Spinal Immobilization Inservice Manual

For Internal Distribution ONLY

Head Injury – Blunt, Penetrating

Assessments

1. Assume life/function threats:
   - **intracranial and/or intracerebral hemorrhage;**
   - **neck/spine injuries; facial/skull fractures;**
   - **other concurrent severe injuries;**
   - **precipitating factors** e.g intoxication.
2. Conduct a scene survey, determine M. of I.; perform the primary survey with manual C-spine stabilization if spine injury is obvious, suspect or cannot be ruled out.

   Make a transport decision.
3. Elicit incident history including any loss/regain of consciousness; perform secondary survey physical assessments:
   i) In patients with multiple trauma, perform a **head-to-toe secondary survey**, including baseline Glasgow Coma Score and neurologic assessment of sensation/motor function;
   ii) In patients where history, M. of I. and scene survey support an assessment of **isolated head injury (including facial injury)**, e.g. blow to the head from a blunt object, perform at minimum:
      - **Head and neck:** inspect, palpate for **CLAP(S)(D), TIC(S)(D);**
      - **Neurologic exam:** pupillary size, reactivity and equality; sensation - light touch, pinch to fingers/toes; movement of fingers/toes, legs/arms - spontaneous or upon request; baseline Glasgow Coma Score;
      - **Other assessments as indicated** on the basis of M. of I., patient's complaints/ condition and scene observations;
      - **Vital signs.**
   iii) In all head injured patients, note emesis (including frequency), urinary/fecal incontinence (if obvious), abnormal posturing, agitation or fluctuating behaviour. Note mastoid bruising, periorbital ecchymosis, possible CSF from ears/nose (indications of basal skull fracture).
4. Make a second transport decision if still at scene.

Management

1. **Specific to head injury:**
   - If the patient is violent or extremely agitated, and all reasonable verbal efforts fail to calm the patient, restrain the patient; assess the need for police or other bystander assistance prior to restraining the patient, and request assistance if required.
   - Immediately stabilize the neck, and immobilize as soon as possible if C-spine injury is obvious, suspect or cannot be ruled out. Secure airway as required. Where applicable, remove helmet to ensure proper assessment and management.
   - Administer high concentration oxygen if indicated.
   - Assist ventilation as required with normal tidal volume and ventilatory rate to provide optimal oxygenation.
   - Hyperventilate at a rate of 20-24 breaths per minute if the patient is exhibiting signs and symptoms of cerebral herniation as evidenced by a rapidly deteriorating Glasgow Coma Score or GCS <9 with asymmetric pupillary reaction/asymmetric motor response **after** measures have been taken to mitigate hypoxemia and hypotension.
   - Manage seizures; be prepared for same if head injury is severe (see *Seizure Standard*).
   - Control external hemorrhage; stabilize an impaled object; cover protruding brain tissue with non-adherent material, e.g. plastic wrap; moist, sterile dressing.
   - If **CSF leak** is obvious or suspect, allow flow to continue unobstructed; place loose gauze over nostrils/external ear to absorb flow (CSF will diffuse across gauze faster than blood and will form a "halo" around the blood).
   - Apply a cold pack to swollen areas if practical.
   - Initiate rapid transport - decreased/decreasing level of consciousness; unequal/unreactive or sluggishly reactive pupils; obvious neurologic deficits; other "load and go" indicators.
2. **Enroute:** monitor; re-evaluate and manage as required; reassess vital signs, level of consciousness every 5 minutes and Glasgow Coma Score at 5-10 minute intervals for all CTAS 1 and 2 patients.

   Prepare for expected problems:
   - emesis (almost always);
   - problems related to concurrent injuries;
   - agitation, aggressive behaviour;
   - seizures;
   - decreasing level of consciousness;
   - respiratory distress/arrest.

If the patient is or becomes agitated:

- repeat the primary survey (plus pupillary assessment); manage critical findings;
- keep low light inside the patient compartment if it does not hinder proper patient care and monitoring;
- maintain a comfortable temperature for the patient in the patient compartment;
- if the patient's temperature appears elevated e.g. skin hot and wet or hot and dry, dispense with blanketing;
- restrain the patient if endangering self and/or crew.

Neck/Back Injury – Blunt, Penetrating

Assessments

1. Assume neck and spinal cord injury until assessment indicates otherwise - all patients involved in and/or suffering from:
   - contact/gymnastic sports accidents (impaction, falls);
   - diving and near-drowning accidents;
   - explosions, other types of forceful acceleration/deceleration injuries;
   - falls from a height;
   - loss of consciousness or decreased level of consciousness where spine injury is obvious, suspect or cannot be ruled out;
   - motor vehicle collisions;
   - penetrating neck/back trauma;
   - severe electrocution.

   And any trauma associated with:

   - complaints of neck or back pain or neurologic symptoms, e.g. numbness, tingling, burning, loss of feeling/function;
   - injuries to head, face, neck or back (obvious, suspect based on M. of I.);
   - tenderness on palpation over the spinous processes +/- associated instability, deformity or crepitus;
   - obvious neurologic deficits.
2. Assume vascular and airway lacerations/tears associated with penetrating neck injury.
3. Conduct a scene survey. Perform the primary survey while manually stabilizing the C-spine. If the patient requires extrication, perform the primary survey and necessary interventions prior to/during extrication whenever possible.

   Elicit incident history. Determine M. of I. Attempt to determine if:

   - the patient has neck or back pain or neurologic symptoms, e.g. numbness, tingling, burning, loss of feeling/function;
   - the patient was moved before paramedic arrival;
   - a paralysed patient had any movement before paramedic arrival;
   - there have been other changes in the patient's condition prior to paramedic arrival, e.g. behaviour, memory of events.

4. Make a transport decision:
   i) If the patient is "load and go" after the primary survey:
      - transfer the patient to a long backboard or adjustable break away stretcher;
      - completely immobilize the spine (including the head), pelvis and legs using appropriate techniques (see *Management Section*); blanket; initiate rapid transport;
      - continue assessment and management enroute.
   ii) If the patient is stable, transfer to a long backboard/adjustable break away stretcher and continue assessment at scene, situation permitting, or immobilize, transport and continue assessment enroute.
5. **Perform a head-to-toe secondary survey.** Ensure assessment includes:
   - **Neck and Back:** inspect, palpate for CLAP(S)(D), TIC(S)(D); inspect, palpate the neck posteriorly, and inspect/palpate the back **only if** the patient can be safely moved to do so, or examine during the log-roll maneuver (if performed);
   - **Sensory/Motor Exam** (light touch or pinch to the fingers/toes, dorsum of hands/feet; movement of fingers/toes, hands/feet - spontaneous or upon request);
   - **Pupillary Assessment**: size/equality/reactivity;
   - **Baseline Glasgow Coma Score;**
   - **Assess for other signs specific to spinal cord injury** if cord injury is obvious or suspect e.g. spinal shock; urinary retention (bladder may be palpable as a large mass in the abdomen); diaphragmatic breathing. Note priapism (sustained penile erection) if obvious.
   - **For all *penetrating neck wounds*:**
     - inspect and/or palpate for entry/exit wounds;
     - assess carefully for tracheal deviation, JVD; inspect the chest and auscultate for decreased air entry over one or both lung fields (possible pneumothorax, tension pneumothorax);
     - assess for signs of airway and/or vascular penetration - frothy/foamy bleeding, sucking wounds, gurgling/crackles/wheezes on chest auscultation, subcutaneous emphysema;
     - do not remove impaled objects in the neck unless it has caused an airway obstruction.
   - **For penetrating injuries below the neck, in the spinal area:**
     - inspect and/or palpate for entry/exit wounds during the log-roll maneuver; as for neck wounds: assess for signs of airway and/or vascular penetration; inspect and auscultate the chest;
     - inspect and palpate the abdomen.
6. Make a second transport decision if still at scene.

