## CHAPTER 25

# ALPINE RESCUE

**Climbing instruction emphasizes strategies for preventing and mitigating accidents, but even the best-prepared climbers may eventually encounter a situation requiring first-aid and rescue skills. With outside assistance often hours or days away, a climbing party must be able to perform first aid, initiate small-party search and rescue (SAR) efforts, and work effectively with SAR authorities.**

This chapter introduces some techniques for small-party rescue from high-angle alpine terrain, search strategies, and guidelines for interacting with SAR agencies. In the event of an accident sustained by another party, climbers must prepare to forgo their planned climb. Instead, they should offer assistance and donate gear, time, and expertise to help.

## LEARNING RESCUE TECHNIQUES

First aid and alpine rescue are two components of responding to an accident or serious illness. The first-aid skills taught in most urban and workplace classes are designed to help a severely injured patient survive for the short time it takes for emergency medical services to arrive. Wilderness-oriented

first aid, in contrast, helps treat and take care of a patient for hours, possibly days, in an outdoor environment. (See Chapter 24, First Aid, for first-aid references throughout this chapter.) Alpine rescue involves actions a party can take to locate a missing climber, rescue an injured climber from steep terrain, and evacuate an ill or injured climber from the wilderness.

As their climbing skills build and broaden, climbers should also add to their knowledge of first-aid and rescue techniques. Due to the wide variety of rescue situations and available techniques, consider taking a course from one of the many organizations that offer classes in self-rescue. Practice setting up and running the systems to keep personal skills fresh.

# THE SEVEN STEPS IN ACCIDENT RESPONSE

Accidents are not inevitable. Smart planning and preparing beforehand, practicing sound climbing strategies and techniques, and recognizing, avoiding, and mitigating hazards can all but eliminate accidents (see Chapter 23, Safety).

The challenges of rescue and evacuation of an ill climber can be just as difficult as those for an injured climber. The early identification of a serious illness is the best strategy for treatment or evacuation before it becomes disabling. Share suspicious signs and behaviors with other party members; the discussion of these clues can facilitate a prompt diagnosis and faster response. Many more rescue options are available for the ill climber who can still walk. While this chapter focuses on accidents, many of the techniques are appropriate for rescuing the ill climber.

## THE SEVEN STEPS IN ACCIDENT RESPONSE

1. Take charge of the situation.
2. Approach the patient safely.
3. Perform emergency rescue and urgent first aid.
4. Protect the patient.
5. Check for other injuries.
6. Make a plan.
7. Carry out the plan.

When serious accidents do occur, they happen unexpectedly, often stimulating an intense adrenaline response. This evolutionary response of "freeze, fight, or flight" compromises a climber's ability to think clearly while producing a powerful motivation to take immediate action. However, this adrenaline-fueled response can lead to inappropriate action, which is likely to make things worse and lead to more injuries or delays in rescue.

Devastating accidents have the potential to overwhelm and emotionally paralyze people including those not physically harmed. Should this happen to you, acknowledge what occurred, tell yourself to address that aspect later, then focus attention on what needs to be done. Start with something small, something that you have control over. During and immediately after the accident, the smartest course is to focus on personal and team safety until the party is able to take calm, deliberate action.

The seven steps in accident response outlined in Chapter 24, First Aid, serve as guidance for rescue response as well as for first aid. The seven steps help the party focus in an orderly manner on the tasks to be accomplished (see "The Seven Steps in Accident Response" sidebar). This section provides an overview of these steps as they relate to rescue; the section "Putting It All Together" later in this chapter elaborates on how these steps are implemented in an accident scenario.

## STEP 1: TAKE CHARGE OF THE SITUATION

The climb leader has overall responsibility for accident response. The immediate priority is to ensure the safety of the remaining climbers. Throughout the situation, the climb leader must keep returning to the big picture, planning ahead, delegating specific tasks, and avoiding being drawn into time- and attention-robbing details. If the climb leader is incapacitated, an experienced party member must step forward to fill that role.

## STEP 2: APPROACH THE PATIENT SAFELY

The rescuer and/or first-aid provider needs safe access to the injured climber. In steep or dangerous terrain, this may require climbing, rappelling, or being lowered to the patient. The party members are likely to be desperate to reach their injured team member, but acting hastily only increases the chance of additional injuries and delays. The party must think out its actions and work deliberately rather than reactively, remembering that survivors' safety always comes first. Considering several solutions to reaching the patient fosters

objectivity and improves the likelihood of finding the best approach. The time it takes to ensure the party's safety will not make a difference in the outcome of the patient's situation. The adage "half as fast, twice as efficient" is applicable in rescue response.

## STEP 3: PERFORM EMERGENCY RESCUE AND URGENT FIRST AID

Provide life-saving circulatory, airway, breathing, and bleeding (CAB-B) treatment, and other crucial first aid. Don't move the patient unless there is a danger at the patient's current location—such as from avalanche, rockfall, icefall, or immersion in water—or unless the patient is in need of urgent first aid that cannot be administered at the current location, such as midpitch on a rock route. See Chapter 24, First Aid, for more on first aid at this stage.

## STEP 4: PROTECT THE PATIENT

Be reassuring and communicate to the injured or ill climber what the team is doing to help. Protect the patient from precipitation, wind, heat, cold, and other environmental factors. As early as possible, anticipate and preventively treat the patient for dehydration, shock, and hypothermia, since successful treatment will be much harder if it begins after signs of these have appeared.

## STEP 5: CHECK FOR OTHER INJURIES

Make a thorough examination of the patient to determine what injuries, illnesses, or medical conditions exist and their extent (see Chapter 24, First Aid). This may be difficult in steep terrain, so repeat this process as soon as the injured or ill climber can be moved to a more suitable location and after the initial numbing shock of the accident has worn off.

## STEP 6: MAKE A PLAN

Input from other party members helps the climb leader take all crucial factors into account, including the following steps, in preparing the rescue plan. WE RAPPED may be a useful acronym:

**Weather.** Take into account anticipated temperature, wind, and precipitation, which may impact both the patient and the rescue team.

**Evacuation.** In assessing how to evacuate the party, consider these questions: How far is it to the trailhead? Can the patient walk? Can the patient tolerate the rigors of evacuation? If the patient is unable to walk, then outside assistance will be needed. Where is the best place to wait? Where is there helicopter access?

**Rope.** Is roped climbing required to reach the patient, move rescue personnel, or send a messenger for help? Will a rope system be needed to raise or lower the patient?

**Assistance.** Are climbing parties nearby who can help? Unless it is obvious that the injured climber can self-evacuate, seek additional assistance. It is better to have outside assistance on the way, even if it turns out later that it might not have been needed, than to delay the request until need is a certainty, because it typically takes several hours for rescuers to mobilize and reach the site. Phones are unreliable in the backcountry, so also carry emergency communication devices—a satellite phone, satellite communicator, or personal locator beacon as appropriate to initiate an official rescue response.

**Patient.** Is the patient improving, stable, or deteriorating? Is the patient at a good location? Can the patient be moved without significantly aggravating any injuries?

**Party.** Are other members of the group injured or traumatized? Traumatized survivors may need to be secured to an anchor or relocated to a safe location, to ensure they do not inadvertently endanger themselves or wander off. What are the party's capabilities? Do they need food, water, or rest? Can they remain on-site for several hours or overnight?

**Equipment.** Was any important equipment lost or damaged in the accident? What equipment is available? What can be done with the available equipment?

**Daylight.** How much daylight is left? Everything will be much harder after dark. What are the nighttime impacts?

Once the WE RAPPED assessment is complete, the climb leader draws together a plan of action. Initially, it may be more conceptual than detailed. The party should expect the plan to evolve or even radically change as new information becomes available.

## STEP 7: CARRY OUT THE PLAN

As the party carries out the plan prepared in step 6, remember to continually assess the team and situation so that the plan may be adjusted or improved upon. With the leader focused on the entirety of the situation, climbers focused on the specific assignments may suggest improvements to the plan.

# RESCUE

When an injured climber or stranded hiker is on steep terrain (for example, rock cliffs, ice faces, or steep hillsides), a team may need to use ropes to lower or raise the patient. Figure 25-1 gives an overall picture of what this might look like: a lowering system (fig. 25-1a) with SERENE anchors (fig. 25-1b), backed up by a belayer (fig. 25-1c), and a climber anchored near the edge (fig. 25-1d) to communicate with the rescuer as she stabilizes the patient (fig. 25-1e). (For knots and anchors, see Chapters 9, Basic Safety System, and 10, Belaying.)

**Safety.** In a stressful rescue situation, ensuring safety is paramount. There is a natural human tendency to fail to appreciate the hazards and take dangerous shortcuts during an emergency. A climbing party must guard against this tunnel-vision urgency, which can make the situation worse.

