Oxford University Cave Club Expedition Rescue Guide

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A brief guide to carrying out a rescue on expedition.

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Part I
Introduction

The booklet was written with the main aim of teaching members of Oxford University Cave Club techniques that may be useful in the event of a rescue, particularly on expedition in Spain. I have now made it publically available in the hope that others will find it useful. I accept no responsibility for any injury resulting from the use of techniques discussed here. I would, however, welcome comments upon the booklet.

You should read this booklet and familiarize yourself with the contents before you need to perform a rescue.

On most expeditions there are a couple of incidents that lead to some sort of rescue operation getting underway. Nearly always these are caused by groups just being slow and missing their call-out times. While these false alarms are annoying, they do provide useful practice in case there is ever a real rescue.

In the event of a serious injury, the Spanish cave rescue organization should be called upon to help. However, there will be a considerable delay before they arrive: it is your responsibility to do as much as you can in this time.

It is most important in a rescue that the rescuers do not neglect their own safety: having one injured caver is unfortunate; having a rescuer injured as well is a nightmare.

There are three main parts to the booklet. This first section makes a few general points about rescues, about how to avoid rescues, and equipment you should carry with you for use in an emergency. The second part describes the procedure to be taken in the event of a rescue. The third section describes techniques that may be useful in a rescue.

1 How to avoid being rescued

Caving in Spain is more dangerous than in Britain for a number of reasons:

- A lot of the rock is somewhat chossy and friable so beware of holds breaking on you: this has been the cause of the two most serious accidents we have had in recent years.
- The caves are longer and harder; as well as making it more likely for you to have an accident, this means that a rescue will be a lot harder.
- The caves are less well travelled than in Britain, so there is often a lot of loose rock about, especially at the top of pitches. If it is safe to do so, garden this rock, but not if there are cavers or ropes below you; the best time to do this is during the initial exploration.
- Some of the rigging may be a little dodgy, because it has been done on a pushing trip. Moral: take time to make the rigging safe.
- You don't have the benefit of good weather forecasts, so you don't know that "the worst storm in living memory" is due to arrive just after you go underground. Moral: try to rig pitches so that they'll still be passable under much heavier water conditions (this isn't always possible).

Therefore

CAVE CAREFULLY.

Do not go caving if you are ill or particularly knackered. Take a day off to recuperate. Also, don't be scared to turn back early if you don't feel up to a trip.

2 Precautions

Before going caving, write a call out time in the back of the log book. Be realistic about the time you set: allow yourself enough time to achieve the goals of the trip, with a bit spare to allow for minor cock-ups; but don't set the call out time too late—if there is a problem, you will want to be rescued earlier rather than later.

Make sure that your gear is in decent knick, particularly your lights. If you have any trouble with your gear, make sure you sort it out before your next trip.

When going caving you should take with you:

- A first aid kit: these should be available on the gear order;
- A balaclava: this will help keep you warm while surveying if nothing else;
- A survival bag—not a space blanket as these don't work as well: Ben Lyon sells good ones that fit safely inside a helmet;
- A candle: when lit inside a bivvy bag, this will keep you very warm; see section 14;
- A spare battery for your light, and spare carbide if you use carbide;
- A spare light (e.g. a Petzl Tikka);
- A knife: there have been several fatalities that might have been prevented by somebody cutting a rope at the critical time; they're also useful for cutting your hair/beard when it gets caught in your descender;
- A pulley—essential if you do have to carry out a rescue, and also useful for tackle hauling.

When walking in the mountains you should carry the same stuff, and also a compass and possibly a map (the Adrados maps are best) and GPS; also take plenty of water, because dehydration is nasty.

Don't go shaft bashing on your own: if you have an accident, nobody will know where to find you.

If you discover some new cave passage, and the route to the new stuff is not obvious, then create some way markers: either build cairns, or leave something like a tacklebag at the start. This will help rescuers to find you if you do have an accident. It will also help other explorers to find the way to the sharp end!

3 Incidents

There are various sorts of incidents that may need some sort of rescue action.

- A caver being injured;

- A caver becoming stuck;
- A caver becoming unable to exit the cave because of either knackeredness or illness;
- A group of cavers getting lost in the cave;
- A group of cavers getting lost on the mountain;
- Total light failure;
- Cavers becoming trapped by floods;
- A group of cavers being slow and missing their call out time.

Statistically the most common cause for a rescue is the last. Fortunately actual injuries are very rare.

4 Responsibilities and personnel

OUCC tends to be a fairly anarchic bunch, not much into "leaders" and "chains of command". However, in a rescue it is important to be well organized. People should be appointed to the following positions:

Runner. Responsibilities: to go down the cave as quickly as possible *while not compromising their own safety*, to contact the overdue team, to find out what is wrong, to give as much help as possible, and to guide other rescuers to them.

Surface controller. Responsibilities: to keep track of who, and what equipment, has gone underground; to arrange for more equipment to be ready and to go underground as necessary; to liaise with other rescue authorities; to arrange rota systems if necessary; to arrange for plenty of food to be ready for rescuers emerging; to arrange for evacuation of injured cavers once they reach the surface.

Underground controller. Responsibilities: to be in overall control of evacuating the rescuees; to ensure adequate communications with the surface; to appoint people to work out how to pass each obstacle, planning ahead; to arrange for each obstacle to be derigged and for the equipment to be carried forward; to ensure tired rescuers take a break before they become too knackered and make a mistake.

Patient monitor. This person should ideally be a doctor, and certainly somebody cheerful and talkative. Responsibilities: to monitor the condition of the patient, and to watch out for any deterioration; to keep them cheerful and informed of what's happening.

Stretcher controller ("Head"). This person should be in charge of the movement of the stretcher, and give instructions to the other rescuers. They should normally be very close to the patient's head, with their hands on the front handles, so as to keep the stretcher steady, and to protect the patient from falling rocks. The job of stretcher controller will swap around very frequently, but each controller is responsible for ensuring that the next is in position before relinquishing control.

Obstacle controller. This person should be appointed by the underground controller to work out how to pass a specific obstacle. They should rig haul lines and lifelines if needed; they should also rig independent safety lines for the rescuers, if needed. If possible, they should hammer off any projections that are likely to get in the way.

