergency medical disembarks by helicopter at sea in North America

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ABSTRACT

Physicians and nurses from shore based practice who move to work on cruise ships often have concerns about the management of critically ill patients and questions about the resources available to transfer by helicopter to a tertiary care facility. This article seeks to outline some of the clinical, operational and logistical issues associated with using a helicopter to transfer a patient from a ship to a shore-side hospital. While it focuses on resources available in the maritime areas around North America, most of the clinical comments would apply to helicopter evacuations anywhere in the world.

(Int Marit Health 2014; 65, 1: 7–12)

Key words: helicopter evacuation, helicopter rescue, MEDIVAC, MEDEVAC, cruise ship medicine

INTRODUCTION

In the event that a passenger or crew member becomes seriously ill or is injured (a life or limb-threatening medical emergency), it may be necessary to evacuate them by helicopter (MEDIVAC or MEDEVAC) to a shore-based medical facility [1]. This is one of the most complex decisions the ship's physician has to make, and the decision-making factors are unique to each case. The physician must be prepared to outline the benefits that would result from the medical evacuation and also account for the risks. A physician or a nurse must accompany the patient, unless there is a physician or flight nurse on the aircraft who will assume medical responsibility for the care of the patient until they reach the destination hospital.

The treating ship's physician is responsible for ensuring that all medical supplies and equipment necessary to treat and sustain the patient during the emergency evacuation process are available and that the physician or nurse who is to accompany the patient is adequately prepared to manage the patient during transfer to the receiving facility. US federal law stipulates that the sending or referring

physician is medico-legally responsible for the patient until the patient physically reach the accepting physician at the receiving hospital. This mandates that the cruise ship physician considers very carefully all potential complications that may be encountered during the flight and takes steps to address and mitigate these.

This article will provide some background information to physicians and nurses new to cruise ship medicine on the decision making process, by explaining the advantages and limitations of the helicopter evacuations. There is also some information on what to expect when assisting in the co-ordination of the evacuation and when accompanying the passenger or crew member during the evacuation.

EARLY NOTIFICATION

As soon as it becomes clear that the patient may need helicopter evacuation, a call should be placed to the local Rescue Co-ordination Centre or Search and Rescue (SAR) co-ordinator. In North America this is usually the appropriate US Coast Guard (USCG) district [2] or in Canada, one of the Canadian Joint Rescue Coordination Centers (JRCCs) [3]. Early notification will assist them in proper mission planning

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and give time to put in place supporting arrangements. It should be noted that at times in some areas, it may take up to 2 h to launch a helicopter. In certain circumstances it may be necessary to also launch a fixed-wing aircraft to assist in the helicopter evacuation. For missions in excess of 150 miles offshore or for complex missions, both the USCG and the Canadian JRCCs may launch a fixed-wing aircraft to provide additional on scene co-ordination and safety back-up.

If it transpires later that the patient can be better managed on board or through some other transport arrangement, the USCG and the Canadian agencies will appreciate having been involved early. They will not launch a helicopter immediately upon receiving a call, but rather will consult with a designated USCG Flight Surgeon or Canadian Duty Medical Officer, who will provide recommendations regarding potential patient transport. Direct ship doctor to Flight Surgeon or SAR agency medical officer communication is highly encouraged and can be co-ordinated by the USCG SAR Co-ordinator or Canadian JRCC.

In addition to all the usual patient information, it is important to state to the USCG or Canadian JRCC that a nurse will be accompanying the patient. Patients who are sick enough to require helicopter evacuation require a nurse to accompany them. Coastguard helicopters usually carry a rescue swimmer or a SAR technician. Their skill set is in challenging aquatic helicopter rescue, not necessarily the care of a complex cardiac patient, or someone on a ventilator.

If there is a suspicion of a potentially communicable disease, such as tuberculosis or meningitis, this should be communicated to the USCG or JRCC at this time.