Management

I. Specific to all spinal injuries:

1. If indicated:
   - establish/improve the airway while stabilizing the C-spine - use a modified jaw thrust to open the airway; remove helmet to ensure airway access and/or neck stabilization;
   - assist ventilation;
   - administer high concentration oxygen;
   - initiate rapid transport.
2. Completely immobilize the neck, spine, pelvis, legs and head when spinal cord injury is obvious, suspect or cannot be ruled out.

   Immobilize in a safe, and orderly fashion:

   i) **Immobilize the cervical spine** with a rigid cervical collar; remove helmet (where applicable).
      - If the neck cannot be brought into neutral alignment with gentle manipulation, immobilize in the position found using rolled blankets, towels or other padding.

   ii) Immobilize the thoraco-lumbar spine, pelvis and legs utilizing a long backboard or adjustable break away stretcher and approved techniques and strapping:
      - Perform emergency rapid extrication if scene survey identifies a condition immediately endangering the victim and the paramedic, and/or the primary survey reveals a condition requiring immediate intervention that cannot be performed inside the vehicle;
      - Perform non-rapid extrication if the patient is assessed as stable/non critical;
      - If extrication is not required, simply transfer and secure the patient.

   iii) **Immobilize the head**; use tape, rolled towels/blankets or a head immobilization device; place padding behind/under the head if needed to maintain neutral C-spine alignment.

Guidelines

When possible, stabilize a fractured femur or tibia by securing it to the uninjured leg **prior to** transfer to a backboard/adjustable break away stretcher; if time and the patient's condition permits, splint further **before** transfer to the backboard/adjustable break away stretcher; if log-rolling, logroll onto the uninjured side.

Guidelines

Time and patient condition permitting, pad backboard/sides of adjustable break away stretcher to improve patient comfort, especially if the patient is too thin to fill out the board/adjustable break away stretcher. Pad under the back in children with large heads, if required. Remove hard objects from the patient's pockets.

3. Use the spinal immobilization extrication device to immobilize the neck, spine and head if:
   - sufficient trained personnel are available to apply it quickly;
   - the spinal immobilization extrication device is appropriate to the situation, e.g. long backboard or adjustable break away stretcher cannot be utilized due to size/shape of the area where the patient is located; board or adjustable break away stretcher has already been applied to another patient;
   - the spinal immobilization extrication device can be applied properly;
   - application will not compromise critical interventions.
4. If **spinal shock** is obvious/suspect, immobilize and:
   - administer high concentration oxygen;
   - blanket the patient as soon as possible;
   - initiate rapid transport.

II. Specific to penetrating neck wounds:

Stabilize an impaled object and control oral and wound hemorrhage:

- control oral hemorrhage (see *Facial and Nose Injury Standard, Management* section);
- if venous bleeding cannot be controlled with direct pressure, apply pressure above and below the point of injury;
- apply pressure over the carotid artery **only if** it is the wound site, and only over one carotid at a time (if both are injured);
- apply pressure lateral to, but not directly over the airway;
- apply occlusive dressings to wounds; use non-circumferential bandaging;
- if an impaled object prevents proper positioning of the patient for purposes of spinal immobilization, stabilize the object, slide the patient onto the backboard, and transport in the most stable position possible.

III. Manage other penetrating wounds as per the *Soft Tissue Injures Standard.*

IV. Enroute:

- keep patient movement to a minimum;
- tilt backboard/adjustable break away stretcher to the left side, i.e. facing the paramedic, if the patient has excessive secretions or if the patient is vomiting;
- keep the patient warm; maintain a comfortable temperature for the patient in the patient compartment;
- monitor; re-evaluate and manage as required: for all CTAS 1 and 2 patients, re-assess vital signs every 5 minutes; repeat Glasgow Coma Score as soon as transport is underway and every 5-10 minutes thereafter.

- **Prepare for expected problems:**
  - problems related to concurrent injuries; emesis;
  - seizures if disruption of cerebral blood flow or air embolism secondary to penetrating vascular injury in the neck and/or concurrent head injury;
  - hemorrhagic shock, shock due to pump failure (tension pneumothorax, cardiac tamponade, vascular injury if penetration into the chest from a penetrating neck wound);
  - spinal shock if cord injury is obvious/suspect;
  - airway compromise, respiratory distress/arrest if multiple trauma, airway/vascular penetrating injury to the neck and/or spinal cord injury.

Guideline

The attending paramedic should sit within the patient's view when possible, so the patient does not attempt to turn their head.

Guidelines

Helmet removal is almost always required to carry out proper assessment and management of injuries involving the airway, C-spine and head. Removal may also be required if the helmet is loose fitting and interfering with proper immobilization. Balance the need for removal against the possibility of causing or exacerbating injury. Use judgement.

If the patient is conscious, and able to assist in helmet removal, request his/her cooperation; if the patient is unable to physically assist, they may be able to assist verbally by supplying advice regarding the helmet design, methods of removal, etc.

Quick Connect Spinal Immobilisation System

Provider Handout

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Ministry of Health and Long-Term Care
Emergency Health Services Branch

Ontario

Quick Connect Spinal Immobilisation System – Provider Handout

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Introduction:

The QC system utilizes anchoring pins and "clasp" straps to secure the patient to a spinal board. It is an immobilization method which is intended to provide rapid and safe immobilization for patients requiring spinal precautions, e.g. #1: suspected head/spinal injury; e.g. #2: patients requiring use of the QC system to assist in conveyance or positioning.

> It is anticipated that use of the system will facilitate safe immobilization of patients during adverse weather conditions, e.g. cold ambient temperature, rain, low light levels, etc.

The system has been field tested in many services within EHS. It has received positive evaluations from EMAs, Base Hospital Program Directors and Emergency Physicians.

The Instructional Goal of the session is: On successful completion of the training session, EMAs will be able to demonstrate correct spinal immobilization of the "patient" within four minutes.

Definitions:

Primary attendant:	designated EMA 1
Second attendant:	designated EMA 2
Safety strap:	a strap consisting of two pieces, each with a clasp and either a tang or receptacle buckle component.
Quick Connect Spinal Board:	Ministry of Health issue.
"Secure":	patient is secure such that no significant movement occurs during normal lifting and positioning, e.g. during lifting/transfer to a #30 cot, or board rotation to facilitate airway maintenance
B.A.P.	Buckle Assembly Point (B.A.P.) is the location at which the male (tang) and receptacle portions of the strap are connected. This point can be predicted by starting the strap assembly procedure with the receptacle part of the strap. The receptacle part of the strap has a fixed length.

Parts Explanation:

The QC system has several features which make it attractive for pre-hospital use.