Try to keep good spirits up within the rescue team. If possible, swap round so that nobody gets too tired. Stop for an occassional rest and brew.

Don't shout at each other, and avoid getting irritated. Be patient while others are rigging, and don't harangue them; if possible, give them a hand.

Remain quiet while others are trying to communicate.

Any rescue will be a long affair, so pace yourself.

Part II
Rescue procedure

There are various ways in which you will realise that some action is needed:

- a member of your party is injured: goto section 9;
- a group's call out time is reached: goto section 5;
- somebody arrives at camp with news of an injury: goto section 6;
- somebody arrives at camp with details of some other problem: goto section 8;
- lights are seen on the mountainside, but nobody arrives at camp: goto section 10.

5 Cavers overdue

If a group is overdue then you should aim to start rescue procedures as soon as the call out time is reached. A rough scheme for what to do is shown in Figure 1, and explained more below. Of course, the number of people in each wave might vary, depending upon who is available.

People	Gear	Responsibilities
Runner (1)	Rescue runner	Locate rescuees; give immediate support; send word to surface.
Second wave (3)	Gear to prevent deterioration (section 7.2) and some hauling gear (section 7.4)	Prevent deterioration of patients' condition; start extraction if possible.
Third wave (3)	Stretcher, spine splint, hauling gear (section 7.4)	Start extracting patients.
Fourth wave	More hauling gear, food, carbide	Continue extraction.

Figure 1: Scheme for cavers overdue

A group of about four cavers, ideally including a doctor, should go to the cave immediately. If it is dark they should leave a light at the entrance to guide other rescuers. Check whether the overdue cavers' rucksacks are still at the entrance: if not they are probably lost on the mountain (see section 10). Take a radio so as to communicate with camp.

One caver, the runner, should head down the cave quickly, carrying just the rescue runner (see section 7.1). (Alternatively, you might prefer to send a pair). The runner's aims are:

- locating the party;
- sorting them out as far as possible with the available equipment;
- guiding other rescuers to the rescuees;
- reassuring them that help is on its way.

This person should cave quickly but carefully. If the runner comes to a junction and has to decide which way to go, then he should leave a note (paper and pencil in the rescue runner) telling the next wave where he has gone; if it later becomes obvious that he has chosen rightly or wrongly (e.g. by finding a pitch that is either rigged or unrigged), he should go back to that point and rewrite the note, telling the next wave the correct route to go.

If you have reason to believe route finding may be difficult then you should send out several runners, in pairs; if a pair finds the rescuees, then one should head out as soon as possible to guide others to them.

The others should follow behind carrying the equipment listed in section 7.2 and a bag of hauling gear (section 7.4). They should cave carefully and preserve their energy as far as possible, as it may be a long resue. Their main aim is to prevent the deterioration of the patient. Their secondary aim is to start getting the patients out of the cave, if they have sufficient personnel.

Another three cavers should follow about half an hour behind, carrying the equipment of section 7.3. Their aim is to start getting the patient out of the cave if they think they have sufficient personnel.

Further cavers should follow carrying the rest of the rescue gear after a further half hour, if necessary. Avoid taking too much gear underground, as it will only get in the way.

When the overdue cavers are found, one person should head out to let everyone else know what the situation is. If those underground are *sure* that they can sort out the situation, then the rest of the rescue can be stood down.

If there is an injury, goto section 6.

If a caver is too knackered or ill to get themselves out, then goto section 12.

Meanwhile, those left at camp should: prepare the rest of the rescue gear; radio base camp to tell them to stand by; cook lots of food. They should rest and await word from the cave.

6 Word of injury reaches camp

This section describes what to do if word of an injury to a caver reaches camp. A rough scheme for what to do is in Figure 2. Of course, this scheme will vary depending on the circumstances: there's no point taking the stretcher for a broken arm, as they'll be able to walk out with some help; equally, there's no point taking the stretcher if you only have two potential stretcher bearers (you need at least six).

You need to decide at some point whether you are going to try to get the casualty out as soon as possible, or whether you are going to hospitalise and wait for reinforcements. But be prepared to

People	Gear	Responsibilities
First wave (3)	Rescue runner, first aid kits, gear to prevent deterioration (section 7.2)	Locate injured cavers; give immediate support; prevent deterioration of patients' condition; send word to surface.
Second wave (3)	Stretcher, spine splint, hauling gear (section 7.3)	Start extraction if possible.
Third wave (3)	More hauling gear (section 7.3)	Start extracting patients.
Fourth wave	More hauling gear, food, carbide	Continue extraction.

Figure 2: Scheme for injured cavers

change your plan, depending on circumstances; even if you expect not to hospitalise, it's worth carrying the gear to the entrance, and possibly underground, in case it is needed.

A group of about three cavers, ideally including a doctor, should go to the cave immediately. If it is dark they should leave a light at the entrance to guide other rescuers.

They should head down the cave quickly, carrying:

- the rescue runner (see section 7.1);
- the gear to prevent the patients' condition from deteriorating (section 7.2);
- if the injury seems minor, maybe a bag of hauling gear so as to start helping the casualty out.

Their aim is to:

- locate the party;
- reassure them that help is on its way;
- give as much first aid as possible (see section 13);
- prevent the deterioration of the patients.

Three more cavers should follow carrying the stretcher and spine splint (if appropriate), and a bag of hauling gear (sections 7.3 and 7.4) if there is *any* chance of it being needed.

More cavers should follow with more hauling gear (7.4), food and carbide. Avoid taking too much gear underground, as it will only get in the way.

Meanwhile, the Spanish rescue authorities should be alerted unless you are *sure* that you can cope with the problem yourselves. Ask to use the refugio radio if necessary. Failing this, radio to base and get them to alert the rescue services. Go to the Guardia Civil (local police) and ask for *espeleosocorro*. Alternatively, you can contact local cavers via Juan José; his number is Oviedo (85) 211790. The rescue services will need to know:

- Name and location of the cave;
- Depth of the accident;
- Time of the accident;
- Condition of the patient.

However, there will probably be a delay of about 12 hours before they reach the cave. Do as much as you can in this time.

If there are any other cavers in the area, alert them as well.

Most people at base should walk up the hill, carrying more rope, rigging gear, and food, as needed. One person, ideally a Spanish speaker, should stay behind to liaise with the Spanish.