Everyone contributes to party safety. Everyone must continually observe and analyze the plan, rope systems, activity, and environment for hazards. Before a rope raise or lower, every item in the system must be inspected by more than one person: this redundant check is an important safeguard for catching stress-induced errors.

Redundant components hugely improve the safety of a raising or lowering system. Mathematically, the probability of both components failing is the product of the failure rates of each independent component, comparatively a much smaller number. Independent backups are one way to provide system redundancy. For example, a separate belay rope system provides redundancy to the primary rescue rope system.

## EQUIPMENT CONSIDERATIONS

Climbing protection and belay systems are designed to absorb or transfer the forces generated by a one-person, not a two-person, fall; yet rescue situations may necessitate having two people supported by the rope and gear. Because typical climbing gear and protection placements are not strong enough to withstand the fall of two people, to safely use recreational climbing gear in a

rescue, the lowering and raising systems must be designed to minimize potential falls and built to withstand higher fall forces. For example, strive to raise and lower from reinforced anchors located above rather than below or off to the side, which must use redirection. Redirected components are subject to greater forces than anchors directly in line with the force. Failure of a redirecting component will lead to a drop that will impart large forces on anchors.

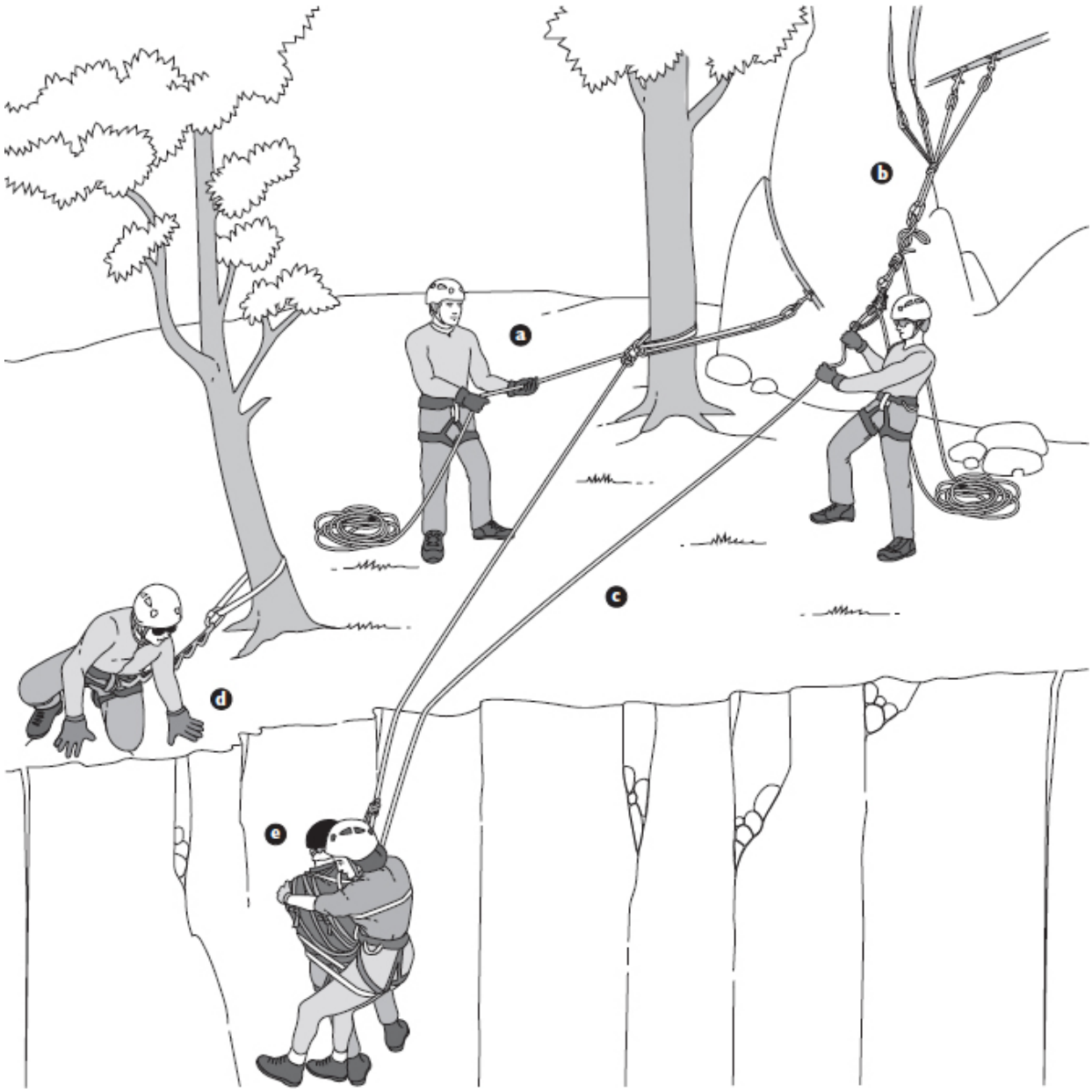


*Fig. 25-1. Small party rescue: a, lowering system on rescue rope; b, SERENE anchors; c, tandem prusik belay on the belay rope; d, climber anchored near edge communicating; e, rescuer stabilizing patient in front of her.*

**Anchors.** Strong anchors are the foundation of rescue systems. Due to the probability of two people relying on the anchor, it must be very strong. Follow the principles of building anchors—Solid, Efficient, Redundant, Equalized, and with No Extension (SERENE)—just as the party would when climbing, until everyone is confident the anchor system will not fail (see "Anchors" in Chapter 10, Belaying). A basket hitch around a tree is a strong anchor that is easy to set up and easy to remove (fig. 25-2).

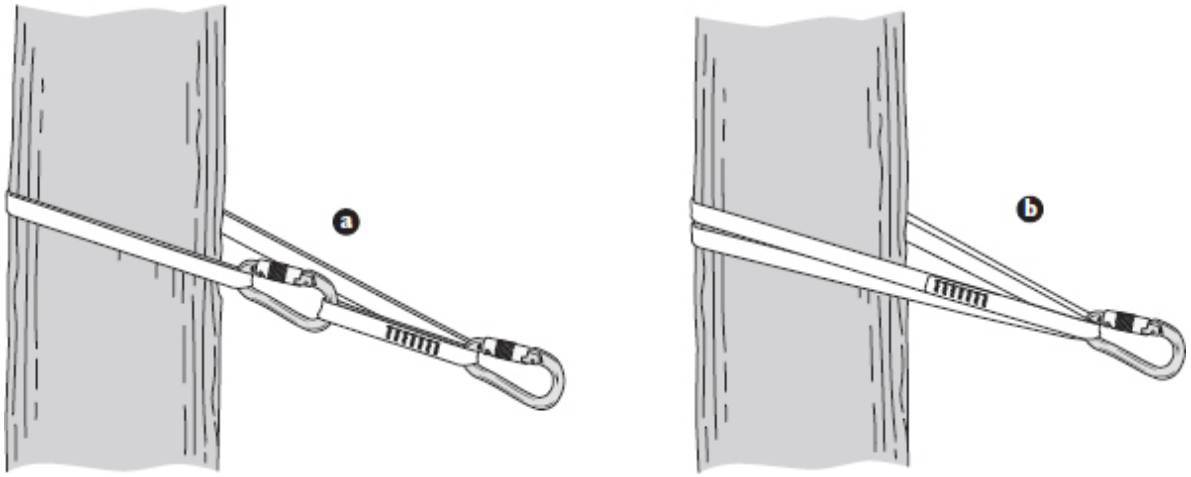


*Fig. 25-2. Basket hitch variations around a tree: a, using two carabiners; b, using a single carabiner.*

Because snow and ice anchors are weaker than rock anchors, create snow and ice anchors using several linked pieces of protection. See "Snow Anchors" in Chapter 16, Snow Travel and Climbing, and "Equipment" in Chapter 19, Alpine Ice Climbing.

A prusik hitch may be useful in connecting added pieces of protection to the rope and fine-tuning load distribution within the anchor system. In the event of a fall, an anchor with legs of similar length will better distribute forces among the pieces of protection.

**Ropes.** Dynamic climbing ropes are designed for a single climber. They typically stretch 6 to 10 percent under the suspended weight of one person; when 100 feet (30 meters) of a dynamic rope is extended, it will stretch nearly 8 feet (2.5 meters). The length of stretch increases with a two-person load. On a steep face, this stretch translates into a rubber-band-like effect. Each time the patient and rescuer hang freely, the rope will stretch. Each time they transfer weight to a feature or ledge, the rope will contract. For example, during a two-person lower, after stepping from a small ledge onto a face, the

pair could drop several feet during the rope extension, potentially striking something. The thin mantle (sheath) on climbing ropes is subject to more abrasion with a two-person load than with a one-person load, and the rubber-band-like stretching effect accentuates this abrasion. Pad places where the rope runs over sharp edges.