1. **Board Design:** The board is covered in a "Phenalic" finish which is impervious to body fluids and which allows for rapid and effective clean up using house-hold cleaners and/or-bleach.

   There is a "shock absorber" located around the perimeter of the board to help protect the board from "contact" damage.

   The Retroreflective stripe located on the board aids in identifying the board in low light situation.

2. **Anchoring Pins:** The incorporation of fourteen integral anchoring pins within the spinal board allows for effective immobilization of a variety of patient body sizes.

   The pins allow x-ray penetration of the board.

   Each of the pins can support approximately 400lbs of weight.

3. **Strap Design:** Four safety straps are provided with each board. The straps have "clasps" on one end which are fitted to an anchoring pin as selected by the operator.

   On the other end of the strap is either a "tang" or "receptacle" (automotive style) buckle.

   The straps can support several times the board's breaking point when properly assembled. The maximum weight the board can support is approximately 400 lbs.

   The Quick Connect straps are similar to the straps that are used with the Quick Connect Scoop Stretcher. The simplicity of strap assembly should promote skill retention by the operator.

Application Procedure:

(Whenever possible, utilize a "third person" as another attendant during patient movement activity i.e. log-rolling, to help maintain spinal alignment.)

Part 1: Head and Neck Immobilization

i. EMA 2: applies gentle manual cervical stabilization

ii. EMA 1: applies appropriate size cervical collar

Part 2: Patient Positioning

iii. EMA 2: maintains head/cervical immobilization

iv. EMA 1: positions the spinal board along side the patient.

v. EMA 1: keeping the patients head/neck and back straight, smoothly rolls patient towards EMA 1 by lifting on the patients' hip and shoulder.

vi. EMA 1: quickly visually examines the patients back for injury.

vii. EMA 1: slides the spinal board to a location partially under the patient

viii. EMA's: smoothly lower the patient back down onto the board

ix. EMA's: position the patient in the centre of the board, keeping the patient's head/neck and back straight

Part 3: Applying Safety Straps

x. EMA 1: connect clasp of a safety strap to an anchoring pin over the patients' shoulder. Connect clasp of the other end of the safety strap to an anchoring pin along side the patients' hip. Repeat procedure for other side so that a cross-strap (X) pattern is formed across the chest.

xi. EMA 1: ensure (if not already assembled) that the tang end of safety strap buckles are inserted and locked into the receptacle part of the buckles. Snug up the straps so that the patient upper body is securely immobilized.

TAKE GREAT CARE THAT THE PATIENTS' BREATHING IS NOT RESTRICTED BY THE SAFETY STRAPS. DO NOT OVERTIGHTEN.

xii. EMA 1: connect clasp of a safety strap to an anchoring pin beside the patients' waist or hips. Connect clasp of the other end of the safety strap to an anchoring pin directly across and on the other side of the board (horizontal strap).

Repeat procedure to place a second horizontal strap across the patient's lower leg area (use the "indented" anchoring pins whenever possible).

xiii. EMA 1: ensure tang end of safety strap buckles are inserted and locked into the receptacle part of the buckles. Snug up the straps so that the patient is securely immobilised.

Part 4: Head/neck Immobilisation

xiv. EMA 1: places a rolled towel on each side of the patient's head. Secures the towels and the patient's head in place by attaching tape or a roll bandage across the patient's forehead and under the spinal board.

xv. EMAs: (For Training Purposes Only to check securement): lift patient from the ground to waist height and then lower back to the ground.

General Considerations

xvi. EMAs: all lifting procedures are to be verbalised/communicated to each other and the patient prior to commencement. Movements are to be smooth and coordinated.

xvii. EMA 1: EMAs should select the B.A.P. with consideration of the patient's build and injuries. Padding is to be placed under any contact areas that could cause discomfort to the patient, e.g. buckles.

Note: The system can be adapted for use with small sized patients e.g. the elderly or children by placing a rolled blanket along each side of the patient once he/she has been centred on the board. The padding should take up any slack in the strapping and thereby prevent significant patient movement.

Generally a figure-of-eight bandage is required around the patients' feet, to help keep the legs "in line".

Various patient injuries and call circumstances may require adapting the strapping system; however, patients should always be "secured".

Tips on Application Procedures

Immobilisation:

A roll of tape can be applied over the upper portion of the cervical collar if more securement is required. Take care not to position the tape over the patients chin (it may create an airway hazard by keeping the patient's mouth closed) and not to occlude the opening of the collar. Be prepared to manage the patient's airway if vomiting occurs.

Remember that a cervical collar alone does not provide adequate cervical immobilisation. Maintain manual stabilisation of the patient's head/neck until the full body is secured.

Always handle the clasps and buckles carefully to avoid inadvertent contact with rescuers or patients. A useful maxim is "ALWAYS TRY TO HAVE TWO HANDS ON THE STRAPS".

When snugging up the securement straps, grasping the strap on each side of the buckle will make the "action" smoother. Use additional straps if circumstances require additional securement.

If the buckle assembly is causing discomfort, the Buckle Assembly Point (B.A.P.) can be located along side the patient's hip by attaching the receptacle buckle and strap along side the patient's hip.

When securing a pregnant patient, position straps above or below the uterus; if the patient has a large and protuberant abdomen, straps may need to be positioned across the mid-abdomen or in the region of the umbilicus if the patient seems unbalanced or inadequately secured with straps above/below the uterus.

Take care to avoid sudden movements in order to reduce excessive abdominal pressure, and possible injury related to the straps.

Body Positioning:

Use of the scoop stretcher can often avoid a log-roll.

Try to position the patient's head/neck in neutral alignment. However if repositioning meets with marked resistance or precipitates pain, immobilise in the position found.

If the patient presents prone or semi-prone and:

1. is having difficulty breathing or apneic, reposition the patient immediately to provide airway and ventilatory care;
2. Presents with profuse bleeding from the mouth or nose, position the patient prone or semi-prone to facilitate drainage and reduce the risk of aspiration.

Do not apply padding if it will aggravate injuries i.e. misalign the spine.

Cot positioning:

Try to bring the cot as close to the patient as possible to minimise the distance the patient is carried.