If rescue in a stretcher is necessary, goto section 15.

If the caver is able to get themselves out, with help from the others, then goto section 12.

As soon as possible, word should be sent to the surface, giving instructions to those there.

Those left at camp should cook lots of food, and rest: you should save your energy as you will probably be needed later. If possible start organizing a rota system if it looks like being a long rescue, and carry food and some bivvy gear to the cave entrance.

7 Rescue kit

This section lists some of the gear that may be useful in the event of a rescue. This equipment should always be at camp in case it is needed. If you are reading this at camp, then check that it is.

In particular, a bolt kit should remain *permanently* with the rescue kit, and a second bolt kit should be quickly available (it can be taken shaft bashing, but should be returned to camp each evening).

7.1 The rescue runner

The following gear should be carried by the first rescuer down the cave. It should be packed in a prussik bag in advance, ready for immediate action.

- first aid kit containing plenty of bandages and temgesic;
- 2 Sam Splints;
- 2 survival bags;
- a storm shelter;
- spare batteries and bulbs;
- food;
- candles and lighter—good for making heat;
- waterproof paper and pencil, for writing messages;
- gaffer tape, for general fixing.

7.2 Equipment to prevent deterioration of the patient

The following equipment is designed to prevent deterioration of injured cavers; it should be carried in by the first wave of rescuers:

- underground first aid kits;
- sleeping bag, thermarest (or similar), bivvy bag;
- a storm shelter, if not already taken;
- stove, brew kit and food;
- hot water bottle.

7.3 Equipment to start evacuation of the patient

The following equipment is designed to start getting the patients out of the cave:

- spine splint;
- the stretcher;
- a bag of hauling gear (see below).

All this equipment should be carried in by the second wave of rescuers.

7.4 Hauling gear

Two or three tackle bags should each be packed with the following, for rigging past particular obstacles, including short pitches:

- a 25m haul line;
- a 25m life line;
- two 20m safety lines for rescuers to clip into;
- a bolt kit, with lots of spits;
- plenty of tapes, wires, hangers, maillons, krabs, pulleys.

Additional longer ropes should be packed for longer pitches, as appropriate. Also, a drill should be carried down if available.

7.5 Other rescue gear

Plenty of food and lighting will be needed on a long rescue.
The following gear may be needed in particular situations:

- Crow bars, hammers, chisels, etc., for widening squeezes, digging open constricted crawls, or digging open collapsed chokes;
- To free a stuck caver: hammers, chisels, washing up liquid (as a lubricant), large knife (to cut them out of their equipment).

8 Other problems

This is most likely to be either somebody too knackered or ill to get themselves out of the cave: see section 12.

Stuck cavers can probably be extricate using hammers and chisels, or washing up liquid as a lubricant. You may need to cut them out of their caving gear, so take down some large knives (but be careful you don't injure them in the process).

If cavers are flooded in, then it's probably best to leave them: sending more rescuers down may lead to the rescuers also being trapped. After the big storm of 1988, the 2/7 streamway started to drop after less than 24 hours. Leave the cavers a dump of food, batteries, dry clothes and a stove, somewhere where they will see it, but where it won't get washed away. When you think the water is dropping again, send a team down to make sure they are alright, and to give moral support.

It should be obvious how to deal with most other problems (e.g. light failures).

9 What to do if a member of your party is injured

Work out how they got injured, and *avoid getting yourself injured in the same way.* If they are in immediate danger, and you can do so without risk to yourself, then move them away from the danger, but be careful of their *back* (see section 13).

See Section 11 for techniques for rescuing an unconcious caver from a rope.

Give as much first aid as possible (see section 13).

If the injury is minor, and you are *sure* you can cope, get them out of the cave.

For more major injuries you should prevent their condition from deteriorating while sending somebody out to get help. If you are near a campsite get them to the camp—or bring the camp to them—and keep them warm. Failing this, put them into a survival bag (which you should have with you) and insulate them from the ground—get them to sit on a rope, a kit bag, or you. See section 14.

If you only have two people in the group you have to decide whether to stay with the patient or go for help. This is why you should always have at least three in a team. Your decision should be based upon how soon you would expect the rest of the expedition to come and rescue you (how soon is your call out time), and how much the patient's condition is likely to deteriorate if you leave them. If in doubt, stay with the patient. Do not leave a patient with reduced consciousness. You should also never leave a patient who you believe to be dying.

10 Cavers lost in the mountains

There's not really a lot you can do about this. Walk along the route they should be taking, blowing whistles. But don't get lost yourself. It's a good idea for the rescuers to carry sleeping bags and bivvy bags in case they do get lost, as well as a compass and GPS. If you have no luck, then leave them: they'll have a miserable night, but they'll survive.

Morals:

- Don't get lost in the mountains: always carry a compass, and know the bearings back from the caves; also carry a GPS if possible;

- If you are going to get lost, carry a bivvy bag with you;
- If you do get hopelessly lost, find a sheltered spot, huddle up together, and wait for morning; avoid sheltering in the mouth of a cave in an electrical storm; see section 14;
- Don't just follow old lags blindly: learn the mountains *early* in expedition; this will help you when shaft-bashing, as well.

If a team hasn't returned within a few hours of sun rise, then inform ICONA, and start a more full-scale, systematic search. Don't overlook the possibility that they may have found their way down to base camp.

Part III
Rescue techniques

In this part I'll describe a few techniques that may be useful in the event of a rescue. Familiarize yourself with these techniques before you actually need to use them.

11 Rescuing an unconcious caver from a rope

If a caver is unconcious and hanging on a rope then you have about ten minutes to get them down; otherwise, the build up of toxins in their body will kill them.

There are two techniques for rescuing a caver in this condition. You should practice both before you need to use them.[1]

If you have rebelays to pass, untie them on the way up. Even when the rebelays are protecting the rope at hideous abrasion points, the rope will be fine without the rebelays for one rappel. It might end up a little fuzzy but it probably won't break. If the rebelays are moving you away from a waterfall or something, turn the rebelay into a deviation.

Brute force method Not everyone can do this. It's not a question of skill, it's physics. If you have good upper body strength and are very proficent on rope, you may be able to pickoff someone who weighs 40% more than you do. On a good day, when you're fresh. That figure is a rough estimate based on observations of people doing it. Try it yourself and see where your limits are.