At some point, early on, in the decision-making process an attempt should be made to contact the cruise company's medical department ashore. This will enable shore-side assistance with the logistics and co-ordination of the evacuation to be provided in a timely manner. In certain cases, the USCG will ask the cruise line shore-side medical department to assist in making arrangements to have an air ambulance meet their aircraft at a pre-designated location. This is because operational restrictions and flying distances involved may not allow the USCG helicopter to fly the patient directly to a hospital ashore. In such cases these fixed-wing rendezvous arrangements need to be made before the evacuation from the ship can take place.

Additionally, it is important to contact the receiving hospital and ensure that they are able to accept and treat the patient. For example, if the patient is unconscious from a possible intra-cerebral haemorrhage, the risk of helicopter evacuation is not justified if the only receiving hospital within helicopter range does not have a functioning computed tomography scanner or neuro-surgery capability. As a clinical imperative and professional courtesy, the referring cruise

ship physician should speak directly with the emergency department or receiving physician to explain the history and condition of the patient and provide them sufficient time to prepare to receive the patient.

PATIENT CRITERIA FOR HELICOPTER EVACUATION

While each patient case is unique due to specific medical problems, on board medical expertise, location of the vessel, time to next port of call and available shore-side medical facilities, there are some very general and basic criteria that should be considered when making an evacuation request.

The actual evacuation of a patient is not without the potential hazards. While both the USCG and Canadian Coast Guard and Defense Forces have an outstanding safety record, the very nature of the operation requires that great thought and a detailed risk assessment are conducted prior to deciding to conduct a helicopter evacuation at sea. Hovering a helicopter over a ship is clearly a low-frequency, high-risk operation. Apart from the risks involved, rescue helicopters are a valuable community resource that should only be requested when there is simply no other way to manage the patient appropriately on board or alternative transport arrangements available.

The decision to request a helicopter evacuation is a complex risk-benefit analysis, with the risk of transport being considered against the potential benefit of earlier care in a medical facility. For example, a patient with a large food impaction, in whom there are concerns about airway compromise, but who has not been intubated, should not normally be put in a helicopter. Any anticipated airway difficulties likely to be encountered in a well-lit and organised ship's medical centre are far more complex and difficult to manage in the back of a helicopter.

Most large cruise companies have a shore-side medical department available 24 h a day to assist the on board physicians with the logistics and operational issues associated with patient evacuations. However, the ultimate decision about whether to evacuate the patient, by whatever method, rests entirely with the on scene ship's physician in conjunction with the duty medical officer for the search and rescue agency involved. During the evolution of a helicopter transfer or MEDEVAC, ultimately the pilot-in-command is the final authority on whether the helicopter evacuation will take place.

Some of the issues to consider are:

- decreased ability to monitor the patient during flight due to noise and vibration inside the aircraft cabin;
- restricted space, light and access to the patient, who is on the floor of the aircraft;
- extreme difficulty in defibrillating or pacing the patient in the aircraft;

- extreme difficulty in airway management in a patient without a secure airway;
- psychological trauma of conscious patient being hoisted off ship in Stokes litter;
- stretcher-bound patient must lie flat;
- inability to allow next of kin to travel, unless the patient is a child (< 16 years of age).

To help to explain general categories of the patients who do, and do not benefit from helicopter evacuations, some examples of different cases are listed here. It must be stressed that these examples or anything contained in this article do not constitute medical advice, but are only clinical examples to demonstrate some of the issues involved. Each case will be unique and the on scene ship's physician is the only one able to make the decision about the need for a helicopter evacuation.

POSSIBLE BENEFIT OUTWEIGHS RISKS OF HELICOPTER EVACUATION

Situations, in which possible benefit outweighs risks of helicopter evacuation are as follows:

- an acute arterial occlusion to an extremity, where early intervention could save a limb;
- suspected vascular emergency, such as thoracic or abdominal aneurysm;
- trauma patient with injuries that require urgent surgical intervention;
- unconscious patient, with secure airway, with intra-cerebral bleed or cerebral aneurysm;
- patient seriously ill with acute surgical emergency, where urgent surgical evaluation is indicated to prevent further deterioration, e.g. suspected perforated bowel, active gastrointestinal or vaginal bleeding, possible necrotising fasciitis, etc.;
- acute serious eye injury, for example, globe rupture from champagne cork or possible foreign body penetration of eye, where there is a high likelihood of loss of sight;
- patient in acute renal failure, where dialysis is available at the receiving facility;
- unstable fractures with vascular or neurological compromise, where reduction and restoration of vascular or neurological integrity has been unsuccessful;
- hypovolemic shock, where blood products are available at the receiving facility;
- patient body weight < 160 kg (350 pounds);
- patient with an acute myocardial infarction, who is not a candidate for fibrinolytic therapy, or if fibrinolytic therapy is not available on board, or where fibrinolytic therapy has failed, with active and continuing chest pain. The suggested receiving facility must have the capability to provide cardiac catheterisation and percutaneous transluminal coronary angioplasty.

RISKS OUTWEIGH POSSIBLE BENEFIT OF HELICOPTER EVACUATION

Situations, in which risks outweigh possible benefit of helicopter evacuation are as follows:

- patient in traumatic or cardiac arrest;
- acute myocardial infarction, assuming access to fibrinolytic treatment on board;
- patient in cardiogenic shock or unstable cardiac rhythm;
- patient in acute respiratory failure, who has not been intubated and ventilated;
- any patient with potential airway compromise, who has not been intubated, for example a patient with a foreign body obstruction or oesophageal impaction;
- patient in active, premature labour, unless short journey to a Special Care Baby unit;
- patient with active psychiatric illness, psychosis or suicidal ideation;
- overdose patient, unless only treatment is dialysis or specific antidote is time sensitive and not available on board;
- patient body weight > 160 kg (350 pounds).

FLIGHT SAFETY

The pilot or aircraft commander is the sole authority for the safety and operation of the helicopter mission. His/her decision on the conduct of the mission is final, including who may accompany the patient and whether the helicopter evacuation occurs at all. The USCG is not able to return the nurse to the ship, and normally do not allow a family member to accompany the patient. An exception may be a parent/guardian being transported with a child patient.

For ships that have on board helipads, the decision of whether to land on a ship or hoist a patient can only be taken by the pilot-in-command/aircraft commander. Landing on a ship's helipad is a complex aviation exercise and requires that the pilot is 'deck-landing qualified'. The ship's physician should not direct that the helicopter land on the ship to avoid having to hoist the patient because of concerns about clinical stability during the hoist. If the patient is not stable enough to be hoisted, then they are not stable enough to be flown in a helicopter.

FLIGHT SURGEON EVALUATION

The flight surgeon will generally use 5 criteria to evaluate a request for a helicopter evacuation:

1. *What does the patient have?* This will be a best guess, based on the ship's physician evaluation.
2. *What does the patient need?* Computed tomography scan, neurosurgeon, general surgery, blood transfusion, etc.
3. *When does the patient need it?* Educated guesses are all that is required, but specifics are most helpful. Avoid statements like 'as soon as possible'.

4. *Where can the patient get what is needed?* USCG will always take the patient to the closest, appropriate facility. USCG Command Centre/SAR desk can confirm with the projected receiving facility that they have the capability to manage the patient.
5. *Can the 'window of opportunity' be met?* If the mission plan will not result in transfer of the patient to the appropriate receiving facility **within the time frame needed**, then there is no expectation of medical gain, and there is only risk associated with the flight.

CLINICAL EQUIPMENT

During the doctor-to-doctor discussion with the search and rescue agency medical officer, mention should be made of any clinical equipment that is needed to accompany the patient. If the patient is intubated and on a ventilator, this should be discussed with the flight surgeon. Shipboard clinicians should be aware that the US Coast Guard does not usually permit the use of a ventilator during helicopter evacuations. Any equipment that is patient-critical should be discussed and agreed with the flight surgeon and then be securely fixed to the Stokes litter.

PATIENT PREPARATION

Once the USCG Flight Surgeon has evaluated the request, and assuming that the mission request is approved, patient preparation should commence.