Example of System Assembly Positions

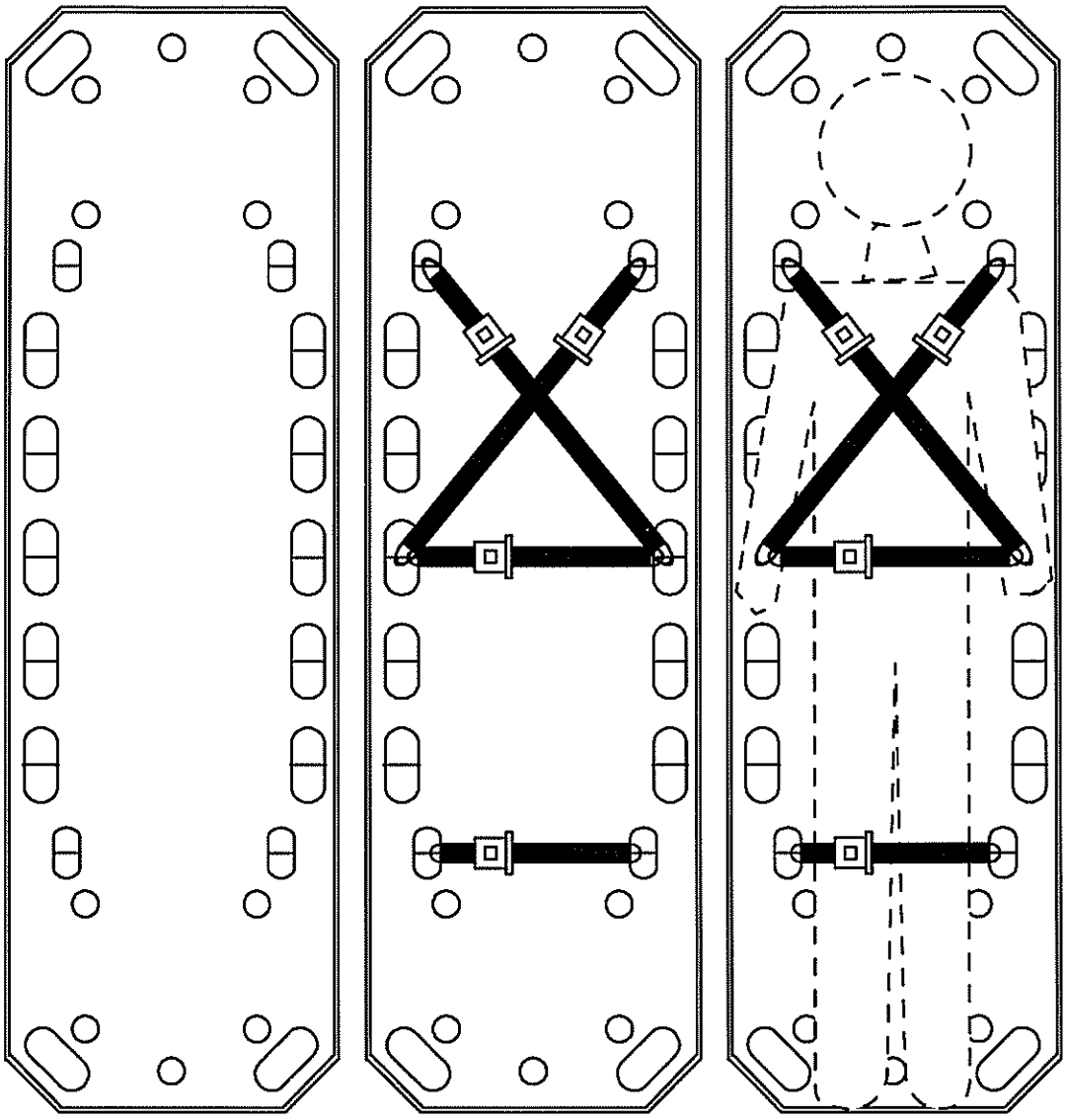


Illustration of Board | Illustration of Straps | Illustration of Straps on Patient

Major Steps:

1. Assess Patient/Cervical collar
2. Position Board
3. Roll Patient
4. Check Back
5. Slide Board under Patient
6. Lower Patient on Board
7. Centre Patient on Board
8. Apply upper Straps
9. Apply lower Straps
10. Complete Head Immobilisation

Strap positioning depends on patient size/injuries
(Cervical collar and head padding not shown)

CHAPTER 25

Injuries to the Spine

OBJECTIVES

1. Describe the implications of not properly caring for potential spinal injuries.
2. Relate the six common mechanisms of injury to the type of potential injury to the spine.
3. State 10 signs and symptoms of a spinal injury.
4. Describe the method of determining if a conscious and an unconscious patient may have a spinal injury.
5. Relate emergency airway techniques to the patient with a suspected spine injury.
6. Discuss the sizing and application of a cervical spine immobilization device.
7. Describe how to log-roll a patient with a suspected spine injury and how to secure him or her to a long backboard.
8. Describe when and how to perform a rapid extrication.
9. Discuss the circumstances when a helmet should be removed and outline the steps for the two methods of helmet removal.
10. Demonstrate a caring attitude toward the patient and family when dealing with injuries to the spine while giving priority to the interests of the patient.

INTRODUCTION

A major goal of EMS has always been the prevention of problems related to spinal injury. From the moment you arrive on the scene, consider the possibility of spinal injury and act accordingly. To appreciate the importance of this task, remember that failing to accomplish it can condemn a patient to life in a wheelchair or even to death. Failing to provide the precautionary care you are able to could result in civil litigation if it turns out that the patient did, indeed, have an injury that, left unprotected, resulted in disability or death.

SECTION 1 ANATOMY OF THE SPINE

The spinal cord lies within the spinal column. It is responsible for sending signals from the brain to the body and for receiving signals from the body and relaying them to the brain. If these signals are interrupted by injury or illness, a person could lose the ability to move, feel, or even breathe. (Review Chapter 4 for more on the musculoskeletal and nervous systems of the body.)

The spinal column is made up of 33 bones, one stacked on top of another. These vertebrae articulate, or fit and move together, so that we can bend, turn, and flex.

The spine is divided into five regions—the cervical, thoracic, lumbar, sacral, and coccygeal (Figures 25–1 and 25–2 on p. 372). The cervical spine starts at the base of the skull where the spinal cord begins. Its seven vertebrae not only house delicate nerve tissue but they also support the weight of the head. This makes them especially vulnerable to injury.

The thoracic spine is supported by the rib cage. There are 12 thoracic vertebrae, one for each set of ribs. Because the ribs help protect this part of the spine, it is less frequently injured.

The next group of five vertebrae make up the lumbar spine. They carry the weight of most of the body. For this reason they are heavier and larger. The discs between the lumbar vertebrae are thicker than in other parts of the spine. Sometimes, a disc can shift, slip, or rupture. Injuries to the lumbar spine cost millions of dollars in medical expenses and lost wages every year.

The last two regions of vertebrae are the sacral and coccygeal. The sacrum has five fused vertebrae.

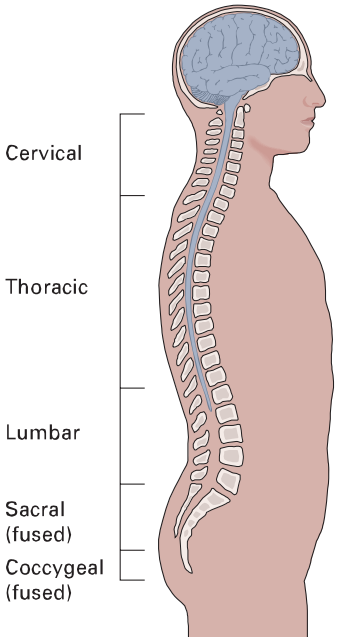


Figure 25–1 Regions of the spine.

The coccyx has four. Together they form the posterior portion of the pelvis. Because they are fused, these parts of the spine do not bend easily.

SECTION 2 SPINAL INJURIES

During scene assessment, you as an EMR must identify the mechanism that injured your patient. In doing so, you consider what occurred and what injuries may have resulted. Your index of suspicion for a spinal

CASE STUDY

DISPATCH

We were on foot patrol at the university football game. Just as the home team receiver looked as if he would score, his lone pursuer dove and hit the post head-first with full force.