1. Climb to unconcious caver, remove his feet from footloops;
2. Clip a safety line between your seat harness and patient's;
3. Detach patient from all except weighted point of attachment;
4. Climb above patient;
5. Climb a bit further and take patient's weight onto your main attachment point;
6. Remove patient's last ascender;

[1] The descriptions of these techniques are due to Rebecca Jones.

7. Change over to rappel; this may be physically impossible;
8. Rappel safely to the ground.

Step 7 is what gets people. Perfect changeover technique helps, a poorly fitting seat harness may doom you to failure.

Counter balance pick-off This technique allows you to lift somebody much heavier than yourself. You need one carabiner in addition to your normal SRT kit. The key to this is to keep things neat. Avoid wrapping lines around each other: the friction will destroy the advantage of the counterbalance and complicate things immensely.

1. Climb to patient, remove his feet from footloop;
2. Clip safety line between your seat harness and patient's;
3. Detach patient from all except weighted point of attachment;
4. Climb above patient;
5. Clip a carabiner through your upper ascender;
6. Run your long cowstail through the carabiner and back to patient's seat harness on the closed side of his Croll;
7. Climb with small steps until the knot at the near end of the cowstail touches the carabiner;
8. Stand up on your footloop, disconnect your croll, sit down on the cowstail;
9. Pull patient up to the carabiner on your upper ascender; if the patient is much heavier than you, put your knees under him, pull up on his seat harness and rock backwards, pushing up against him;
10. Rig in the patient's descender; lock it off; remove patient's last ascender;
11. Stand up on your foot loop and lower patient onto his descender;
12. Derig the long cowstail from the carabiner;
13. Clip in to the patient, as close as possible to the patient's descender;
14. Unlock the descender; remove your ascender; abseil safely to the ground.

This pick-off uses the patient's descender; if you are not comfortable using his to control a two person load, prepare to put your descender on his harness.

One perk of this method is that you are under the patient and can better control the descent. Rather than just plunking the patient dirrectly at the base of the drop and then climbing off of him, you land first and can manouver him to a good place.

12 Dealing with knackered or ill cavers

If this is the case, give the caver as much help as possible. Maybe some food and encouragement will be enough (a Carbide Assist: light a flame under their butt, and out they go).

You can help them by rigging a combined hand line–life line on climbs: belay a rope to something solid at the top of the climb, passed through a krab on the patient's harness, and then back up to somebody at the top of the climb; the person at the top can lifeline and help pull the patient (with a 2:1 advantage); the patient can use the other length of rope as a handline.

If necessary patients can be hauled through vertical squeezes in a harness. On large pitches, tandeming will help to give moral support, and means that somebody is on hand to help with change-overs. See section 16 for details of dealing with particular obstacles that are to be found in our caves. Consider setting up a temporary camp site to let them get some rest, and try again when they are feeling stronger.

13 First aid

This booklet does not aim to deal comprehensively with first aid. You should familiarise yourself with the first aid manuals from the bibliography.

The following information is based on an article by Tom Houghton in Proc. 12, and an article on the Cavers' Digest.

Do the following in sequence:

1. **Don't panic**. Be methodical. Don't be rushed into hasty action. Keep your reason. Don't put yourself in danger.

2. **Get the patient out of immediate danger**: loose rocks, for instance, or cold water. Mind yourself; be careful.

3. **Consciousness.** Is the patient able to talk? If so, ask them if they can feel and move their limbs. *If not, ensure an airway.*

4. **Airway.** *Pull the jaw forwards, and keep it there.* This stops the tongue lolling back into the windpipe. The ideal position is 'sniffing the spring air'—head forwards and chin up. An unconscious patient will die rapidly without an open airway. If they puke or look as if they might, roll them on their side and let the vomit come out—but see **spine**. If there is any muck or whatever blocking their airway, *get it out.*

5. **Breathing.** If the patient is not breathing, then give them two breathes of air—head in the 'morning air' position, pinch the nose, seal your lips over theirs and exhale firmly. The time to learn how to do this is when you don't have to.

6. **Circulation**. Check for signs of life, that give evidence that their heart is beating. Are they pink or grey? There is not much point in checking for a pulse: tests have revealed that even trained doctors get this wrong, for example by thinking that they can detect a pulse on a corpse.

   If their heart is not beating, the patient needs chest compression ('cardiac massage'). By this stage you are probably on a hiding to nothing, but you might just be able to get them going again.

Technique: this has recently changed slightly, as a result of research. Get the patient onto a firm flat surface on their back. Press over the lower third of the sternum (lower edge of your hand 2 fingerbreadths up from the bottom of the sternum). Keeping your arms straight and using the weight of your upper body, lean with the heels of your hands on the middle of the breastbone, giving relatively short pushes. Say 'one thousand', release saying 'one', do it again. Don't do it too quickly. Give them fifteen squeezes and then two breaths of air. If there is someone else with you, then each of you should take stints while the other rests: don't try to work simultaneously, as it won't work.

Continue for twenty minutes if it is safe to do so. However, there is little point continuing for longer than that. Exceptions include drowning, hypothermia or certain poisons (e.g. from jellyfish), where casualties have been resuscitated after surpisingly long periods.

7. **Injuries.** Do a rapid all-over search for life-threatening injuries. Run your hands over their body, looking for signs of bleeding or other injuries. Talk to the patient.

8. **Bleeding.** If they are obviously bleeding, *press on it* with your hand or a pad (i.e. a firm wodge of anything reasonably clean) for five or ten minutes without peeping to see if it's stopped. If it doesn't stop, keep pressing. If there are avulsions (flaps of skin and tissue) fold them back in approximate place and bind in place. If the wound bleeds more, then put more stuff on top of it. Do not remove old dressings before you put on the new ones. This will just cause bleeding to start again. Try to put sterile material on the wound (hah!). Don't try to clean out dirt or mud unless you know exactly what you are doing. *Always* recheck distals after doing anything significant.

9. **Shock.** *Shock is a serious risk.* Put a storm shelter over him, but don't move him more yet. If he doesn't have leg injuries, then gently raise their legs.

