Assessing Patients in the Wake of Motor Vehicle Accidents

Urgent message: Patients presenting to urgent care in the wake of a motor vehicle accident have self-selected their treatment setting. However, it is imperative to maintain vigilance for potentially serious and even life-threatening injuries that may not be apparent.

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According to the National Center for Health Statistics, motor vehicle accidents (MVAs) accounted for nearly 5 million ED visits in 2006. The diverse injuries may be temporary, debilitating, or life-threatening (**Table 1**).

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In the urgent care setting, most victims of MVAs present on their own, sometimes even several days after the accident. Thus, our patients tend to be victims of low-speed, low-impact accidents who have presumed their injuries to be minor; however, this may not always be the case. It is vital that we not be lulled into a false sense of security; nor should we rush to expensive, in-depth radiological work-ups.

This article will summarize an urgent care approach to chief complaints in patients who present to the urgent care center after a motor vehicle accident.

Chief Complaint and History of Present Illness

It is essential to have your patients describe the details of the accident in depth. This is an important part of the evaluation, as it provides a context for their physical complaints and may give clues to the correct diagnosis. Some important questions to ask are:

- Was the patient the driver or a passenger?
  - If a passenger, in the front or back seat?
- What was the nature of the accident (e.g., head-on collision, rear-ended, rollover)?
- Was the patient wearing a seatbelt?
- Were the airbags deployed?
- How fast were they and the other car driving?
- Was there passenger space intrusion?
- Did the steering wheel collapse?
- Was the windshield broken?
- When did the accident occur?

Obviously, our threshold for ordering more extensive studies or referring our patients to the emergency room for further evaluation would be lowered in those describing a high-speed, high-impact accident with extensive damage to the vehicles. Furthermore, some complaints are more high risk than others and should prompt us to approach them thoroughly and carefully.

Table 1. Common MVA Injuries

Face and head	Scrape, bruise, laceration, fracture, temporomandibular joint injury, dental injury
Brain	Concussion, post-concussion syndrome, closed head or traumatic brain injury
Neck	Sprain, strain, whiplash, fracture, cervical radiculopathy, disc injury
Shoulder and arm	Laceration, sprain, strain, fracture, dislocation, rotator cuff injury
Back	Sprain, strain, fracture, disc injury, lumbar radiculopathy
Leg, knee, foot	Laceration, sprain, strain, fracture, dislocation, ligament injury
Psychological	Post-traumatic stress disorder, acute stress reaction

Source: *www.all-about-car-accidents.com/car-accident-injuries.html*.

Headache

Post-traumatic headaches are estimated to occur in 25% to 78% of patients with a mild traumatic brain injury (TBI); in the United States, 45% of TBIs are caused by MVAs.[1,2] The differential diagnoses of these headaches range from benign etiologies such as post-concussive syndromes, tension, or migraine, to more serious and potentially life-threatening ones such as epidural hematomas, subdural hematomas, or injuries of the carotid or vertebral arteries.

It is incumbent upon us to seek out details that may cause concern in the history and exam.

The post-MVA headaches that we see most commonly in the urgent care center are tension headaches, which can be related to simple cervical strains. Often, these present as a persistent throbbing headache; unfortunately, this is nonspecific and does not rule out a more serious cause which can present in a delayed fashion. Therefore, the examiner should look for concerning physical signs, such as extensive bruising and hematomas of the scalp, as well as a hematoma or bruit over the lateral neck.

Epidural hematomas

Epidural hematomas present in 5% to 10% of patients with severe head injuries. A brief loss of consciousness at the time of the accident or an alteration in behavior may be the only clue to an epidural or subdural hematoma. Other signs and symptoms, such as headache, dizziness, unsteady gait, lack of awareness of surroundings, nausea, and vomiting may develop gradually.

The classic presentation is a patient who loses consciousness from the initial concussion, gradually recovers over a few minutes, and enters the "lucid interval" where they may be neurologically intact. Accumulation of blood from the lacerated artery may compress the brain and cause a shift, leading to a declining level of consciousness and eventually a second loss of consciousness with herniation and death. There can be a very short window of opportunity to intervene; this is considered a true emergency.

Subdural hematomas

Subdural hematomas may be acute, subacute (six to 20 days after trauma), or chronic (>20 days after trauma). The patterns vary, but most patients present with headache, a decreased level of consciousness, or focal neurological deficits. The initial injury may cause a small amount of bleeding and go unnoticed. If sufficient further bleeding occurs, intracranial pressure may rise and cause herniation.

Subacute or chronic hematomas may be difficult to diagnose, as the symptoms may be non-specific, such as headache, irritability, poor balance, and concentration. On occasion, the patient may not recall the trauma or associate it with the current symptoms.