The original climbing rope may have been damaged in the fall. Prudence calls for transferring the patient to a different rope if available. If a low-stretch or static rope is available, it is better suited for a rescue (see Chapter 9, Basic Safety System). However, this lack of stretch makes such ropes unsuitable for catching any fall, and its anchor system must be built to handle large forces.

When a party is performing a rescue, it is helpful to distinguish ropes by labeling them according to their function. The rope used to raise or lower a patient and/or a rescuer becomes the "rescue rope." A backup rope to the rescue rope, used whenever two people are raised or lowered, becomes the "belay rope."

**Double munter hitch.** Most belay and rappel devices lack the friction necessary to lower, stop, or hold a two-person load. The double munter hitch (see Figure 25-4b) provides sufficient friction to do this.

**Pulleys.** In a raising system, even the best pulleys suffer friction losses. Due to frictional losses, a theoretical 3:1 (Z) pulley system may actually have a ratio of 2.7:1 or less; a 9:1 (Z-on-Z) pulley system will have an actual ratio of between 6:1 and 7:1 (see Figure 25-6). Carabiners can be used, at a sufficient friction disadvantage, if no pulleys are available.

**Prusiks.** Prusiks are useful as rope grabs. Prusiks in combination with a pulley simplify resetting of raising systems by holding the load during resets. They act as an automatic acting belay in the event of a rescue rope failure and provide a hands-free belay if the belayer must temporarily let go of the belay rope to help pull when raising or if forced to let go by rockfall, bees, nearby lightning, et cetera. Prusiks can be used to piggyback supplemental anchor protection and mechanical advantage systems to the rescue rope.

**Tension-release hitch.** This hitch, known as a TRH, is used to release tension on a weighted rope system. It consists of prusik(s), a locking carabiner, figure eight, and munter (or double munter) hitch around a pearabiner with a mule knot finish.

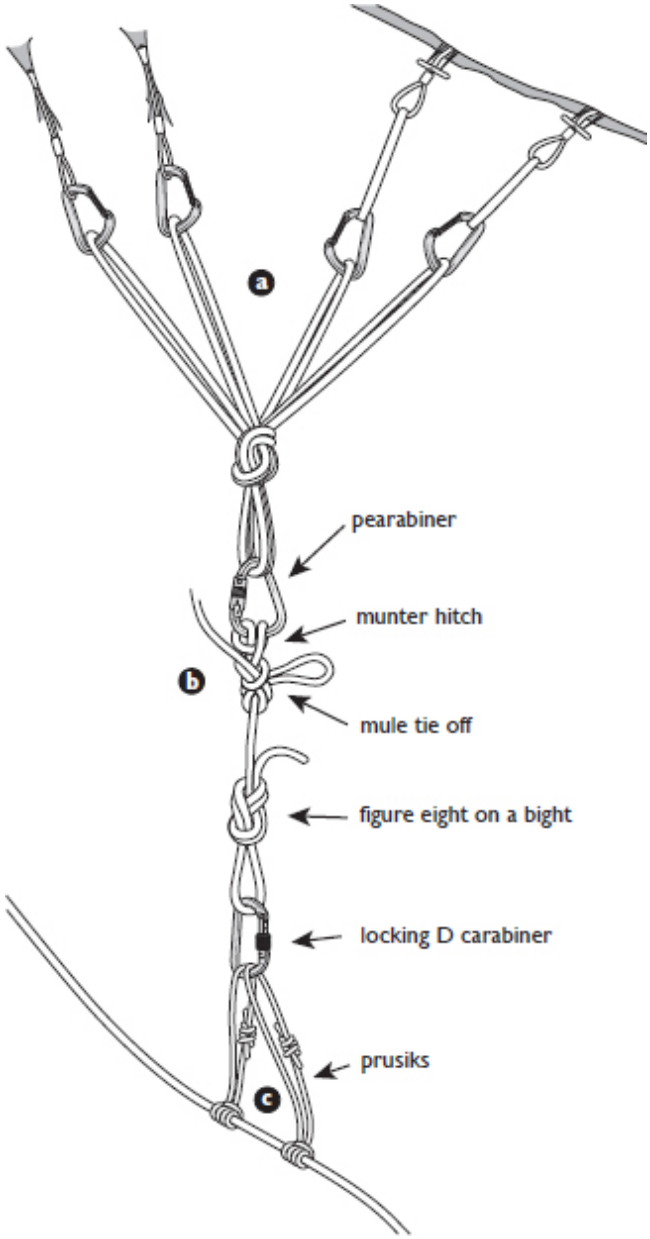


*Fig. 25-3. Tandem prusik belay with tension release hitch: a, SERENE anchor; b, munter-mule made from tail of rope; c, tandem prusiks spaced 4 inches apart.*

**Belays.** The belay rope is an independent rope backup to the rescue rope. The belay system consists of a SERENE anchor (fig. 25-3a); a TRH (fig. 25-3b); and two tandem prusiks around the rescue rope, spaced at least 4 inches (10 centimeters) apart (fig. 25-3c). The belayer pulls rope through the prusiks maintaining a few inches of slack to back up the rescue rope during the raise or lower. The slack will keep the prusiks from inadvertently tightening or grabbing during routine raising or lowering on the rescue rope. If the rescue system fails, the resulting force on the belay rope will cause them to be pulled

from the belayer's hands, and the prusiks will automatically grab the rope to catch the load. Although one prusik should work, the second prusik offers redundancy. Once grabbed, the TRH is used to transfer the load from the belay rope back to the rescue rope.

## RAISING AND LOWERING SYSTEMS

An injured climber may need to be extricated from steep terrain. If the injuries are not too severe, the party may use a mechanical advantage assist to help raise them or a friction device to lower them as they climb under their own power. For a patient with more severe injuries, a rescuer can help support the patient while the team raises or lowers both of them.

**Commands.** In addition to the typical climbing commands outlined in Table 10-1 of Chapter 10, Belaying, a couple of additional ones specific to rescues are helpful. At any time, anyone who notices anything appearing unsafe or amiss should shout "Stop!" immediately. Only when the issue is resolved should the rescue resume. Calling out "Stop" a dozen times can be expected. The rescue leader uses "Up" or "Down" to direct those operating the raising or lowering system and "Reset" when the pullers need to reset the traveling pulleys in a raising system. Those to whom the commands are directed should repeat the commands to acknowledge receiving them and help ensure that everyone has heard them.

**Unassisted rescue.** A single person puts less stress on the rope and anchor system than two people (see "Ropes" in the preceding section), so if the fallen climber is uninjured or has upper-body injuries, the rescuers may decide to raise or lower the patient without an accompanying rescuer. The patient ties in to the rescue rope and is then raised or lowered off the steep terrain by others who do the work.

**Assisted rescue.** If the fallen climber has more-severe injuries, an accompanying rescuer is required. The rescuer ties in at the end of the rescue rope. Upon reaching the patient, the rescuer clips a double sling between the rescuer's harness and the patient's harness using locking carabiners. The patient and rescuer are now redundantly linked to each other and both ropes.

For assisted raising or lowering, the patient is attached to the rescue rope by a prusik hitch that is girth-hitched to a sling, which is attached by a locking carabiner to the patient's harness belay loop. This can replace the double sling used initially to safeguard the patient. Slide the friction hitch up or down the rescue rope to place the patient alongside the rescuer, in the rescuer's lap,

below the rescuer, or on the back of the rescuer with the patient's chest even with the rescuer's upper back (as shown in Figure 25-1e). With an optimal adjustment of the prusik extension, the patient's weight hangs from the rescue rope and not from the rescuer; the rescuer maneuvers and stabilizes the patient as they are being moved. A second rope is used as the belay rope.

As the angle decreases, less weight hangs from the rescue rope and more upon the rescuer. If the rescuer cannot manage the patient's weight on low-angle terrain, such as a wide bench, it may be helpful to have another rescuer rappel from a separate anchor and rope to assist alongside. The rappelling rescuer should use a rappel backup such as the autoblock, as he or she may need both hands to help move the patient (see "Safety Backups" in Chapter 11, Rappelling).

**Lowering systems.** It is much easier and faster to lower a patient than to raise one, and the double munter hitch is used to lower two people. For instance, a rescuer can be lowered with a munter hitch (fig. 25-4a) to the patient, then the munter hitch can easily be converted to a double munter hitch (fig. 25-4b) to lower both patient and rescuer. The pearabiner must be opened to convert to a double munter. This conversion can be accomplished while the rescuer is hanging on the rope, say, for a mid-face rescue. If the rescuer will be stationary for a while, secure the double munter hitch using a mule hitch tie-off (see Figure 25-3b). Do not lower two people from a harness; lower directly off the anchor.