10. **Make preparations to take the patient out.** Unless the injury is obviously trivial, all accident patients should be brought to the surface as quickly as possible. Beware those who have been hit on the head but look 'all right now'. They could be bleeding inside the skull and unconscious or dying in a couple of hours. *Get them out.*

11. **Secondary survey.** Using your hands and a light, examine every part of the patient's body looking for any signs of injuries.

    Start at the head and work down to the toes. Talk to the patient. All along the exam make sure he can feel your hands.

    - Run you hands over his head, looking for bumps or bleeding.
    - Check whether his eyes look ok and his pupils dilate when you shine a light in them.
    - Check his ears; note in particular any liquid in his ears, which could be a sign of the brain being compressed.
    - Check all the way down his spine (or as much as you can); see **spine**, below.
    - Check his shoulders and arms.
    - See if he can grip you hands firmly and equally.
    - Press gently on his chest as he breathes in and out.
    - Then repeat on his abdomen (looking for signs of internal injuries).
    - Check whether his pelvis flexes when you press on it.

- Check all the way down his legs.
- See if he can push up and down with his feet.

You are looking for additional wounds, swellings, eccymosis (black marks from pooling blood), tenderness, etc. *Always do this survey. Write down the results.*

When you have worked out what is wrong, write down the results. You should have some waterproof paper in your first aid kit for this; alternatively use a page from a survey book. Write down the following: who it is, what happened, when, location, observed injuries. Give it to whoever is going for help.

12. **Spine** *Don't move the patient till you've felt their back, or if they are paralysed or lack sensation anywhere.* The exception to this is if you need to move them to get away from immediate danger, or to check airway, breathing, circulation — those always take priority.

    Feel all the way down the spine. You will feel a row of regular bumps; if there is a gap or a step, or if the patient has pain on one spot on pressing, they have a back injury. If in doubt, play safe and treat as one.

    If there is any possibility of a neck injury, put them in a neck splint. This can be improvised out of a doubled piece of karrimat and a belay belt.

    Log roll: With three people, move the patient as a unit without bending or twisting, like a log. Don't forget the head: don't turn, drop or bend it, but keep it part of the log—they might have a neck injury, especially if they've had a blow to the head. In this fashion, get the patient out of harm's way onto a flat, firm, horizontal surface. Don't move them again until you've got them onto a stretcher, or similar.

13. **Pulse.** Compare the patient's pulse with your own. *Shock*—severe blood loss—the patient has a fast, thready, weak pulse; they are cold, clammy and sweaty. If you are in no doubt that the patient is like this, they need an intravenous line and lots of fluid—but you probably don't have these or the knowledge to use them safely. *Get them out.* Don't give them fluids by mouth: the guts stop working in shock, and so you're only giving them something to puke up.

    If you can't feel a pulse at the wrist—there is a muscle on each side of the neck running in a straight line from just below the ear to the inner end of the collarbone. If you put your fingers just in front of this muscle at its midpoint and press in *gently*, you will feel the cartoid pulse (try it on yourself).

    Record the pulse on a piece of waterproof paper.

14. **Breathing rate.** Record the breathing rate; try not to let him know you're checking it or he'll react.

15. **Visible symptoms.** Record whether his colour and skin temperature look normal. Record his level of conciousness on the AVPU scale: Alert; responds to Voice; responds to Pain; unresponsive.

16. **Chest.** If the patient has difficulty breathing, or pain on breathing, *ensure an airway* and look at the chest (open the clothing, look at both sides). If there is a wound on the chest, *put a pad on it* to stop air leaking in and letting the lungs down. Look at the movements; if one bit goes in while all the rest comes out, and vice versa, *put a big pad on that bit* to hold it in—that is a 'flail segment', a bit of chest wall that has come out and is moving independently of the rest, and while it is free the patient can't breathe properly.

17. **Distals**. For an arm this is the radial pulse (thumb side of the inner wrist) and sensation on all fingers. For a leg this is the *dosalis pedis* (between and above the big toe and first toe) as well as sensation in all toes. Always make sure you can find these before you start treating a wound, dislocation, or break on that limb.

18. **Broken bones.** The rule here is to immobilize the joint above and below the break. This is done by binding the limb to the body or to rigid splints. Strap a broken leg to the sound one. Try not to move the broken part. If the break is severely angulated then you may have to reposition it before it can be splinted, but do this only if it is required for transport.

19. **Dislocations.** It is hard to tell the difference between dislocations and breaks. You need training and experience. Treat dislocations as breaks unless you have good reason to believe otherwise (patient tells you it has happened before?).

    To reduce (move the bone back to anatomical position) a patella (knee cap), pull on the ankle (with about 20lbs of force) while another person holds the patient and another holds the knee cap. Let the patella slide back into place *slowly* to avoid trapping nerves and blood vessels behind it when it locks back in place. It can take minutes for the bone to start moving back in place. Be patient. Recheck distals.

    Note: The patient screams and moans a lot during relocations. You must be the source of calm and reason during this time. If you are not up to the job then get someone who is.

    To reduce a shoulder have the patient lie face down with the arm over a ledge. Tie a 15lb rock to the wrist and wait for up to an hour. Recheck distals. Note that attempting to relocate a dislocation always runs the risk of causing an amputation to be required later.

20. **Heat.** *Exposure is a risk*, especially for immobile patients. Change wet gear for dry if someone else is wearing drier gear. Put into a survival bag (which you have in your helmet of course). Put into a sleeping bag if you've got one. Sugary food can be a good idea, but *be careful*; drowsy patients might puke and block their airway, and the injured might go into shock and do the same. See section 14. *Get them out.*

21. **Antibiotics.** It is worth starting an antibiotic regime after significant cave injuries.

22. **Painkillers.** Painkillers are a good idea if the patient is in pain. Pain can worsen effective fluid loss by causing fainting, and it makes the casualty more difficult to move, quite apart from any humanitarian considerations.

    On the other hand, powerful analgesics (the morphine-based ones such as Temgesic) depress respiration and make the patient more likely to suffocate. They shouldn't be given where there is reduced consciousness, and definitely not if there has been a head injury. A non-exhautive list would be: chest injuries, head injuries, abdominal injuries, cases of severe shock and hypothermia. In head injury you're looking for any depression of consciousness caused by intracranial bleeding, and if the punter's been knocked goofy by drugs this can be difficult to spot.

