Evaluating a Patient for Emergency Sump Rescue

by Michael A. Raymond and Dr. Richard Harris, BMBS, FANZCA

In June 2014, a caver exploring the dry Riesending cave in Germany suffered a traumatic brain injury from a rockfall. His group was 1000 meters deep in the cave. Three days later, two physicians reached him, came to an agreement about the diagnosis, and cleared him for movement. It took 11 days and more than 700 people to move him to the surface.

You may face similar challenges when evaluating a patient (or patients) during a sump rescue. After checking the air quality and ascertaining whether the patient presents a risk, you will need to conduct a medical assessment. This will help inform your exit plan.

While there are doctors with both the dry caving and cave diving experience necessary to conduct a sump rescue, they are few and far between.

Do you know what to do?

Evacuation options

On the surface, there are three basic options for dealing with a wilderness injury. The first is to treat the patient in place and continue the trip. The second option is to self evacuate to civilization for professional medical care. Some injuries cannot be treated without equipment or conditions not available in the back country.

The final option is rapid evacuation. This usually means a helicopter. Generally speaking, the sooner the patient gets to definitive care, the better the outcome. There's also the possibility of combining approaches: You could call the evacuation team, start moving the patient yourself, and meet the team closer to a road. This will enable the team to evacuate the patient even faster.

For dry caving, things are a little different. No helicopter is coming to get you. With a few exceptions, you can't make a telephone call. If a patient needs to be evacuated, your options include self rescue, sending a runner to get a rescue team, or a combination of the two.

In the Riesending case, one of the injured party's fellow cavers did a solo 10-hour climb to exit the cave to call for help. "Rapid" evacuation takes on a whole new meaning.

High-quality, low-cost training is available for this from the National Cave Rescue Commission (NCRC). In the initial week-long course, participants are introduced to patient assessment, patient packaging (how to wrap someone to keep him or her dry and secure to a litter), search, and rigging haul systems. In later courses, cavers learn to lead rescue teams of varying sizes, conduct more extensive medical care, and rig advanced rope systems.

One of the authors has assisted with teaching the Small Party Assisted Rescue (SPAR) course. In this course, cavers are trained to assess which patients can self rescue and how to help them to move using the minimal gear already in the cave.

In-water rescue

Divers learn a few basic skills in the Rescue Diver course. They are taught how to get a distressed diver safely to the surface, how to move the person, and to conduct rescue breathing. They learn how to remove someone from the water and about basic leadership on the surface. Patient assessment and care are kept to a minimum. Regardless of the incident's cause, drowning is a likely final outcome as long as the stricken diver is immersed.

For a sump rescue, the range of options and the method of choosing between them is technical. Until recently, the received wisdom in sump rescue was to leave the patient(s) in place. This was because our experience was almost entirely with rain-induced, short-lived sumps. A more comprehensive examination of the world-wide incident history has shown that at a minimum, sending a diver to check on the patient as soon as possible is recommended.

When leaving the patient in place is not a viable option, the choices are to find or make an alternate dry exit, have the patient swim out under his or her own power, or to swim the patient out. We'll cover how to choose between these options below.

Organizations like the National Outdoor Leadership School (NOLS) teach initial patient evaluation in great depth in their Wilderness First Aid and Wilderness First Responder ("woofer") courses. Evaluating the patient will identify what needs treatment, if the person is improving or getting worse, and what type of exit the patient can tolerate.