It is preferable to lower a patient and rescuer than to use an assisted rappel. Tandem rappelling requires the rescuer to do all the work, whereas lowering allows other climbers to control the descent, stops, and raising if needed; the rescuer can focus on controlling the patient. Furthermore, if the patient became unable to continue during a tandem rappel, the rescuer would be in a tough predicament. Also, there may be insufficient friction to safely control the rappel with some combinations of rope diameter, weight, rappel device, and terrain steepness. In the event that a tandem rappel must be used, two climbers may rappel together by attaching themselves to the same rappel device with a rappel extension made from a double runner (fig. 25-5). The rescuer backs up the rappel with an autoblock.

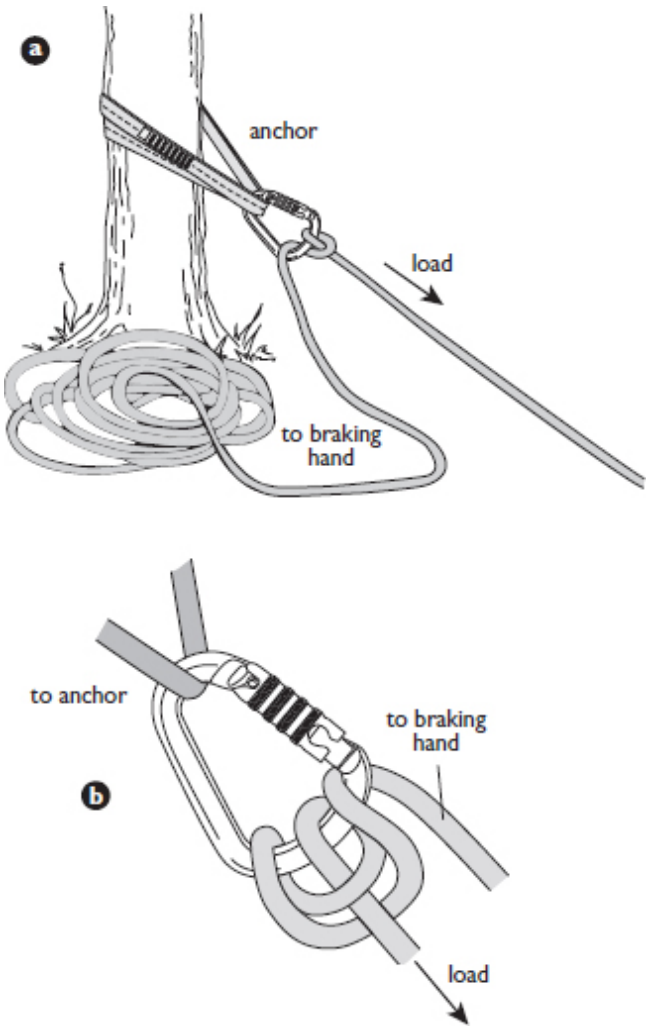


*Fig. 25-4. Lowering systems: a, using a munter hitch; b, using a double munter hitch.*

**Raising systems.** A raising system leverages the force the puller can pull with. The 3:1 (Z) pulley system is usually the most useful of the simple raising systems (fig. 25-6a). Chapter 18, Glacier Travel and Crevasse Rescue, describes setting up a 3:1 system.

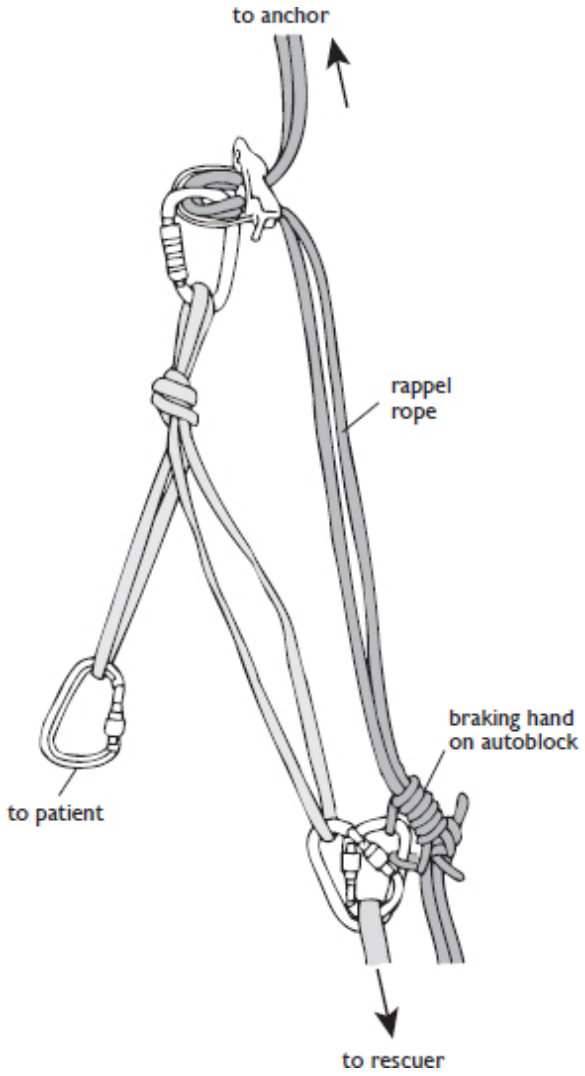


*Fig. 25-5. Tandem rappel setup.*

When there is a two-person load or only a few haulers, a second 3:1 system can be added to the pulling end of the first 3:1 system to create a compound 9:1 (Z-on-Z) raising system (fig. 25-6b).

If a 9:1 system provides too much mechanical advantage, it can be easily converted to a 5:1 system by removing the last prusik and connecting that prusik's pulley or carabiner directly to the same carabiner as the second pulley (fig. 25-6c).

A fast, jerky raise makes it difficult for the rescuer and patient to negotiate broken terrain and maintain a stable position. If the rope jams and the haulers keep pulling, the system then applies its powerful mechanical advantage to the anchors instead of raising the climbers; this may pull out the anchors. During raising, the belayer should take accumulating slack out of the belay system to

keep the belay tight by pulling the rope through the tandem prusiks. When practicing rescue techniques, always use a belay rope (see Figure 25-1c).

If a short lower will be followed by a raise, set up a raising system and use it in reverse to lower the rescuer to the patient. Then it is all ready to raise.

**Knot passes.** If a knot in the rope (such as a butterfly knot used to isolate a damaged section) must pass through a lowering system, use a tension-release hitch (TRH) (see Figure 25-3b).

As a knot approaches the double munter in a lowering system, attach a TRH below the double munter hitch and lower the load onto it. When the rescue rope slackens, relocate the double munter hitch to above the knot. Then loosen the TRH to transfer the load back onto the relocated double munter hitch.

In a raising system, as the knot approaches the traveling pulley prusik, reset and relocate the traveling prusik to below the knot. Continue raising, until the knot is close to the ratchet pulley prusik. Set the ratchet pulley prusik to hold the load and, using slings, extend the ratchet pulley with a new ratchet prusik to below the knot. Continue the raise working the knot through the remainder of the system with resets of different lengths.

# PUTTING IT ALL TOGETHER

No definitive step-by-step "recipe" will work for all rescues. There are numerous accident scenarios and possible ways to use rescue techniques to solve the problems that arise. Following the seven steps in accident response and using the party's technical climbing, rescue, and first-aid skills will guide climbers through what needs to be done to respond to an accident in steep terrain.

This section presents possible raising and lowering solutions to a scenario in which a lead climber has fallen on high-angle terrain to illustrate how to use the seven steps, interwoven with many climbing, rescue, and first-aid skills. In this scenario, the climbing party is made up of two rope teams of two climbers each. Each team has a rope, a rack, and a radio. The lead climber has fallen on a steep face more than halfway through a pitch on a multipitch climb and is unconscious and out of sight of the belayer. The climbing rope has been damaged. The other rope team has already completed the climb.