SCENE ASSESSMENT

The coach and team trainer ran out onto the field. Almost immediately the trainer indicated he needed us there. We donned our gloves on the way.

When we got to the patient, we saw that the trainer was already stabilizing his head and neck. He quickly told us that the player appeared to be unconscious. We noticed the helmet was cracked along the top. We called for EMS support immediately.

PRIMARY ASSESSMENT

My partner and I assisted the trainer who was experienced in helmet removal. Then we used the jaw-thrust manoeuvre to open his airway. It was clear of blood and secretions. Breathing was adequate but irregular. We applied 100% oxygen by non-rebreather mask, using a small portable oxygen tank. The patient's pulse was strong and bounding, and his skin was warm and dry. No bleeding was noted. We carefully applied a cervical collar.

Consider this patient as you read Chapter 25. What else might be done to assess and treat his condition?

injury should be very high in any of the emergencies described below:

- Motor vehicle accidents (MVAs)
- Motorcycle crashes
- Pedestrian–car crashes
- Falls
- Diving accidents
- Hangings
- Blunt trauma
- Penetrating trauma to the head, neck, or torso
- Gunshot wounds
- Any speed sport accident, such as rollerblading, skateboarding, bicycling, skiing, surfing, or sledding
- Any unconscious trauma patient

Note that if the mechanism of injury suggests it (Figure 25–3 on p. 373), you should proceed as if the patient has a spinal injury—even if the patient says he or she is not injured at all. The absence of back pain and having the ability to walk, move arms and legs, or feel sensation does not rule out spinal injury.

TIP

Patients found hanging ideally require at least three rescuers to cut the rope and lower the patient to the floor if resuscitation is to be attempted without further injury. In addition to the cervical trauma, the hangman's fracture can cause severing of the spinal cord. Tracheal injury, causing airway complications, is also associated with hanging.

Patient Assessment

If you suspect spinal injury in your patient, you must protect the spine from further damage. Immediately upon completing your scene assessment, stabilize the patient's head and neck. Then assess the ABCs. Be sure to use the jaw-thrust manoeuvre to open and maintain the airway. Remember that a cervical spine injury can result in severe breathing problems, even respiratory arrest. Be sure to monitor the patient's airway and breathing continuously.

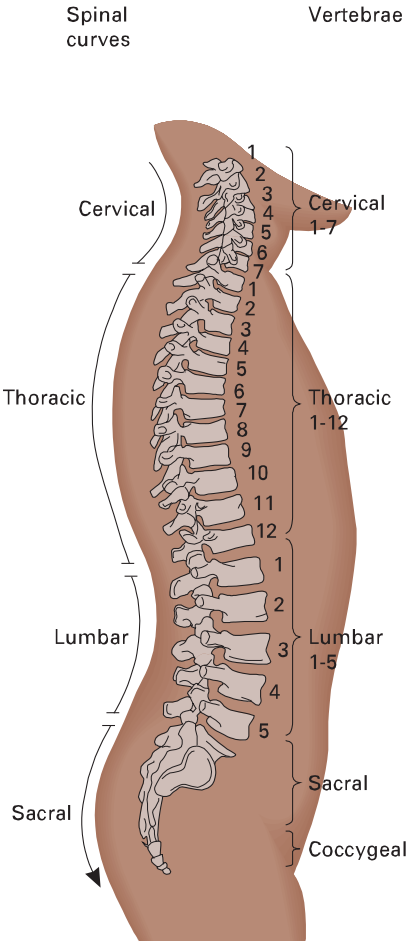


Figure 25–2 Curves and vertebrae of the spine.

There may be no signs at all of spinal injury. However, when they do appear, they typically include one or more of the following:

- Respiratory distress
- Tenderness at the site of injury on the spinal column
- Pain along the spinal column with movement (Do not move the patient or ask the patient to move to test for this pain.)
- Constant or intermittent pain, even without movement, along the spinal column or in the lower legs
- Obvious deformity of the spine (rare)
- Soft-tissue injuries to the head, neck, shoulders, back, abdomen, or legs
- Numbness, weakness, or tingling in the arms or legs
- Loss of sensation or paralysis in the upper or lower extremities or below the injury site
- Incontinence, or loss of bowel or bladder control
- Priapism, or a constant erection of the penis (a classic sign of cervical spine injury in men)

During the secondary assessment, do not risk moving the spine by taking off the patient's shirt or coat. Cut off the patient's clothes if necessary. Be sure to ask the patient if and where the spine hurts. Stop immediately if the patient complains of pain upon palpation of the spine. Continue the assessment of other areas of the body.

Assess pulses, movement, and sensation in all four extremities (Figure 25–4 on p. 374). To assess movement, ask the patient if he or she can move the hands and feet. Then have him or her squeeze both your hands at the same time. Gauge the patient's strength and decide if it is equal on both sides. Also, have the patient push his or her feet against your hands. Again, gauge strength and equality.

To assess sensation, gently squeeze one extremity and then the other. As you do, ask questions such as these: "Can you feel me touching your fingers? Can you feel me touching your toes?"

If the patient is unconscious, or unable to follow your instructions, apply a painful stimulus to check response. Either pinch the webbing between the toes and fingers or apply pressure with a pen across the back of a fingernail. The patient should withdraw from the pain. Note the response to pain in all four extremities.

After the assessment of the front of the patient, perform a log roll so that you can assess the back. However, do so only if you are trained in its use and have enough help to do so safely. Details on how to perform a log roll are provided later in this chapter. When performing the log roll, have a backboard ready to roll the patient back onto.

Remember that a patient may be uncomfortable, confused, and possibly afraid of paralysis or death. It is important for you to show a caring attitude. As you proceed with the secondary assessment, for example, be careful how you communicate your findings to your partner. A casual remark could terrify the patient. When you speak to the patient's family, be honest but do not alarm them unnecessarily.

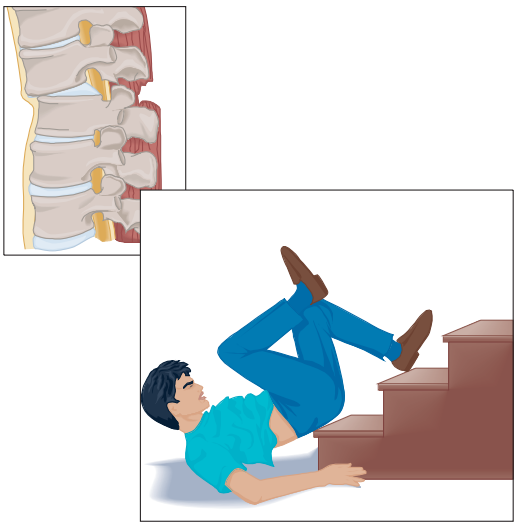
General Guidelines for Emergency Care

If the mechanism of injury suggests a possible spinal injury, stabilize the patient's cervical spine immediately. This means placing your gloved hands just behind the patient's ears. Then hold the patient's head firm and steady in a neutral, in-line position. *Neutral* means the head is not flexed forward or extended back. *In-line* means the patient's nose is in line with the navel.