    Also, if the patient screams whenever you put pressure on their injuries, then you'll probably treat them more gently, so you shouldn't be aiming to prevent all pain.

23. **On the way out:** keep talking to them. Check and record pulse, breathing rate and visible symptoms when you can—if they weren't shocked before, they might become so.

14 Keeping warm

There's a lot you can do to keep either yourself or an injured caver warm. Ideally get them into dry clothing, into a sleeping bag, and insulate them from the ground. Sit them on a rope, a tackle bag, knee pads, or you. Put them inside a bivvy bag, under a survival blanket, or under a storm shelter; light a candle or carbide flame in with them: the heat given off by the flame is significant, and can be a life saver. Alternatively, put a carbide generator inside their furry suit.

Hot drinks for an injured caver are probably a bad idea on the whole. Patients with head injuries can spew them up and inhale them, and somebody who isn't drowsy now may be later. (Spew does horrible things to lungs.) Similarly with internal injuries; the patient's condition can change quickly. Also, any serious injury patient is likely to need to go to an operating theatre when they get out, and the stomach has to be empty for a general anaesthetic. Although stomachs normally empty in 4-6 hours, serious injury and stress can paralyse the normal peristalsis so a trauma patient can keep stuff swilling around in the stomach for ages. On the other hand, if you're sure there's been no serious injury, hot drinks help keep up core temperature and supply fluid and sugars, so if you're just extracting someone because their tin leg broke, then fine.

15 Rescuing a patient on a stretcher

15.1 Loading the stretcher

1. Put a cervical collar on the patient;
2. Put the patient into the spine splint;
3. Put a harness on the patient;
4. Put the patient into a sleeping bag allowing access to the harness; if that's not possible, at least put a bivvy bag over his legs, and a space blanket over him;
5. Anchor the patient to the stretcher, to prevent them sliding around.

Be very careful when moving the patient, especially if a spinal injury is suspected. See **spine** above.

15.2 Treatment of patient

The patient's morale is very important. Keep talking to them, reassuring them, and telling them what's happening. Appoint somebody—ideally a doctor, and certainly somebody cheerful and talkative—to be in charge of this. They should also monitor the patient's condition, recording signs (pulse, breathing, conciousness, temperature and appearance) looking out for any deterioration: even if you don't know how to interpret the symptoms, they might be useful to a doctor later.

Make sure that the patient's head is protected at all times.

If the patient vomits, roll the stretcher upside down to clear the airway. If they are unconcious, it may be a good idea to haul them in a horizontal position and upside down, so that if they vomit, they do not choke.

Other rescuers should also help to keep the patient happy. Refer to them by their name, not “the body”. When talking to them, say your name, so they know who they're talking to. Avoid stepping over them and dropping mud in their eyes.

15.3 Horizontal stretcher movement

Along horizontal passages there are various ways of moving the stretcher.

- Several carriers on each side of the stretcher holding the handles, possibly with shoulder straps so as to spread the weight; few of the passages in our caves are wide enough to do this.
- In reasonably wide passage with an uneven floor, carriers are situated along the passage, and the stretcher is passed along between them, from hand to hand.
- In narrow rift, carriers are situated along the passage, and the stretcher is passed along between them, either over their backs, or under their legs.
- One caver crawls on hands and knees, with the stretcher on his back; two others control the ends of the stretcher.
- In flat out crawls, the stretcher can be pulled through with a rope.

At all times somebody should be in charge of protecting the patient's head.

You will often find that several rescuers get stuck behind the stretcher. Allow them to get past as soon as possible.

15.4 Vertical stretcher movement

For hauling a stretcher up anything except for very short drops, you will need some sort of hauling system: to haul a stretcher smoothly without any mechanical advantage requires eight to twelve people, assuming they can all get into a useful position to haul; with a mechanical advantage, you can reduce this to two or three.

You should also have an independent life line to the patient.

Decide whether you are going to haul in a horizontal or vertical position. It is normally more comfortable for the patient to be horizontal; further, this will help to prevent shock; also, if there are leg or pelvic injuries, having the legs high will reduce pain. However, you might need to have the stretcher vertical to get through a tight pitch head. If the stretcher is horizontal, you will be able to haul higher before you reach the belay, which might make it easier to get the stretcher off the pitch head.

A rescuer should prussik up the pitch with the casualty, to prevent the stretcher swinging around too much, and to look after the casualty.

Pulley-jammer

A useful component of any hauling system is a pulley-jammer, which is illustrated in figure 3. Practice setting up a pulley-jammer before you need to use it; it is very hard to work out how to do this from first principles. Attach the jammer to the rope, upside-down. Then pass the rope through a pulley, below the jammer. Next, attach the pulley and jammer together using a krab. Finally anchor the pulley-jammer by passing a maillon through the krab.

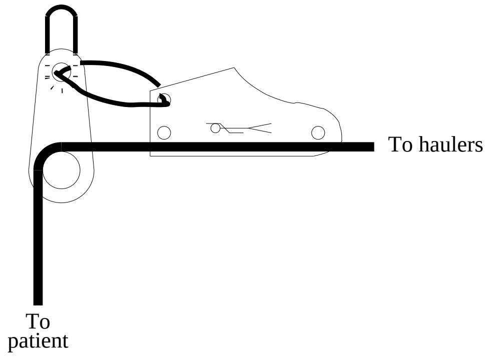

Figure 3: Pulley-jammer

Simple pulley system

You can achieve a 2:1 advantage very simply, using a pulley and a rope slightly longer than twice the pitch length:

1. Attach one end of the rope to a belay at or above the pitch head;
2. Pass it through a pulley attached to the stretcher;
3. Return it to the top of the pitch.

We can improve this basic system in two ways.

As described above, the haulers have to haul the rope vertically. This is difficult. Passing the rope through a pulley at the pitch head will allow them to haul horizontally. Better still is to use either a pulley-jammer, or a traxion (a self-jamming pulley): this will mean that if the hauling rope is released, the casualty will be held by the jammer; this is also nearly essential if this system is to be combined with a 2:1 mechanical advantage system (see below).

As described above, if either the belay for the end of the rope or the belay holding the pulley were to fail, the casualty would drop onto the lifeline. It is better to back up the belays in some way, either to one another, or (better) to another belay, above.