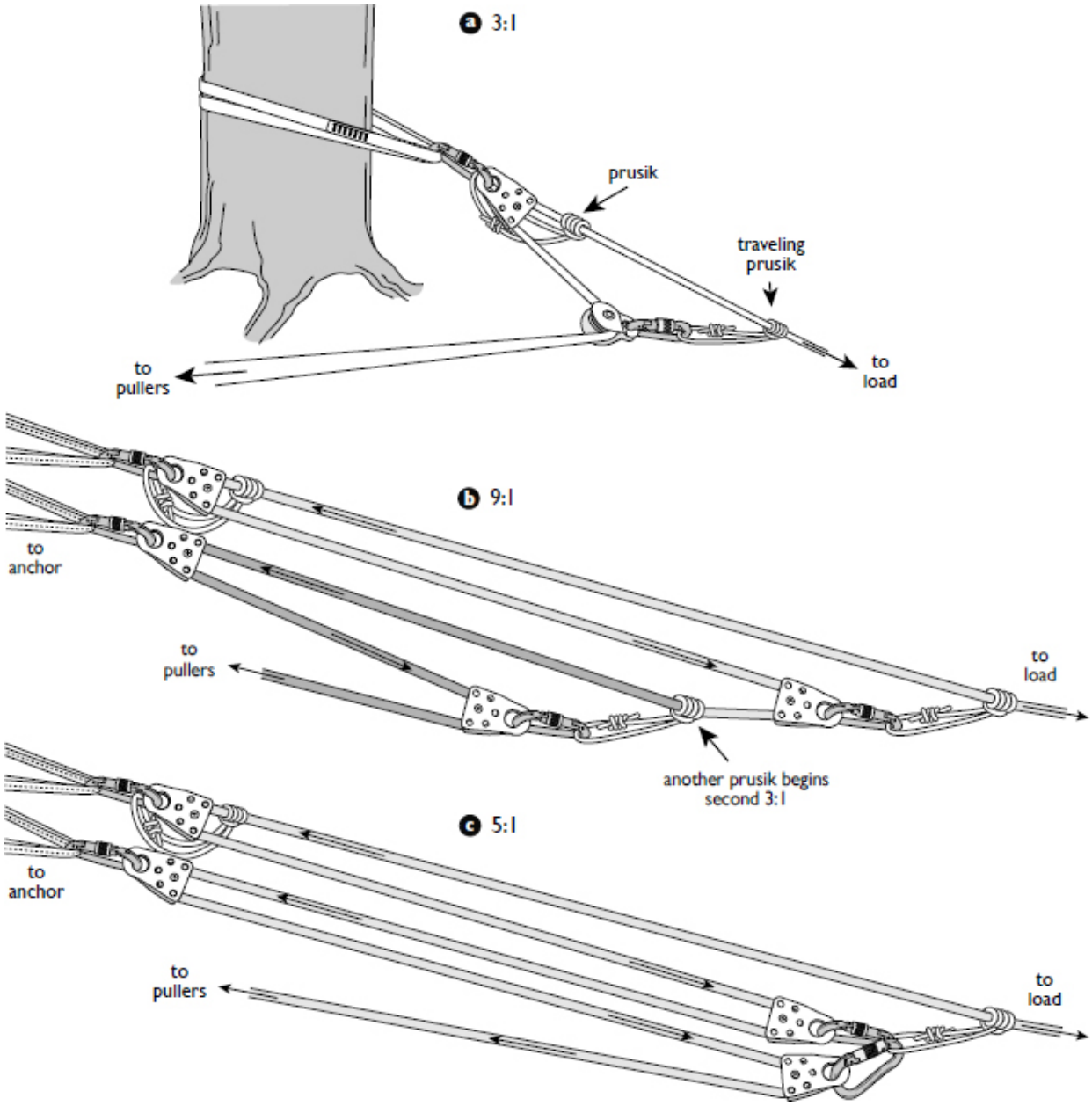


*Fig. 25-6. Raising systems: a, 3:1 system; b, 9:1 system; c, 5:1 system.*

**Step 1: Take charge of the situation.** The fallen climber's belayer arrests the fall, and after the climber fails to respond or move, the belayer radios to the two other climbers already on the summit. The belayer takes charge. The other team rappels to the top of the pitch, observing the unmoving, hanging climber below. The party contacts emergency first responders by using a phone (unreliable in the backcountry), PLB, satellite communicator, or satellite phone.

**Step 2: Approach the patient safely.** The top team builds a SERENE anchor system beefed up for a two-person load. One of these two climbers lowers the other, who is now the rescuer, with a munter hitch. The rescuer takes down first-aid supplies, a warm jacket, and the rack. As the rescuer is lowered past the patient's highest remaining protection, from which the patient is hanging, the rescuer notices that the sheath of the patient's rope has been stripped from the core.

Continuing down, the rescuer stops above the patient and builds an anchor in a crack while secured by the rescue rope. Using a TRH, the rescuer attaches the hitch's prusik to the patient's rope below the damaged core. The fallen climber's belayer lowers the patient onto this new anchor. The rescuer is lowered farther down to the patient and attaches a sling between the belay loops of both the patient's and the rescuer's harnesses.

**Step 3: Perform emergency rescue and urgent first aid.** The rescuer determines that the fallen climber is breathing and is not bleeding profusely but is unconscious. Concerned the patient has sustained spinal injuries in the fall, the rescuer strives to minimize movement of the patient's head, neck, and spine. The rescuer places a sling around the patient's knees and attaches it to the anchor, adjusting it to raise the patient's legs toward a more level orientation to treat possible harness suspension trauma (see Chapter 24, First Aid).

**Step 4: Protect the patient.** The rescuer zips a warm jacket around the patient's torso and arms to help prevent hypothermia.

**Step 5: Check for other injuries.** The rescuer examines the patient but can find no obvious injuries.

## FIRST SOLUTION: RESCUE BY RAISING

**Step 6: Make a plan.** The three climbers decide the best course of action is to raise the patient to the top of the pitch and await rescue.

**Step 7: Carry out the plan.** The patient's belayer unties from the rope; the rescuer pulls the climbing rope through the pieces of protection, isolates the damaged core with a butterfly knot, and tosses the end back down to the patient's belayer (climbing partner).

The rescuer now belays the patient's partner, who climbs and cleans protection up to the rescuer. Here the patient's partner takes both racks, attaches a prusik safety from his or her harness to the rescue rope, and then climbs, sliding the prusik up the rescue rope (self-belaying) while also being

belayed by the rescuer, until it's possible to tie in to the unused end of the rescue rope that has been dropped down. The patient's partner removes the self-belay prusik and continues ascending, top belayed, to the ledge.

The two climbers at the top of the pitch use the damaged climbing rope to set up a tandem prusik belay with a TRH on a new anchor and use the rescue rope to set up a 9:1 (3:1 on 3:1) raising system.

The top climbers maneuver the rescuer with the 9:1 system so that the patient can be secured to the rescuer's back with a nylon webbing carry (see Figure 25-9f). As these two are hoisted and belayed past the mid-face anchor the patient had been suspended from, the rescuer removes the TRH holding the patient. (The tension release feature was not needed.)

Once they are all at the top of the pitch, the party reassesses the patient's injuries, provides more spinal immobilization, and adds clothing and insulation to help prevent hypothermia and shock. They consider their own survival needs and resources, then prepare to wait for outside help from a local search and rescue agency.

Later the three climbers decide it makes little sense for all four to remain at the belay ledge rather than for two of them to leave their extra clothing, food, and water and descend.

## SECOND SOLUTION: RESCUE BY LOWERING

**Step 6: Make a plan.** In this case, when the party makes their plan they decide to lower the patient.

**Step 7: Carry out the plan.** The patient's belayer unties; the rescuer pulls the climbing rope through the pieces of protection, clips in to it with a butterfly knot beyond the damaged core, threads the rope through the new mid-face anchor, and tosses the free end back down to the patient's belayer, who builds a tandem prusik belay with a TRH.

The rescuer connects a sling from the patient's harness belay loop to a prusik on the rescue rope, then releases the mid-face anchor TRH to transfer the patient onto the rescue rope. The climber at the top lowers the rescuer and patient on a double munter hitch while the patient's partner operates a bottom belay until the rope runs out.

The rescuer takes the belay rope from the bottom belayer and sets up a self-belay with tandem prusiks from the harness belay loop; the rope now runs from the tandem prusiks up through the mid-face anchor and back down to the butterfly tie-in on the rescuer's harness.

The top climber continues the lower of the patient and rescuer to the belay ledge while the rescuer self-belays with the tandem prusiks. The top climber rappels the route, cleaning it.