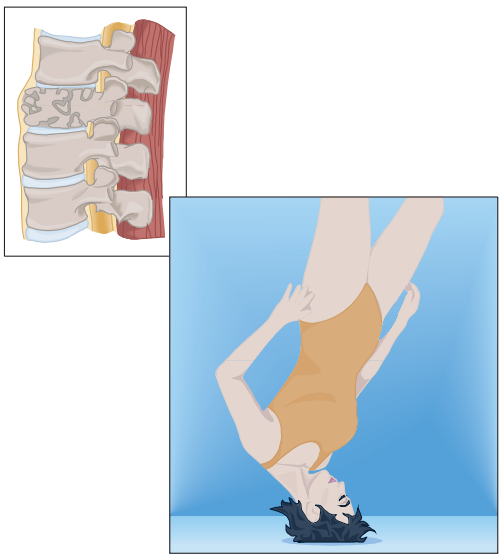
If you find that the patient's head is not in line, you must gently put it there. Stop at once if the conscious patient complains of pain or if you feel resistance in the unconscious patient. In this case, stabilize the head and neck in the position in which they were found.

Manual stabilization may be released only when the patient is immobilized from head to toe on a long backboard. When possible, have another rescuer

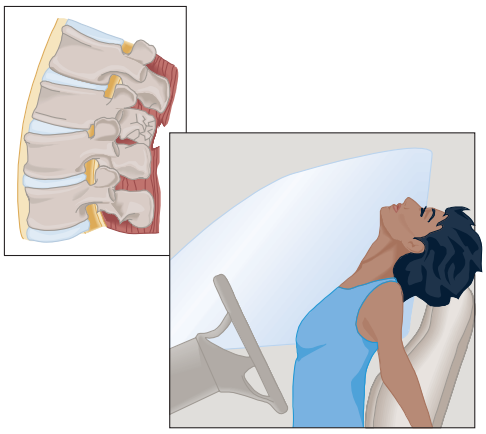
FLEXION INJURY



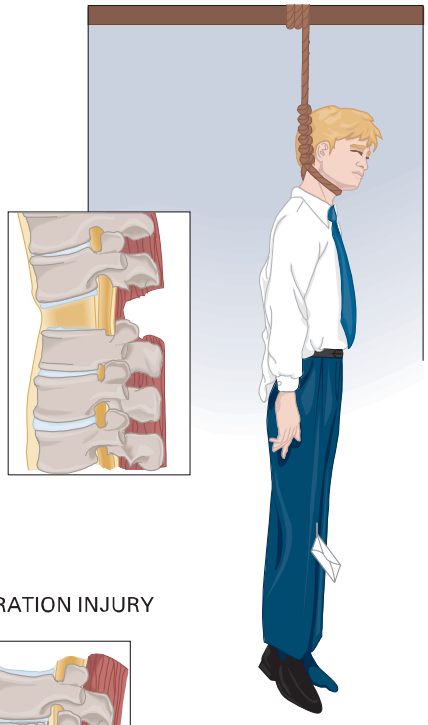
COMPRESSION INJURY



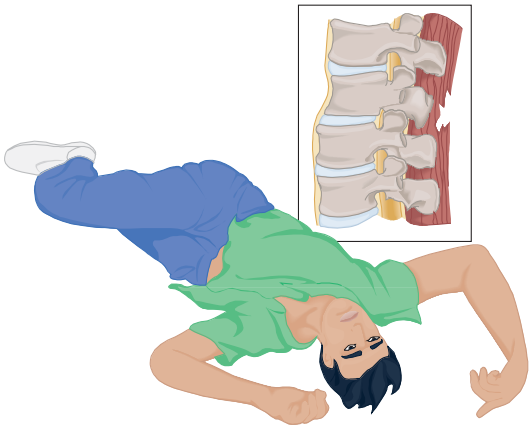
HYPEREXTENSION INJURY



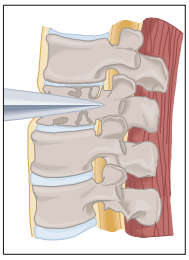
DISTRACTION INJURY



FLEXION-ROTATION INJURY



PENETRATION INJURY



ASSESSING PULSE, MOVEMENT, AND SENSATION

Figure 25-4a Feel for a pulse in all the extremities.

Figure 25-4b See if the feet and toes can move.

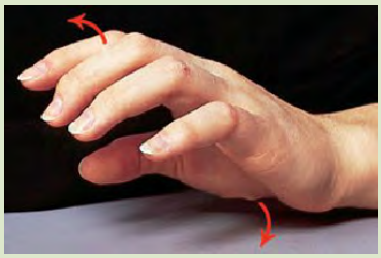


Figure 25-4c See if the hands and fingers can move.

Figure 25-4d Touch the toes to assess for sensation.

Figure 25-4e Touch the fingers to assess for sensation.

Figure 25-4f If the patient is unconscious, see if he or she responds to painful stimuli.

maintain manual stabilization so that you can be free to care for the patient.

In general, emergency care for a suspected spinal injury patient proceeds as follows:

1. Take BSI precautions. Observe the mechanism of injury.
2. Stabilize the patient's head and neck immediately (Figure 25–5). Keep the patient from moving.
3. Then perform a primary assessment and provide treatment. Be sure to open and maintain the airway with the jaw-thrust manoeuvre. Insert an oropharyngeal or nasopharyngeal airway if needed. Suction without turning the patient's head.
4. Provide high-flow oxygen via a non-rebreather mask. If the patient stops breathing or if breathing is inadequate, assist with artificial ventilation. Maintain neutral, in-line stabilization throughout.
5. Perform a secondary assessment and provide treatment. Be sure to monitor the patient's airway and breathing continuously.
6. Maintain manual stabilization until the patient is completely immobilized.

Immobilization Techniques

Many EMS systems allow EMRs to **immobilize** a suspected spinal injury patient. Even if your system does not, you may be called to assist the paramedics. Become familiar with the techniques. They include cervical immobilization, long backboard immobilization, rapid extrication, and helmet removal.

Remember: Never attempt to treat or move a spinal injury patient unless you have the proper equipment, training, and personnel.

Cervical Immobilization

After a primary assessment, a rigid cervical immobilization device, or extrication collar, should be applied to the patient (Figure 25–6). Various types are available. However, never use a soft collar in the field. They are nothing more than cotton-covered foam rings, which do not prevent movement of the head and neck.

Use rigid or hard collars in the field. They are designed to prevent the patient from turning, flexing, and extending the head. They can restrict movement by up to 70 percent. The remaining 30 percent must be accomplished by manual stabilization.

Follow the manufacturer's instructions for applying a cervical collar, or C-collar. Though instructions will vary, all collars are supported at the same points: the maxilla (jaw), shoulders, and clavicles. Note that failure to fit a patient properly can aggravate the injury.

Before application, be sure that jewellery and long hair have been moved away from the area. In addition, examine and palpate the patient's neck before the collar is applied.

In general, to apply a rigid cervical collar to a supine patient, follow these steps (Figure 25–7):

1. Slide the posterior portion of the collar into the gap under the patient's neck.

Figure 25–5 Manual stabilization means holding the patient's head firmly and steadily in a neutral, in-line position.

Figure 25–6 If you are allowed, apply a rigid cervical immobilization device to the patient.