The patient should be advised that it is medically necessary for them to be evacuated by helicopter and that it will not be possible for them to travel with anyone except the nurse. There should be clear communication between the bridge and medical team on the arrival time for the helicopter. It is critical to reduce to a minimum the time spent with the helicopter hovering over the ship, as this consumes all important fuel. Where possible, the patient should be brought to a sheltered area close to the anticipated hoisting area just prior to the arrival of the helicopter. This will facilitate a timely and safe handover of the patient to the helicopter crew member and allow sufficient time for the transfer of the patient to their litter.

The patient will not be hoisted in the ship's stretcher. A special folding Stokes litter, supplied by the helicopter aircrew, will be lowered. **Only this stretcher** may be used to hoist a patient. This litter and the hoist cable are rated to hold up to 600 lbs. Two blankets should be placed under the patient to ensure that they are well insulated from the metal litter.

If the patient is conscious, the accompanying nurse should clearly explain what the patient should expect during the airlift. As it will be very difficult to hear or communicate, a system of hand signals should be agreed. If it is daytime and the patient's vision is reasonable, a notepad and pen may greatly help the communication during the flight.

Normally the helicopter will lower the rescue swimmer or corpsman down to the ship to supervise the patient placement in the litter and the hoisting operation. In rare circumstances if flight time is limited due to fuel considerations and the rescue swimmer cannot be lowered, the ship's medical staff may need to place the patient in the helicopter's lowered Stokes litter. Prior to touching the litter, it should settle on the deck to allow discharge of any static electricity. If a trail line is used, **the trail line used to guide the litter must never be tied to any part of the ship.**

Ensure that the patient is placed in the Stokes litter the correct way up. The red or orange tubular flotation devices that are secured to the litter should be at the patient's head end. Otherwise, if the stretcher ends up in the water, the patient's feet will float and the head will be under water.

All IV sites should be well taped and bandaged. All tubes or lines should be well secured and tucked under a blanket to avoid 'snagging' during patient movement or hoisting. If an oxygen mask is in use, it should be taped as well as secured using the elastic band.

As hovering helicopters can develop severe downdraft winds in excess of 70 miles/h, any loose objects can get blown off the patient and may be sucked into the helicopter's engine intakes. Blankets in particular pose a great hazard to the rotor blades, tail rotor and engine intakes. The sudden loss of the engine during a hoist could be catastrophic.

Any unconscious patient requires a protected airway and the endotracheal tube must be adequately secured. It is almost impossible to re-intubate a patient in the back of the helicopter. The ventilator must be secured between the legs of the patient, and 1 of the litter straps must pass through the carrying handle of the ventilator. The oxygen tank should be secured by the side of the patient, but ideally under the patient's arm to help counterbalance the weight of the ventilator. Alternatively, the oxygen tank can be secured between the patient's legs and the ventilator under one arm, adjacent to the chest. Special care must be taken to ensure that the ventilator tubing is firmly attached to the ventilator and the endotracheal tube.

A properly balanced litter will greatly assist with patient handling in and out of the aircraft. Note that as the hoist litter is being manoeuvred into the doorway of the aircraft, the 'feet end' at times may drop down and any equipment not firmly secured will fall out.

Always assume that the helicopter crew does not have additional oxygen or medical supplies. The accompanying nurse should take all that will be needed, including sufficient oxygen for the flight and any ground transport after the flight. The nurse should also be carrying her/his own as well as the patient's passport and other documentation, including medical summary and additional clinical information for the

receiving facility. This should be placed in a waterproof bag. The nurse should also have a credit card and the company's 24-h emergency phone number. Foam ear plugs are recommended to provide some hearing protection from the engine noise. A summary of some of the safety issues for the accompanying medical provider can be found in Appendix 1.

Under normal operating conditions, the nurse will be hoisted first in a small rescue basket, along with the cardiac monitor. Then the patient will be hoisted and the monitor reattached once in the aircraft. The nurse should be wearing a manually inflating life jacket. The standard ship's non-inflatable life jacket should not be worn, as this is too bulky to enable patient care, and if the aircraft cabin fills with water, exit from the aircraft will be more difficult. Often the helicopter crew will provide the appropriate manually inflating life-preserver.