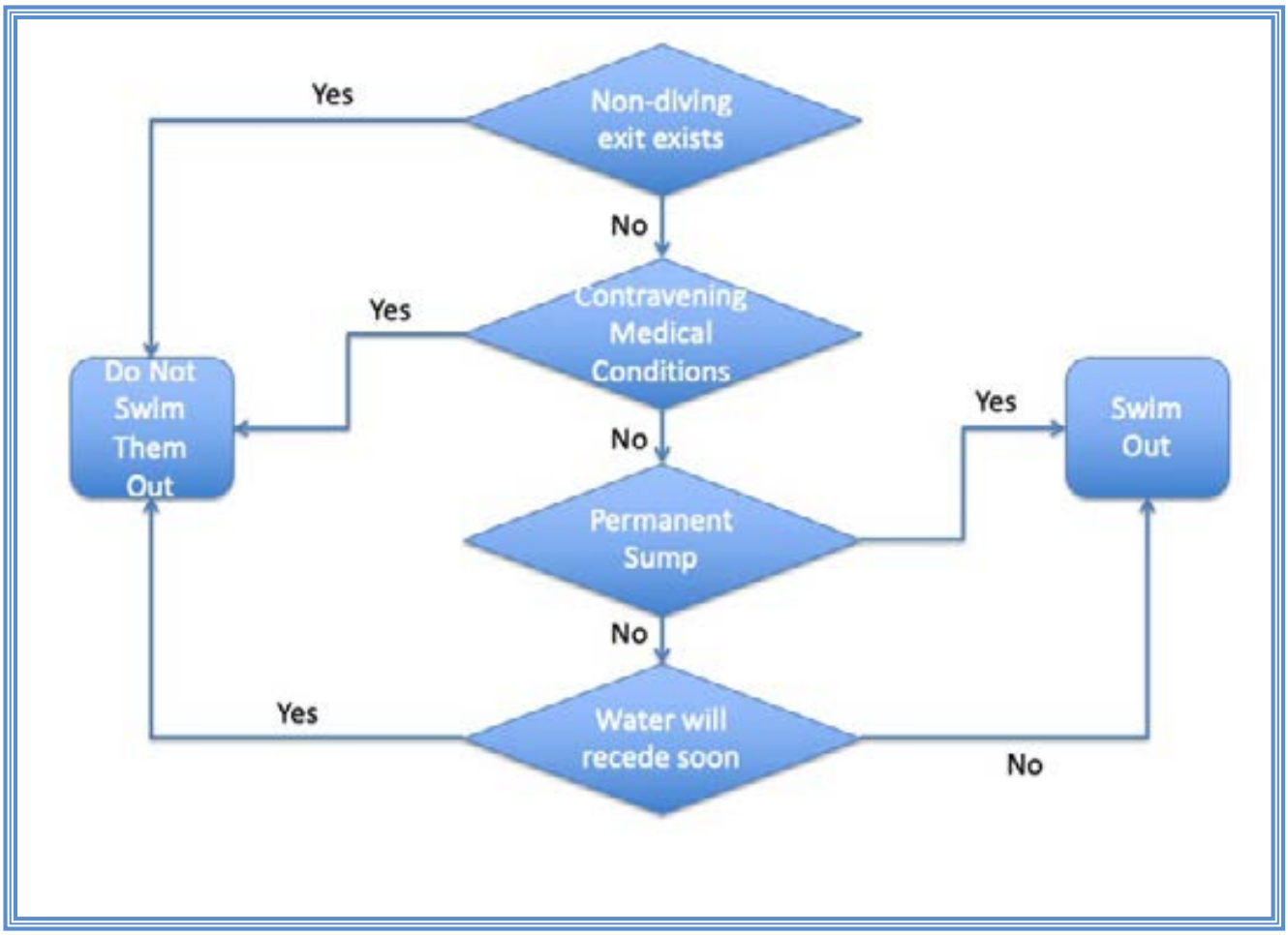

Figure 1: Exit Method Decision Tree

You're likely showing up after a patient has been trapped for some time. Someone who had an immediately life-threatening problem would likely already be dead. Still, any serious injury may preclude a lengthy dive out through a sump. A thorough assessment of the injured person's medical and psychological condition is critically important. We'll go over the basic steps.

Patient evaluation

When you locate the patient in an air chamber, first check the air quality. The first priority is always personal safety and assessing the incident scene for hazards. Only then should you turn your attention to the patient.

First a little more about scene safety. You've already started this by checking for bad air and becoming confident that the patient won't jump you. Watch out for the possibility of rock fall. Is the water rising? Make doubly sure to secure your own equipment so that you don't get trapped here as well.

You'll also want to make sure the patient feels safe about you. Get permission before you start poking and prodding. It's also never too early to start on psychological first aid.

Primary survey

Use the mnemonic "DR-ABCDE". Check the patient for a response, then check the ABCs: airway, breathing, and circulation. Treat any problems as you find them. If the chamber is running out of oxygen and accumulating CO_2, consider starting the patient on a regulator (and mask).

"D" is for debilitating injury: Is there a neurological or musculoskeletal injury keeping the patient in the cave?

"E" refers to "expose" or "exposure." This is one area that differs considerably from surface medicine. On the surface, one would usually expose any injuries for proper examination. If your patient is wearing a wetsuit or a drysuit, this is going to be a problem.

Cutting the suit open may make your job even harder. In addition to any other issues, your patient likely already has significant hypothermia. He or she may need to go back in the water to exit the cave. Even if you could get the suit off, are you sure you could get it back on? Could you do your evaluation through and under the suit instead? Unless you suspect uncontrolled bleeding, lean towards leaving the suit on. Monitor the patient's temperature early and aggressively.