APPLYING A RIGID CERVICAL IMMOBILIZATION DEVICE

Figure 25-7a

Figure 25-7b

NOTE: Do not use soft collars. Only use rigid cervical immobilization devices in the field. Also, do not use the chin piece as an anchoring point for the collar. This may cause hyperextension, which may injure the patient's cervical spine.

SIZING

It is critical to select a collar that is the correct size. Too tall can overextend the neck, force the jaw closed, and limit access to the airway. Too short can lead to inadequate immobilization. Too tight can impede blood flow. One way to measure collar size is to use your fingers to compare the neck size to the corresponding area of the collar.

Figure 25-7c

Figure 25-7d

Figure 25-7e

SEATED APPLICATION

The patient's chin must be well supported by the chin piece. To accomplish this, slide the collar up the patient's chest wall. If the collar is pushed directly inward, it may be difficult to position the chin piece and, therefore, to apply the collar tightly enough.

TIGHTENING

Grip the "trache" hole as you tighten the collar. Then check to see that the collar fits according to the manufacturer's instructions.

Figure 25-7f

Figure 25-7g

Figure 25-7h

SUPINE APPLICATION

Slip the collar underneath the patient's neck. Then rotate the collar up along the chest until the chin piece is properly positioned.

WARNING

Always check for neutral alignment and proper fit. Improper sizing or application may allow the patient's chin to slip inside the collar. This must be prevented.

2. Then flip the anterior portion over the chin.
3. Secure the collar with the Velcro strap. Be careful not to pull too hard on one end. It can twist the patient's head.

TIP

EMS professionals appreciate having their equipment as ready as possible for use. One idea that has dual benefits is to open your packaged cravats or triangular bandages, fold and wrap them in a ready-to-use fashion, and secure them with an elastic band. This band can also be used later to tie up a patient's long hair into a bun, which will enable you to have better access for assessment and treatment—including C-collar application—of a trauma patient.

If your patient is sitting, move the collar up the chest until the chin is trapped. Then slide the posterior portion around the back of the neck and fasten it. Whatever position your patient is in, you must maintain manual stabilization of the head and neck.

Release it only when the patient is completely immobilized on a long backboard.

Long Backboard Immobilization

All patients with suspected spinal injury must be immobilized onto a long backboard. To immobilize a supine or prone patient, you must first roll the patient onto the side, slip the board under him or her, and roll the patient back. This procedure is called a **log roll.**

To perform a log roll safely, you need at least three rescuers, preferably four, who are trained in the procedure. One should stay at the head to maintain manual stabilization and to coordinate the move. The other two should position themselves along one side of the patient's body. Proceed as follows (Figure 25–8):

1. Maintain manual stabilization of the patient's head and neck. Continue to do so until the patient is completely immobilized.
2. Apply a rigid cervical immobilization device.
3. Assess pulses, movement, and sensation in all four extremities.
4. Position the patient. Place the patient's arms straight down by the sides if possible.
5. Position the rescuers. At the signal of the rescuer at the head, the other two should reach to the far side of the patient. One rescuer should position his or her hands on the shoulder and the hip. The second rescuer should position the hands at the thigh and lower leg.
6. On signal, the rescuers should simultaneously roll the patient onto the side. Note that this is a good time to assess the patient's posterior if it has not been done already.
7. Position the board. A fourth person—another rescuer, a family member, or bystander—should push the board under the patient. If no one else is available, one of the rescuers at the side may lean over the patient, grab the backboard, and pull it under the patient.
8. On signal, the rescuers should simultaneously roll the patient back down and onto the board. If the patient is not in the middle of the board, gently pull the patient down and then up again until he or she is straight on the board. This is done at the shoulders and hips and by pulling in alignment with the long axis of the spine. Never push a patient over to the middle of the backboard.
9. Reassess pulses, movement, and sensation in all four extremities. Report any change to the incoming paramedics.

Once the patient is in place, pad the spaces between the patient and the board (Figure 25–9). For an adult, pad anywhere along the length of the body to maintain neutral alignment and provide comfort. For an infant or child, also pad under the shoulders. This is to keep the relatively larger head from flexing forward. Take care to avoid extra movement.

Your next step is to secure the patient to the long backboard. It should always be done in this order (Figure 25–10 on p. 379):

1. Immobilize the torso first. If you have to turn the patient laterally in order to facilitate vomiting during immobilization, a secured thorax better enables you to maintain alignment of the head and spine. If you turn a patient with only the head secured to the board, the thorax may compromise proper cervical alignment.
2. Immobilize the head next. The head must always be immobilized after the torso. Take a great deal of care not to lock the jaw in place. If the patient needs to vomit, the patient must be able to open his or her mouth.
3. Immobilize the legs last.
4. Withdraw manual stabilization of the head and neck.
5. Reassess pulses, movement, and sensation. Report any change to the incoming paramedics.

Short Backboard or Vest-Type Immobilization

You can use either a short backboard or vest-type device to help immobilize a seated patient. It minimizes the risk of further injury while the patient is being moved to a long backboard.

To apply a short backboard or vest to a seated patient, follow the steps outlined below. Remember to maintain manual stabilization throughout, until the

THREE-RESCUER LOG ROLL

Figure 25-8a Maintain the patient's head and neck in a neutral, in-line position.

Figure 25-8b Roll the patient onto the side.

Figure 25-8c A bystander or one of the three rescuers should move the long backboard into place.

Figure 25-8d Lower the patient onto the long backboard.

Figure 25-9 Pad the gaps between the patient and the board.

patient is completely immobilized. Proceed as follows (Figure 25–11 on p. 380):

1. Maintain manual stabilization of the patient's head and neck. If possible, hold the patient's head and neck from behind.
2. Apply a rigid cervical immobilization device.
3. Assess pulses, movement, and sensation in all four extremities.
4. Slide the device behind the patient. Slip it as far down into the seat as possible, but not below the patient's coccyx. The top of the short backboard should be level with the top of the patient's head. The body flaps of the vest should fit snugly under the patient's armpits. Try not to jostle the patient or the rescuer who is maintaining manual stabilization.

SECURING A PATIENT TO A LONG BACKBOARD

Figure 25–10a Immobilize the patient's torso first.

Figure 25–10b Immobilize the head next.

Figure 25–10c Finally, immobilize the patient's legs and feet.

5. Secure the patient to the device. Strap up the patient's torso first. If the device has leg straps, tighten those next. Finally, secure the patient's head. To make sure the head and neck remain in neutral alignment with the rest of the spine, you may need to pad behind them.

To move the patient to a long backboard, position it under or next to the patient's buttocks. Rotate the patient until his or her back is in line with it. Then lower the patient onto the long backboard. If you utilized a vest type of device, then you must release the leg straps before you secure the patient to the board.

Follow the instructions outlined above for securing the patient. Release manual stabilization when the patient is completely immobilized.

Rapid Extrication

In general, rescuers should move a sitting spinal injury patient only after short backboard immobilization. However, in certain emergencies, there is not enough time. A rapid extrication may need to be performed in the following circumstances:

- The scene is not safe. For example, there is a threat of fire or explosion, a hostile crowd, or extreme weather conditions.
- Life-saving care cannot be given because of the patient's location or position.
- There is an inability to gain access to other patients who need life-saving care.