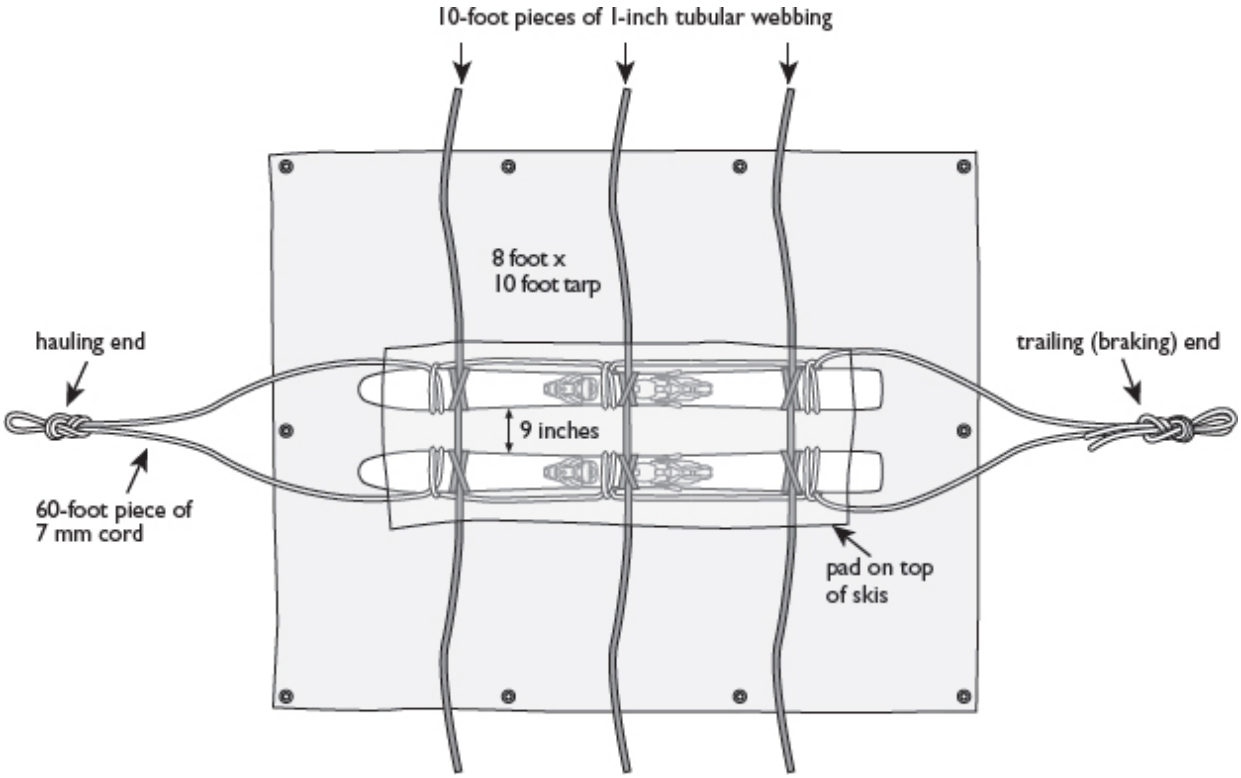


*Fig. 25-7. Improvised sled for snow evacuation using a tarp, a pair of skis, and sleeping pads.*

# EVACUATION

When an injury occurs the party may be miles from the trailhead or even a trail. The patient's condition, the distance to be traveled, and the party's strength determine the feasibility of evacuation to the trailhead. The party may also decide to evacuate the patient to a better location to wait until outside assistance arrives or evacuate to an area suitable for helicopter pickup, or they may remain in place.

For a time after an injury, the patient's pain may be lessened by endorphins in the bloodstream. As time goes on, the endorphin levels drop and swelling tissues may add to pain or limit range of motion. If the patient must be moved or must move under his or her own power, doing this sooner is generally less painful than waiting until later.

**Snow evacuations.** The party may be able to improvise a sled with typical gear carried by the group (fig. 25-7). Spread out a tarp, bivy sack, tent, or rain fly. Place two skis flat on top of the tarp, with the tips and the tails tied together approximately two to three ski widths apart; the skis provide support for the patient's head, torso, and pelvis, so adjust the final spacing between the skis to maximize this support. Next, place layers of sleeping pads, packs, clothing, and sleeping bags on the skis to protect the patient from heat loss and bumps by isolating the patient from the ground. Now place the patient on top of the padding. Wrap and secure the tarp around the patient. At the top of the patient's head, gather the tarp material together and tie a rope or sling around this point; an over-hand knot in the tarp material is one way of keeping the cord or webbing from slipping off.

Place loops in the hauling rope to go around the pullers' waists. Following the fall line is the easiest path; traversing on a firm slope is difficult. A trailing line, attached to the rear of the sled, may be used as a brake on steeper downhill slopes to keep the sled from overrunning the pulling climbers. On steep slopes, lower the patient with a lowering system rather than pulling the sled.

**Cross-country versus trail evacuations.** It takes considerable effort to move a nonambulatory patient a short distance on a trail. It is almost impossible without a trail.

**Assisted walk.** If the patient is able, he or she can walk, with one or more rescuers walking alongside to provide physical support. A rescuer close behind can help in difficult terrain. Have party members ahead select the easiest route and remove loose branches and other obstacles. Using trekking poles may help. Along some stretches, such as crossing boulder fields or logs, the patient may choose to scoot across on his or her own.

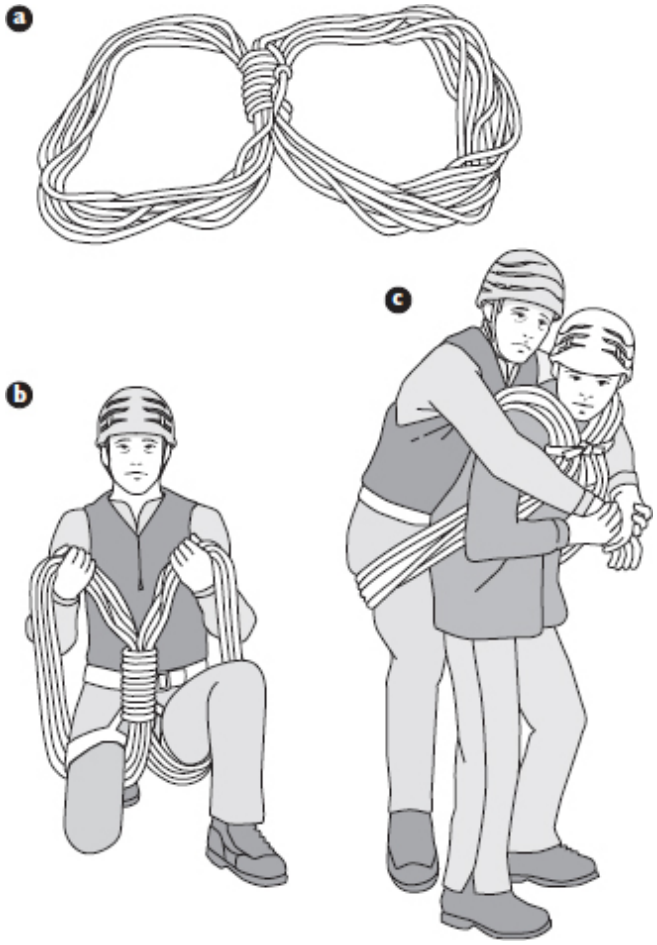


*Fig. 25-8. Coil carry: a, coil the rope, sizing the loops to fit from the patient's armpits to crotch, then separate the coil in half to form a pair of loops; b, place patient's legs through loops; c, slip upper part of loops over carrier's shoulders and tie these loops together at the chest with a short piece of webbing.*

**Back carries.** A strong climber may be able to carry the patient on his or her back for a short distance if the weight is distributed properly. Either the coil carry (fig. 25-8) or the nylon webbing carry (fig. 25-9) is helpful. For the nylon webbing carry, use 1-inch webbing, and pad pressure points for greater comfort. On a trail, doubling the webbing may be more comfortable. The rucksack carry is another method of back carry: make slits in the sides of a large backpack so the patient can step into it as though it were a pair of shorts, then the carrier wears the backpack as usual, with the patient as the load. Rescuers should take turns acting as carriers and choose a pace that will not exhaust the party. Using of any of these techniques off trail is difficult.

**Stream and obstacle crossings.** A rescue party may need to cross slippery streams or jumbled boulders. Loss of footing could prove disastrous to both

the patient and a rescuer who is doing a carry. Form two lines of rescuers across the obstacle from one side to the other. These rescuers can act as handholds and supports for the rescuer who is carrying the patient.

With swift water, it is easy to underestimate the water's hydraulic forces. It is dangerous to tie in to a rope; if someone slips, the rope may entrap the person underwater or midstream. Ropes should not cross perpendicular to the banks but at an angle downstream so that the current helps move you across. A Tyrolean traverse may be possible if it can be rigged high enough above the water to ensure that the patient will not sag down into the water. See Chapter 15, Aid and Big Wall Climbing.

## RESCUES INVOLVING OUTSIDE RESOURCES

When the party lacks the resources to deal with the search, injuries, rescue, or evacuation, they need outside rescue assistance. Organized search and rescue (SAR) groups bring to the scene the benefits of training and experience, combined with specialized equipment and techniques. When planning a climbing trip, make sure to find out and include in the itinerary what outside agency will be contacted should assistance be required.