This is illustrated in Figure 4: a rope starts at bolt A; goes up to the back-up bolt at B; down to the main attachment bolt at C; down to a pulley attached to the stretcher at D; back up to a traxion at A; and then horizontally to the haulers.

A 2:1 mechanical advantage

One can obtain a 2:1 mechanical advantage on a haul line as follows, and illustrated in Figure 5:

- Attach a jammer to the haul line, so that it is able to slide towards the caualty;
- Attach a pulley to the bottom hole in the jammer;
- Attach a second rope (or use the tail of the first rope) to a belay further back up the passage (this belay does not need to be well placed);
- Run the second rope through the pulley on the jammer.

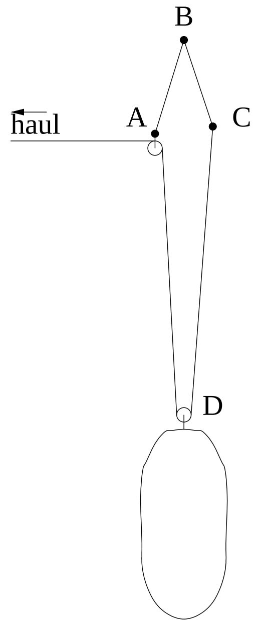

Figure 4: A simple 2:1 hauling system

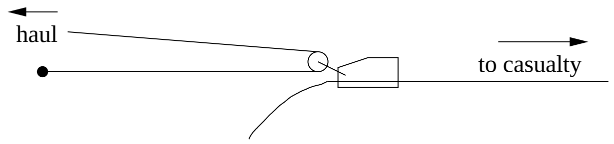

Figure 5: A 2:1 mechanical advantage

Pulling on the secondary rope will now give you a 2:1 advantage. You will need to reset the pulley occasionally: this is easiest if there is a pulley-jammer between you and the casualty: release the secondary rope until the weight is taken by the pulley-jammer (if you're not using a pulley-jammer, you need to hold onto the primary rope as you release the secondary rope); slide the jammer along the primary rope.

In practice, we have found that it is best to combine the simple pulley system with a 2:1 mechanical advantage to give a 4:1 mechanical advantage. About three people should then be adequate for hauling. An extra advantage of this set up is that the patient moves more slowly and smoothly.

Counterweight method

The counterweight hauling system is illustrated in figure 6. A rope is attached to the stretcher, and passed through a pulley at the top of the pitch. A rescuer, the *counterweight* then attempts to prussik up the other side of the rope. As he does so, the patient will be pulled up. If he is the same weight or lighter than the patient then he will find himself moving up the rope—pulling up on the rope attached to the patient will compensate for this. It is important to have a lifeline from above.

Alternatively, the counterweight can clip himself into something at the top of the pitch, and prussik on the haul rope from there. In this case, somebody else should climb up next to the patient.

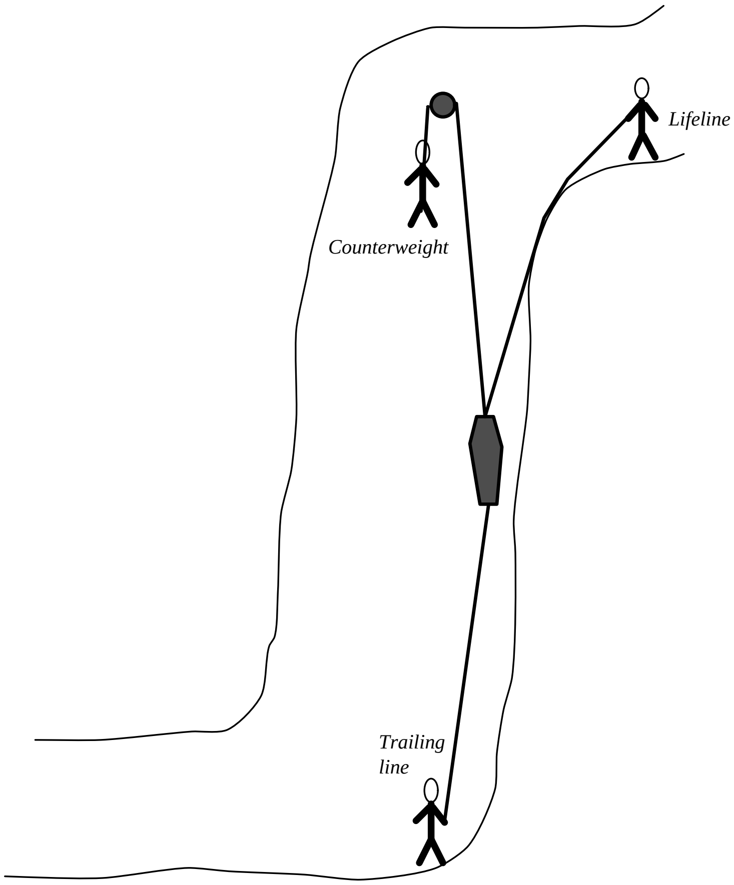

Figure 6: Counterweight hauling method

The pitch head

Plan how you are going to get the patient off the pitch head before starting to haul. Think about where the ropes will be when the stretcher reaches the top: will they be in the way?

It is a good idea to ensure all belays are high up, and the point of attachment to the stretcher is quite low down. Otherwise you will haul the stretcher to a point still some way below the pitch head.

On many pitches, it's easiest to haul the casualty vertically, but then to take them off the pitch head horizontally.

You will probably need a secondary hauling system for the pitch head. This might take a similar form to the primary haul rig, but be attached to belays further back from the pitch head. You need to work out how to transfer the weight from one to the other: this might be a case of gently slackening on the primary and taking in on the secondary; alternatively, you might want to clip the stretcher to the primary belay using, e.g., a cowstail, while you transfer over. Remove the primary haul system from the stretcher as soon as you can so that it does not get in the way.

Alternatively, you might be able to attach the casualty to a traverse line, and just pull them off horizontally. Again, you need to think about how you will transfer the weight.

Deviations

It can be useful to put deviations on the haul rope, for example, to avoid water. These can be difficult to release if the angle of deviation is large. One trick is to attach the deviation with a highwayman's hitch.

16 Local difficulties

In this section are a few ideas for dealing with particular problems that may be found in our caves.