In general, a rapid extrication must be performed by a team of three or more rescuers. The objective is to

SECURING A PATIENT WITH AN EXTRICATION VEST

Figure 25–11a Manually stabilize the head and neck. Then, apply a rigid cervical collar.

Figure 25–11b Position the extrication vest behind the patient.

Figure 25–11c Secure the torso and leg straps.

Figure 25–11d Pad behind the head if necessary and secure the head straps.

move a sitting patient to a long backboard with only manual stabilization of the spine. To do so, proceed as follows (Figure 25–12):

1. Bring the patient's head into a neutral, in-line position. This is best done from behind or to the side of the patient.
2. Apply a rigid cervical immobilization device.
3. Rotate the patient into position. Do so in several short, coordinated moves until the patient's back is in the open doorway and his or her feet are on the adjoining seat.
4. Bring the long backboard in line with the patient. It should rest against the patient's buttocks.
5. Lower the patient onto the long backboard and slide him or her into position in short, coordinated moves.
6. Secure the patient to the backboard. Release manual stabilization only when the patient is completely immobilized on a long backboard.

It may be necessary to hand off manual stabilization to someone else during the procedure. Be sure it is maintained continuously until the patient is completely immobilized. If the level of danger does not afford you even the time to apply a C-collar, remove the patient by using the shirt drag technique (see Figure 6–7 on p. 71), using your forearms to provide as much cervical stability as possible.

RAPID EXTRICATION

Figure 25-12a Bring the patient's head into a neutral, in-line position.

Figure 25-12b Apply a rigid cervical immobilization device.

Figure 25-12c Rotate the patient into position.

Figure 25-12d Bring the long backboard in line with the patient.

Figure 25-12e Lower the patient onto the long backboard.

Figure 25-12f Slide the patient into position in small steps and secure the patient to the backboard.

Helmet Removal

There are two basic types of helmets: motorcycle helmets and sports helmets such as those worn for football. Typically, a sports helmet has an opening in front that allows easy access to the patient's airway. For many, the face shield can be unclipped or snapped off for easy removal. A full-face motorcycle helmet, however, will prevent access to the patient's airway.

In general, if your patient can be properly assessed and the airway maintained, a helmet should be left in place. Do not attempt to remove a helmet by yourself. Wait for help. If it must be removed, follow these steps (Figures 25–13 and 25–14):

1. Stabilize the helmet to prevent movement. The rescuer at the head holds each side of the helmet and places his or her fingers on the lower jaw.
2. Loosen the chin strap. The second rescuer does this while the first maintains manual stabilization.
3. Transfer stabilization. To do so, the second rescuer places one hand on the mandible at the angle of the jaw. He or she then places the other hand at the back of the head.
4. Slip off the helmet about halfway. Be sure to pull it wide so it can clear the ears. The second rescuer then adjusts his or her hands in order to maintain alignment of the head.
5. Remove the helmet completely. The rescuer at the head then takes over manual stabilization until the patient is completely immobilized.

HELMET REMOVAL

Figure 25–13a Stabilize the helmet, head, and neck to prevent movement.

Figure 25–13b The second rescuer loosens the chin strap while the first maintains manual stabilization.

Figure 25–13c Transfer stabilization to the second rescuer.

Figure 25–13d Slip off the helmet about halfway while the second rescuer maintains an in-line position of the head.

HELMET REMOVAL (*continued*)

Figure 25-13e The second rescuer adjusts his or her hands to maintain manual stabilization.

Figure 25-13f When the helmet is completely removed, transfer manual stabilization to the rescuer at the head.

HELMET REMOVAL—ALTERNATIVE METHOD

Figure 25-14a Stabilize the helmet, head, and neck to prevent movement.

Figure 25-14b The second rescuer removes the chin strap while the first maintains manual stabilization.

Figure 25-14c The second rescuer removes the helmet. Full-face helmets will have to be tilted back to clear the nose.

Figure 25-14d Apply a rigid cervical collar, and maintain manual stabilization until the patient is completely immobilized.

EMR FOCUS

Even after a collision with heavy damage to the crash vehicles, there may be patients with a complaint of only minor pain or no pain at all. It is just as important to take spinal precautions with these patients as with patients who complain of pain. Never assume a patient is uninjured if the mechanism suggests injury. That is for the hospital physicians to decide.

An EMS instructor wrote this simple but powerful message on the chalkboard during an EMR class: "Quadriplegia is forever." (Quadriplegia is the inability to use any of the extremities because of a spinal cord injury.) Use caution with every patient who has a possible spinal injury. The consequences of not doing so are extremely serious!

CASE STUDY FOLLOW-UP

At the beginning of this chapter, you read that EMRs were caring for a male patient with possible head and spinal injuries. To see how the chapter skills apply to this emergency, read the following. It describes how the call was completed.

SECONDARY ASSESSMENT

The ETA of the ambulance was about three minutes. I began a secondary assessment as the team trainer carefully removed the patient's pads. My partner maintained manual stabilization and asked the coach about the patient's history.

My first obvious finding was a deformity and swelling on the top of the patient's head. Clear fluid and blood seeped out of his ears. His facial bones all appeared to be intact.

PATIENT HISTORY

The coach got the patient's medical history card from his pack at the sideline. It indicated that the player had no known allergies and that he did not take any prescribed medication. His last physical by the team doctor was unremarkable. He had no other significant past medical history.

The coach told my partner that the team players had eaten lunch about an hour before the game.

ONGOING ASSESSMENT

We maintained manual stabilization. Since the patient was unconscious and his respirations were somewhat irregular, we watched his breathing carefully. We also checked his pulse again. We radioed for the ambulance to bring immobilization equipment and to drive right onto the field.

PATIENT HAND-OFF

When the paramedics arrived, I told them what we knew:

> "This is Henry Jones, 21 years old. He struck a steel goal post, shattering his helmet and sustaining a head injury. He was unconscious upon our arrival, and that hasn't changed. His respirations have been irregular but deep. We'll have to assist his breathing soon. Pulse has dropped from 80 to 56. We removed the helmet and pads with the assistance of the trainer. We manually stabilized his head and neck the whole time. The coach has his history—nothing of note."

We helped to log-roll the patient onto a long backboard. The paramedics radioed the trauma centre to report a possible neurosurgical emergency.

Head and spinal injuries are among the most devastating injuries a patient can suffer. Always be alert to the possibility that an injury to the spine may have occurred. Do everything you can to protect it from further harm. Remember, if the mechanism of injury suggests it, treat for it.

NOCPs

3.2 Secure patient safely to applicable equipment **S**

5.7 Immobilize suspected fractures involving axial skeleton **S**

REVIEW QUESTIONS

Page references where answers may be found or supported are provided at the end of each question.

SECTION 1

1. Which of the five regions of the spine is most vulnerable to injury? Why? (p. 370)

SECTION 2

2. What are five emergencies in which your index of suspicion for spinal injury should be high? (p. 371)
3. When should you begin manual stabilization of the cervical spine? When may you release it? (p. 372)
4. What is the basic emergency care for a suspected spinal injury patient? (p. 375)
5. Under what circumstances would rapid extrication be appropriate? (p. 379)
6. When should a helmet be left in place? (p. 382)
7. How many rescuers are required to properly perform helmet removal? (p. 382)