Secondary survey

Suited or not, you'll need to perform a head-to-toe examination focusing on finding issues that will affect your exit plan. The most common dry caver injuries are extremity sprains and fractures. Operating dive gear without the use of the thumb or with a bad wrist can be a challenge. The same goes for kicking with an injured ankle.

Check for circulation, sensation, and motion in the hands and feet. The presence of pulses, extremity warmth, and normal skin color indicates adequate blood flow. Can the person feel your touch? Is there normal range of motion? These are good indicators of the patient's ability to travel.

The baseline level of consciousness is important to describe, as are any changes you note. Use the acronym "AVPU" —alertness, response to voice, response to pain, or unresponsive.
Check and record the vital signs, including pulse and respiration rates, blood pressure, pupillary size and responsiveness, and temperature. Most dive computers do not measure seconds, so it may be difficult to count an accurate rate.

It's difficult to palpate a pulse through a drysuit seal—and the radial artery is below the base of the thumb. Work around the seal or lift it back slightly. © Grace Hubbard.

The wrist and neck seals also may impede your ability to palpate the pulse. If you can feel a peripheral pulse (wrist or ankle) it suggests that the systolic pressure is at least 80 mm. The presence of a central neck or femoral pulse suggests at least 60 mm. No one expects you to take an exact blood pressure past a sump.

Is the heart rate roughly normal (70-90 beats per minute), rapid (greater than 100 bpm), or noticeably slow (less than 60 bpm)? We are interested only in extremes, not the exact rate.

Are respirations within normal range (12-18 per minute)? Is the effort normal or labored?

Assume that the patient is cold and will get colder. Take measures immediately to keep the person warm!

Write down your findings in your wet notes so you can monitor trends and report your findings to the surface medical team.

Medical history

Lastly, use the SAMPLE acronym to guide taking the medical history. What *symptoms* does the patient describe, and what signs do you observe? Is there a history of *allergies* to medications? What *medications* does the person take, and is s/he behind on the dosage? Is there a significant *past history* of disease,

such as diabetes? When was the person's *last* intake (food and drink) and output (urine and feces)? What *events* led up to any injuries and becoming trapped?

Decisions and judgment calls

With the evaluation in hand, you now have some decisions to make. There are many ways to get a person past a sump, the mechanics of which would each make for a good article. Your decision is whether to do a hasty rescue, stay in place to evaluate and stabilize the patient further, or to swim back and provide your data to the chain of command. A helpful decision tree is illustrated in Figure 1.

This decision tree does not cover the decision whether to do a hasty swim out or to return to the incident command team to plan a more deliberate approach. If the patient would be dead before help arrives, and if you think you could make the hasty rescue attempt with acceptably low risk to yourself, then the decision is clear. If you survive the attempt and the patient doesn't, then the result is no worse than if you hadn't made the attempt. Deciding your patient's odds of survival and your own risk level are not simple tasks, especially under time pressure.

If you don't need to conduct a hasty rescue, your evaluation is one part of the equation. The command team will look at three principal variables - the patient, equipment, and passage. The patient variable is affected by your evaluation and the patient's experience level and mental state. The available equipment and its condition may open up non-diving options or severely restrict you. Length, temperature, visibility, restrictions, alternate paths, impending weather, current, depth, and other variables affect the passage issue.

The determining factor

Armed with a proper patient evaluation, you and the incident command team are much better placed to make a good decision. By knowing if your patient is fully mobile, needs a little help, or needs intervention by medical professionals, you have the starting point for a plan. You enabled this with a thorough examination instead of focusing only on the most obvious issue(s). In the case of the Riesending cave rescue, the team's confidence in the patient's medical condition enabled them to rig for speedy movement as opposed to an excessively gentle and slow approach.

Even if you're not an experienced trauma physician, your ability to evaluate a patient can have a huge beneficial impact.

Mnemonics for Patient Evaluation

PRIMARY SURVEY: *DR ABCDE*

D	Danger
R	Response– See AVPU
A	Airway
B	Breathing
C	Circulation and hemorrhage control
D	Debilitating injury
E	Expose/exposure + hypothermia

RESPONSE ASSESSMENT: *AVPU*

A	Alert
V	Responds to voice
P	Responds to pain
U	Unresponsive

HISTORY TAKING: *SAMPLE*

S	Symptoms
A	Allergies
M	Medications
P	Past medical history
L	Last ate; last urine/feces
E	Events leading to situation

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