Once inside the cabin of the helicopter, the physician or nurse should immediately sit down as directed by the crew and fasten the seat belt. The management of the transition of the stretcher from the hoist to the helicopter cabin is optimally handled by the helicopter crew and the best thing the physician or nurse can do is to remain away from the area of the doorway and be securely fastened into the seat, unless instructed to the contrary by the helicopter crew.

During the flight, the accompanying medical provider may be provided with a helicopter headset. The microphone may be activated by either a small button on the cable or by VOX, meaning as you speak, the microphone activates. Conversation should always be initiated by the helicopter crew and be limited to critical patient communication, since typically the pilots are on the same intercom circuit and they need to monitor and communicate with air traffic control.

During the flight you will not be able to auscultate blood pressure or breath sounds, and your ability to monitor the

patient will be limited. Medical interventions should be kept to a minimum and the guiding principle should be 'if it ain't broke, don't fix it!' Most helicopters do not fly at an altitude where cabin altitude or atmospheric pressure will have any impact on patient management.

When the helicopter lands, take clear direction from the helicopter crew and allow them to initiate and manage the transfer to the ground ambulance or stretcher. Never walk back behind a helicopter, even when the engines are shut down, and never leave or approach the helicopter until signaled to do so by a member of the helicopter crew.

CONCLUSIONS

It is inevitable that a passenger or crew member will become seriously ill or injured at some point. The successful outcome of any helicopter evacuation is highly dependent on the smooth interface between the ship's medical staff, the ship's bridge team, the company's shore-side medical department, the local SAR agency, any assisting air ambulance company, and the receiving hospital.

Shipboard medical personnel who are new to cruise ship medicine should take time to familiarise themselves with their company approved operations policies or operating procedures to ensure that when the time comes to consider a helicopter MEDEVAC, it is requested appropriately and executed safely in accordance with company policy and accepted safety practices.

REFERENCES

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APPENDIX 1. Safety tips for the medical team member flying in a helicopter

- Follow the instructions of the pilot/aircraft commander or crew members at all times.
- Wear the manually inflating life jacket at all times in the helicopter, even over land.
- Under no circumstances approach or leave the aircraft without being told to do so by the aircraft commander or crew member.
- NEVER go behind any helicopter.
- Be aware of the risks of rotor wash and the possibility of objects being blown into your eyes.
- Be aware of the dangers of the rotor blades and tail rotor, especially during start up and shut down.
- Do not wear a hat or scarf or any item of loose clothing that may be blown off.
- During hoisting in a basket, keep your arms well within the basket.
- During the hoist hold onto equipment firmly.
- Do not attempt to grab the doorway or crew member at the aircraft doorway, the hoist operator will grasp the basket, not your hand, to pull the basket inside the aircraft.
- Once seated inside the aircraft, stay there, fasten the seat belt if one is available and avoid the door area. Sudden aircraft movement or turbulence may throw you out the open door.
- Wear the microphone/headset or the helmet provided by the crew.
- At night avoid using a flashlight inside the aircraft unless absolutely necessary, and then ask permission of the crew. At night the crew members often wear Night Vision Goggles (NVG). When using these NVG, bright light at close range can momentarily blind the wearer.
- If it becomes necessary to defibrillate or pace the patient, advise the crew prior to attempting and make absolutely sure that the patient is isolated by blankets from the METAL basket.
- In the event that the aircraft is forced to land in the water, remove all sharp objects from your pockets, if asked, assist crew members in securing any loose equipment, remove any eye glasses, assume the crash position, and grasp firmly on a 'point of reference' and do not let go. Remember the location of the doorway in relation to your 'point of reference'. If the aircraft cabin survives the water landing, you will have plenty of time to exit the aircraft. Follow the instructions of the crew and do not inflate your life jacket until outside the helicopter.
- If the patient survives the water landing, the helicopter crew will remove the patient from the aircraft. Do not try to re-enter the aircraft.