Post-concussive syndrome

Post-concussive syndrome is a common sequela to traumatic head injuries, and may present with headaches, dizziness, inability to concentrate, or irritability that may persist for several weeks following the injury. This can be a diagnosis of exclusion, as these patients may need neuroimaging and further testing initially to rule out intracranial bleeding. Treatment is supportive with reassurance and education.

Assessment and discharge

Since recognizing the patients who are at risk for life-threatening or chronic injuries may be challenging, guidelines have been established on who requires imaging. One of these is the Canadian head CT rule described in **Table 2**.

When outpatient observation is appropriate, the pa-

tient should be sent home with a caregiver and explicit instructions provided. Medical help should be sought immediately if any of the following occurs:

- Inability to wake the patient
- Severe or worsening headache
- Somnolence or confusion
- Restlessness or seizures
- Changes in vision
- Vomiting, fever or stiff neck
- Weakness or numbness

Neck Pain

A detailed history and physical, as well as consideration of radiography, are essential in the evaluation of the patient with posttraumatic neck pain. Such a patient should be observed for movement and resting posture of the head and neck.

It is important to palpate the trapezius and paraspinal muscles to assess for tenderness and muscle spasms, and each spinous process should be palpated individually down the cervical spine for point tenderness.

Cervical range of motion is an important, objective observation that should be recorded. It appears to be an important predictor of outcome in patients with whiplash injury, as well as a useful tool in measuring subsequent recovery.[3]

Normally, the cervical spine can rotate an average of 90°, bend an average of 45° laterally, forward flex to 60°, and extend backwards 75°.

The most common injury seen in patients who present to urgent care with neck pain after an MVA is a self-limiting myofascial strain. Cervical strain—frequently referred to as whiplash—occurs with the abrupt flexion/extension movement of the cervical spine. Abrupt movement from one side to the other and rotational trauma can be involved.

Symptoms include pain, spasm, loss of range of motion, and, often, an occipital headache. The pain is usually midline or paraspinous, and may be referred to the shoulders, periscapular region, or occiput.

One should always be concerned about missing an injury to the vertebral column or the spinal cord. In a patient with severe pain, restricted range of motion, or radicular symptoms, consideration should be given for advanced imaging, as plain films are often inadequate to answer the question at hand. When there is a concern for bony abnormalities without cord injury, CT scanning is often preferred. When there is concern for cord injury because of signs and symptoms such as bilateral paresis or paresthesia, MRI is often preferred.

A negative neurological examination indicates a low likelihood of significant neurologic injury, but the history, physical, and plain films are not sensitive enough to rule out a potentially unstable injury when the index of suspi-

Table 2. Canadian CT Head Rule

Head CT is required for patients according to the risk categories below.

High risk (for neurological intervention)
- Glasgow Coma Scale (GCS) score <15 at 2 hours post injury
- Suspected open or depressed skull fracture
- Any sign of basal skull fracture*
- ≥2 episodes vomiting
- Age ≥65 years

Medium risk (for brain injury on CT)
- Amnesia before impact ≥30 minutes
- Dangerous mechanism†

Rule is *not* applicable if:
- non-trauma case
- GCS <13
- age <16 years
- coumadin or bleeding disorder
- obvious open skull fracture

*Signs of basal skull fracture = hemotympanum, "raccoon" eyes, CSF otorrhea/rhinorrhea, Bettle's sign
†Dangerous mechanism = pedestrian struck by vehicle, occupant ejected from motor vehicle, fall from elevation ≥3 feet or 5 stairs

Note that patients with neurologic deficit, seizure, presence of bleeding diathesis, or oral anticoagulant use were excluded in the population in which these criteria were originally developed and tested. The presence of any of these may also be an indication for head CT.

Source: Stiell IG, Wells GA, Vandemheen K, et al. The Canadian CT head rule for patients with minor head injury. *Lancet*. 2001;357:1391-1396.