As caves are extended, plans should be made to deal with any obstacles that are encountered. Where could a camp be established? How would you set up hauling systems? What parts would need to be widened?

Some of the caves round Top Camp are very cold, particularly near the surface, where there is a lot of snow and ice around. If an accident happens here, it will be very important to keep the patient warm. See section 14.

16.1 2/7: Pozu Jultayu

The biggest problem with a rescue from 2/7 will be the depth of the cave. It might be necessary to move the camp with the rescue, to allow rescuers to sleep between shifts.

Paradise rift

A diagram of a suggested way of hauling an injured caver is given in figure 7. It would be impossible to get a stretcher through here, so you would have to haul in a harness and backboard.

A bolt with a pulley should be placed at 'A' on the outside of the rift, overlooking Flying Rébellés, for use with a safety line. The main haul line should be attached at 'B', roughly above the widest part of the rift, slightly nearer the way out. If the patient feels able to climb the ladder, with help, he should be lined/hauled up it, to the squeeze into the rift. If he feels unable to climb the ladder, then it should be removed to get it out of the way. At the squeeze into the rift, somebody should be positioned to pull the patient in. He should then be hauled up the widest part of the rift, and manoeuvred through the squeeze just below 'B', using the ropes to lift his weight.

Seventh Heaven

Here it will probably be necessary to pull the patient through in a harness, again. Place two bolts directly above the squeeze.

17 Further reading

This document has, at best, scratched the surface of cave rescue techniques. The following publications give general information about cave rescues:

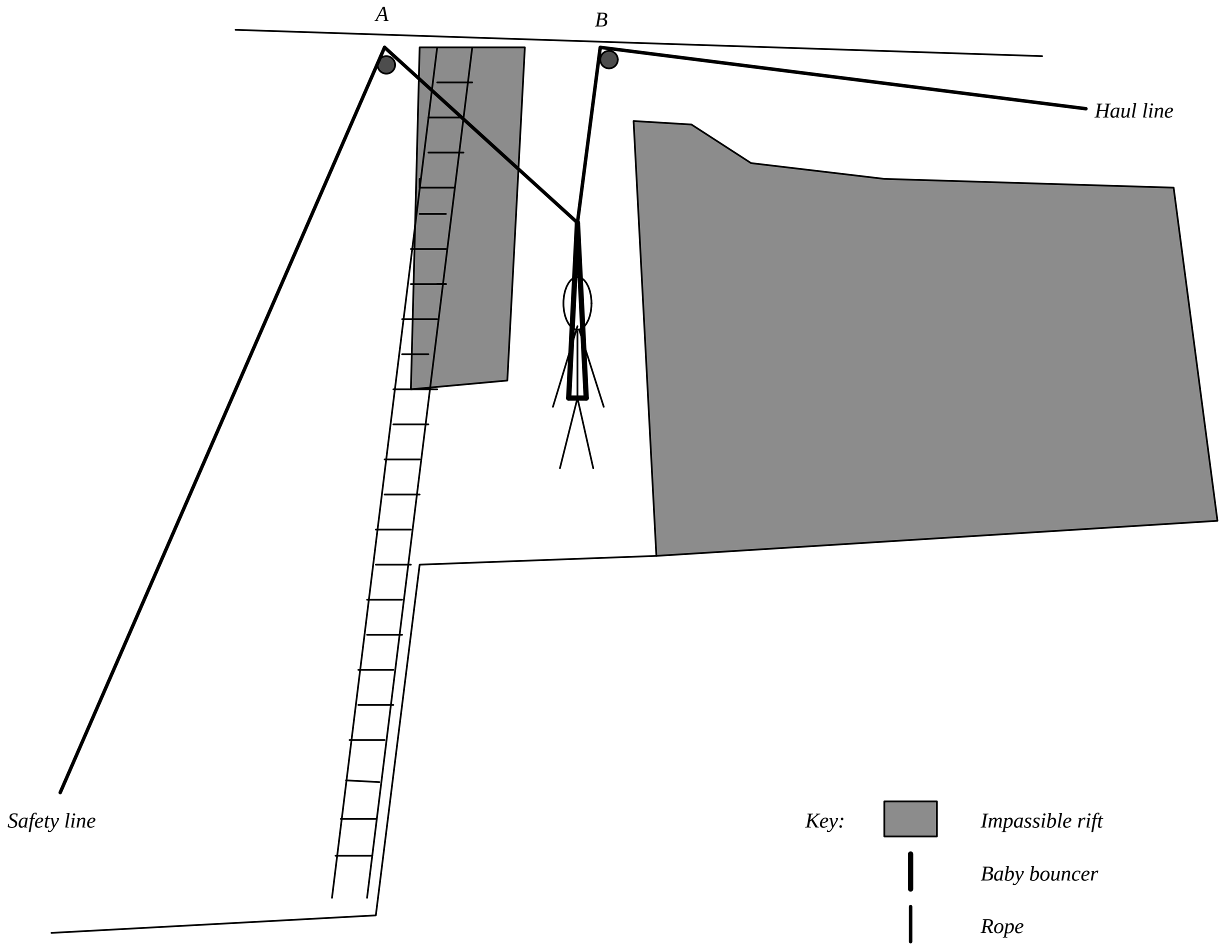

Figure 7: Paradise Rift

- David Judson (ed), *Caving Practice and Equipment*, especially chapter 17, "Accidents to Cavers", by Dr John Frankland.
- Jim Eyres and Dr John Frankland, *Race against Time.* The story of the Yorkshire CRO, hilarious, and very informative.
- Steve Hudson, *Manual of US Cave Rescue Techniques.* Needs to be taken with a pinch of salt.

The following give information about first aid:

- Joan's first aid notes: aimed particularly at this expedition.
- Dr Peter Glanville, *First Aid for Cavers.*
- James A. Wilkerson, *Medicine for Mountaineering and other Hazardous Activities.* Earlier editions are called *Medicine for Mountaineers.*
- St John's Ambulance, *First Aid.*

The following give information about vertical rescue techniques:

- Neil Montgomery, *Single Rope Techniques*, especially chapter 9, "Self Rescue from a Vertical Cave".
- Mike Meredith, *Vertical Caving*, especially chapter X, "Mini-rescue".