Worldwide, there are a variety of approaches to SAR. Many countries may have nationalized SAR services. In urban North America, the local fire department is responsible for rescue. In the backcountry, responsibility most frequently rests with the county sheriff's department. In some parts of the United States, the state, National Park Service, military, or coast guard may be responsible. Most field SAR personnel are volunteers. Mountain rescue teams consist of volunteer climbers who receive training in wilderness-oriented first aid, search, rescue, and helicopter operations.

In North America, it is rare to be charged for SAR costs. In Europe and many other parts of the world, climbers must expect to be charged. Usually, inexpensive insurance policies for climbing can cover these costs.

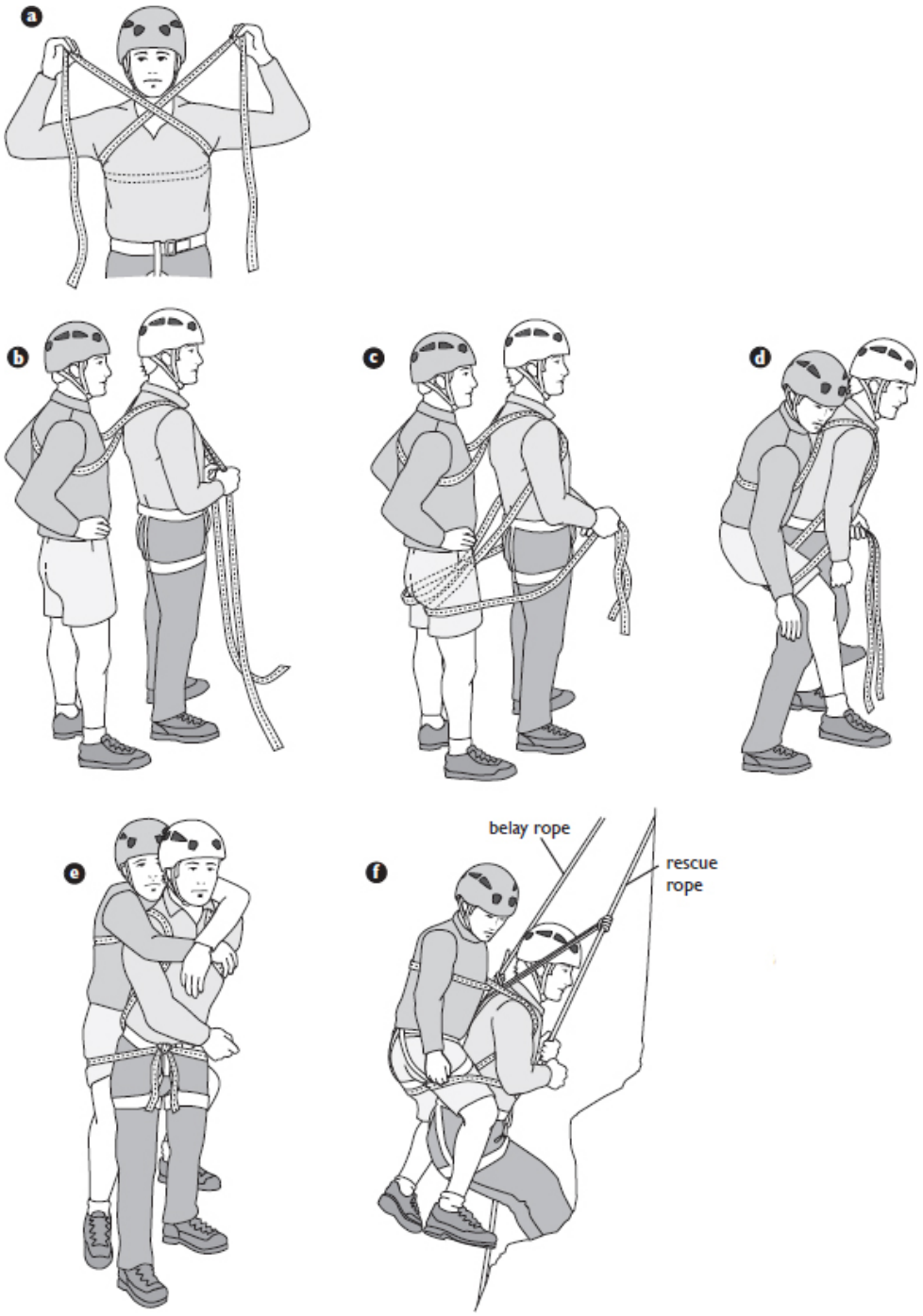


*Fig. 25-9. Nylon webbing carry: a, place webbing around patient's back and under shoulders, crossing in front of the chest; b, place ends over carrier's shoulders (from back to front); c, bring ends alongside carrier's ribs, through patient's crotch, and around outside of patient's thighs; d, carrier ties ends of webbing together around waist; e, patient puts arms around carrier's neck, if able; f, patient hangs primarily from prusik to rescue rope, webbing secures and stabilizes patient to rescuer, and belay rope provides redundancy.*

## Requesting Outside Assistance

It is essential to communicate clearly with the SAR agency to avoid miscommunication. From a SAR perspective, location of the patient and whether or not the patient is ambulatory are the most important pieces of information. Next in importance is information on the injury, condition of the patient, and best access to the accident site. The accident report in Figure 24-1, in Chapter 24, First Aid, provides a good format for documenting this crucial information.

Being prepared for the unexpected is a hallmark of competent climbers, and being prepared includes having the ability to summon help in an emergency. Outside rescuers can be contacted using various emergency communication devices such as radios, smartphones (unreliable in the backcountry), PLBs, satellite communicators, or human messengers.

**Radios and smartphones.** Climbing parties will save hours in obtaining help if they can get through with a radio or smartphone, but in the mountains and wilderness, smartphones and radios tend to be unreliable. Radios require line-of-sight communications with another radio or repeater station. Amateur radios, together with amateur repeaters, are generally the most reliable method of communication from remote locations. These radios are regulated by the federal government; their operation requires a license. Citizens band (CB), family radio service (FRS), and general mobile radio service (GMRS) radios have range and propagation limitations. With all devices, sometimes service can be improved if the caller moves a bit, reorients the antenna, or transmits from a higher elevation. Satellite phones, due to their greater bulk and expense, have not seen widespread acceptance except in remote climbing areas.

Where smartphones have network coverage, they are invaluable for communicating with outside rescuers. During a remote climb, cell phone batteries are likely to be rapidly depleted due to the phones' intensified attempts to stay on the network where coverage is poor. Smartphones should be turned off at the trailhead or, to use the camera or GPS navigation features, place phones in "airplane mode." The display is usually the largest power consumer. Take along an extra battery or power source. When battery life becomes an issue, inform the SAR authorities; it may be best to shut the phone off for an agreed-upon period of time. Texting will help preserve instructions without having to write them down and will save battery life; texting may also

be able to access the cellular network when voice will not. Increasingly it is possible to text 9-1-1 call centers.

**Personal locator beacons.** PLBs are the most reliable means of summoning help; they use technology similar to that used on aircraft and ships for emergencies. The signal's location will be routed to the local government SAR authority. These robust devices—which weigh as little as 4 ounces (112 grams)—will send signals for at least 24 hours in extreme environments.

**Satellite communicators.** Businesses have developed somewhat similar devices using commercial satellites but they are not as robust. Generally satellite communicators have richer features but require paid subscriptions. Depending on the devices, you can enable ongoing location tracking, send different notifications, summon help, and text message. When a party is running slow, being able to keep friends and family informed provides everyone peace of mind and may head off an unnecessary search and rescue call. (See Chapter 5, Navigation.)

**Human messengers.** In some situations, sending someone from the climbing party may be the only means of communicating with outside help. If this is the case, try to send two messengers for safety. Resist rushing to send the messengers on their way. Instead, take a few minutes to make sure the messengers have everything they will need such as car keys, the party's plans, emergency contacts, and the like. A messenger should carry a map showing the precise location of the patient. Messengers need to pace themselves and travel safely; they must avoid the natural tendency to rush. It is more important to be certain that the messengers will reach assistance than to worry about the time it will take them to reach assistance.

## Interacting with SAR

The initial call for outside assistance should use the normal local procedure for fire, police, or medical emergencies, such as dialing 9-1-1 in the United States. The dispatcher will connect the party to the appropriate SAR authority.

**Communicate location.** Because emergency dispatch centers rarely handle wilderness emergency requests, there is potential for miscommunication. For example, the jurisdiction where the accident is reported or where the emergency dispatch center is located may be different from where the accident occurred. Geographical names may vary and may even be used for multiple places in the same region. The dispatcher is not likely to be familiar with climbing terminology.

The location of the accident must be communicated unmistakably. Start with simple information such as the state, county, closest city or town, and road names. This may seem too basic, but heartrending stories abound of rescuers being sent to the wrong side of a mountain or of a desperate climbing party watching a helicopter search an adjacent peak. If communicating by radio or phone, give information such as map coordinates; the type of map and its name, along with a description of the location; and the route name, including the guidebook that describes it. Use more than one way to describe the location (redundancy). The party's elevation can be an invaluable piece of information for establishing location. If using a coordinate system, specify the datum and format, especially when using latitude and longitude, since there are several formats. Specify whether any compass bearings are true or magnetic.

**Assist the rescuers.** Make an effort to speak with the rescue team that will be entering the field. Mountain rescuers will have specific questions about access and route conditions that dispatchers or SAR mission leaders are unlikely to ask. This information will assist the mountain rescuers in formulating the best strategy and selecting the right equipment. Rarely, the party's messengers may be asked to escort rescuers back to the accident scene.

At the scene, do everything possible to help the arriving SAR team. This could range from having drinking water available to setting up fixed lines to help rescuers reach the accident scene. When a mountain rescue team arrives, they will assume responsibility for first-aid treatment and completing the rescue and evacuation. The SAR leader will look to members of the arriving teams to perform most of the vital tasks.

The climbing party can help by cooperating closely with the rescuers. The climb leader remains in charge of the remaining climbing party and is responsible for its safety. The climbing party may be escorted out. However, the climbing party should be prepared to lend a hand in the rescue if requested.

## HELICOPTER RESCUE

Helicopters have revolutionized mountain rescue. They can deliver rescue teams to remote areas and pluck injured climbers from cliffs and glaciers. Helicopters can deliver an injured climber to the hospital in hours, whereas ground evacuation can take days. However, do not base rescue plans on an

immediate helicopter rescue just because helicopters are used in the area. Bad weather, darkness, hot temperatures, or high altitude may limit helicopter operation. A helicopter also may not be available due to another assignment or maintenance. If a helicopter can rescue an injured climber(s), the remaining party members may or may not be evacuated by helicopter.

**Make the party visible.** In many types of terrain, it is surprisingly difficult to see people from a helicopter. Help the crew by waving brightly colored items; using mirrors, watch or electronic device display faces, stove windscreens, or shiny pots; making tracks in snow; or moving around on a contrasting background such as snow, forest clearings, ridges, and riverbeds. Effectively sized flares and smoke bombs are too large for climbing parties to carry, but devices similar to laser presentation pointers, intended for signaling helicopters, could be carried. If a helicopter approaches at night, presume the pilot is using night vision goggles. If so, too much light can be disruptive to such vision. A single small light directed at the ground is sufficient once you believe the helicopter is headed toward you. Once the helicopter has positively identified the party, it may fly off to prepare for the rescue or to land rescuers a short distance away.

**Prepare the area.** A rescue helicopter loads an injured person in one of three ways: it lands (or hovers just above the ground) and takes the patient aboard; it hovers overhead while hoisting the patient aboard; or it hovers over-head to connect the patient to a fixed-length cable. For an anticipated landing, clear a level area for the helicopter. Move all loose objects, such as branches and saplings, well away from a landing site. Fly a brightly-colored wind indicator from a nearby location as high as possible.

**Take safety precautions.** When dealing with helicopters, safety concerns are of utmost importance. Many things pose a danger, including static electricity buildup on the helicopter, blowing dust and debris, intense windchill, and loss of visibility from blowing rock, dirt, debris, and snow. The downwash and noise of the helicopter are overwhelming; wear eye protection and climbing helmets. Anything not secured will blow away!

**Assist the crew.** If a radio is lowered to the party, you may need to press a button to talk to the pilot. If the helicopter lands, stay out of the proximate landing area and behind protection from windblown debris. Expect a crew member, upon landing, to come to you; approach *only* when signaled to do so. If you must approach, do so from the front or sides of the helicopter, as long as you can stay well below the main rotor. *Do not approach from behind*, to

avoid the low and nearly invisible tail rotor. If a pack must accompany the patient, remove any loose items and place them inside the pack, and be sure to send the written accident report out with the patient. If the helicopter hovers and lowers a crew member to the ground, prepare to assist this crew member in loading the injured climber. This person will not necessarily be a climber and may be unfamiliar with glaciers, steep terrain, and safe climbing practices. Do not touch any cables and baskets from the helicopter until they first touch the ground, which discharges static electricity.

Finally, if the helicopter hovers and lowers a bare hook, allow the helicopter cable's hook to touch the ground to discharge static electricity before touching it! Do not anchor the hook to the ground, and ensure that the hook and cable do not snag on anything. Expect the hook and cable to move about as the helicopter adjusts to hold a stationary hover.

For the patient to remain upright when hoisted, make sure that both a seat harness and a chest harness are on the patient. Girth-hitch a single-length sling to the seat harness belay loop and pass it through the chest harness to create the attachment point. Press the helicopter hook's safety latch to open it, and place the attaching sling in the hook. If a pack is also being hoisted by hook, girth-hitch a double-length sling through both the pack's shoulder straps (the haul loop may not be strong enough) and insert the sling into the same hook with the climber; the pack will hang below the climber.

Once the attaching sling is secured in the hook and the patient is no longer attached to any anchor, make eye contact with the hoist operator and raise your hand overhead, pointing to the sky.

# SEARCHES

The Climbing Code described in Chapter 1, First Steps, instructs climbers to stay together. The desire to split the group is an indicator of a worrisome problem within the team; separating sets up the weaker party for a mishap. Generally, the smaller the party, the higher the risk for becoming lost. Solo travelers are at greatest risk. Do not allow a single person to descend on his or her own, and do not spread out the group in unfamiliar terrain and on poorly marked trails. If a climber becomes separated from the climbing party, there is always the risk that an accident might injure that individual, immobilizing him or her.

## SEARCHES BY THE CLIMBING PARTY

If a climbing party realizes that a member is missing, it's time to initiate a search.

**Prepare a search plan.** In preparing to search, examine the topographical map for possible alternate paths the climber may have taken. Try to visualize errors the person might have made. Give consideration to the lost person's skill level, resources, and remaining stamina. Lost people tend to head downhill and to take the path of least resistance. Look at the map for inviting pathways, choke points that focus travel, and barriers that block travel altogether.

Careful strategy saves time. Before sending out party members, the climb leader should set a meeting or return time and place based on a reasonable amount of search time. If radios or cell phones are available, the search teams should agree on a scheduled call-in.

**Start the search.** If bad weather, difficult terrain, or medical considerations suggest that the missing climber might need help, start the search without delay. The most effective search strategy is to return to the location where the missing person was last seen and retrace the route, looking for places where the climber might have left the path. Use whistles, shouting, or any other noisemaking to extend your reach. Look for clues, especially footprints. Inform any encountered travelers of the search and share instructions to pass on to the lost person. Prominently mark and identify all physical points you want outside searchers to be able to locate.

**Request outside help.** If, after the designated period of searching, the party members check in and/or meet up only to find that no sign of the missing climber has been seen, it is time to request outside help. The longer a lost person is on the move, the farther he or she can travel and the harder it is to find the person.

## SEARCHES INVOLVING OUTSIDE RESOURCES

The science of searching has advanced over the years. Leaders from government agencies responsible for searches have models to help predict the behavior of lost people and determine search segment probabilities. A number of specialized SAR teams may search. Search dogs follow scents and disturbances; human trackers can spot signs of passage; helicopters cover large areas quickly; drones cover smaller parcels; horseback and foot teams

search less-difficult terrain; four-wheel-drive and all-terrain vehicles travel rough roads and wait at trailheads; mountain rescue teams cover steep terrain.

Each search has different needs. Once the authorities have been notified, the best action for the original climbing team is to meet with the SAR leader. The SAR leader will want specific information that only the climbing team can provide. The party will be directed where to meet the SAR leader, which usually means waiting at the trailhead. After an initial debriefing, the search leader may ask the climbing team to remain at the SAR base to answer questions that arise. The climb leader should call the emergency contact person for the missing climber. When the climbing party leaves the SAR base, they should always leave their contact information. Friends of the missing person and other untrained volunteers are unlikely to be used during a SAR-organized search.

# GOING FORWARD

Planning and preparation identify many hazards before a climb begins, and during the climb, hazard identification and avoidance go a long way in ensuring the party's safety. Still, circumstances do arise, so being prepared to perform rescues is important. Learn leadership, first-aid, and rescue skills, and keep current by regular practice and review. Make sure to *practice* the rescue techniques outlined in this chapter—reading by itself does not provide the necessary skills. Consider contributing your mountaineering skills to the community by joining your local mountain rescue group.

Become one of those climbers—confident in leadership, accident prevention, first-aid, and rescue skills—who has the ability to rescue and evacuate an injured person in treacherous terrain. Then you will be more fully prepared to pursue the freedom of the hills.