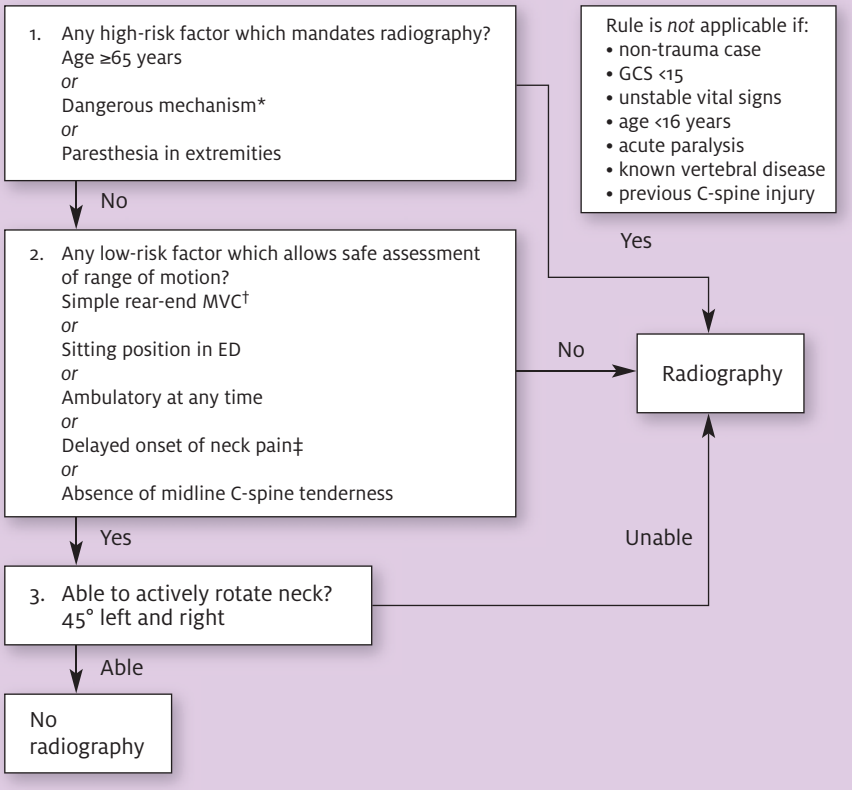
Table 3. NEXUS Low-Risk Criteria

Radiography is unnecessary in patients meeting *all five* of the following criteria:

1. Absence of posterior midline cervical tenderness
2. Normal level of alertness
   - Altered level of consciousness is defined as:
     - GCS score <15
     - disorientation to person, place, time, or events
     - inability to remember three objects at five minutes.
     - delayed or inappropriate response to external stimuli
3. No evidence of intoxication
4. No abnormal neurologic findings
5. No painful distracting injuries
   - Painful distracting injuries include:
     - long bone fractures
     - visceral injury requiring surgical consultation
     - crush injuries
     - large lacerations or burns
     - any injury that has the potential to impair the patient's ability to appreciate other injuries

Figure 1. Canadian C-spine (CCS) rule.

For alert (GCS=15) and stable trauma patients where cervical spine injury is a concern.



*Dangerous mechanism = fall from elevation ≥3 feet or 5 stairs; axial load to head (e.g., diving); high-speed MVA (>62 mph), rollover, ejection; motorized recreational vehicles; bicycle struck or collision.
†Simple rear-end MVA excludes = pushed into oncoming traffic; hit by bus/large truck; rollover; hit by high-speed vehicle.
‡Delayed = not immediate onset of neck pain.

Source: Stiell IG, Clement CM, McKnight RD, et al. *N Engl J Med.* 2003;25;349(26):2510-2518.

cion is high. This may, of course, require transfer to an ED.

Clinical decision rules

Two clinical decision rules, the NEXUS Low-risk Criteria (NLC) and the Canadian C-Spine Rule (CCS), have been well validated to help determine the need for cervical spine imaging.

The NLC (**Table 3**) states that radiography is unnecessary in patients who demonstrate all five characteristics spelled out in the rule. The NLC's sensitivity and specificity was found to be 99.6% (95% CI 98.6-100) and 12.9% (95% CI 12.8-13.0),[5] respectively.

The CCS (**Figure 1**) identifies patients who are in need of radiography. Its sensitivity was found to be 99.4% (95% CI 96-100) and its specificity 45.1% (95% CI 44-46).[6]

Chest Pain and Blunt Chest Trauma

The chest houses multiple organs that are at risk for many serious injuries. Direct trauma, rapid deceleration, and other mechanisms may lead to chest wall injuries, including rib fractures, cardiovascular contusion, aortic injury, pulmonary contusions, lacerations, or pneumothorax.

Risk factors for severe thoracic injury include high speed, no seat belt use, extensive vehicular damage, and steering wheel deformity. Inquiring about contact with the steering wheel, chest pain, palpitations, or trouble breathing is also important to the history. A complete visual inspection should be done, looking for a paradoxical movement of the chest wall, and identifying all wounds on the chest and back. The exact location, appearance, number, and type of wounds should be noted and well documented.

Auscultation for absent or diminished breath sounds may indicate a pneumothorax or hemothorax.

Palpation of the chest wall should be done carefully, feeling for subcutaneous emphysema or bony crepitus.

An electrocardiogram should be performed in all patients with anterior chest trauma, pain and tenderness directly over the mid-anterior chest, and in those patients with a history or active signs and symptoms suggestive of cardiac disease, as well as in the elderly. Findings concerning for cardiac contusion include unexplained persistent tachycardia, new bundle branch block (with right BBB being the most common), or dysrhythmia. These patients should be admitted for cardiac monitoring.

Life-threatening injuries

While most patients with blunt cardiac and pulmonary injury will die in the field, some life-threatening injuries, such as transection of the aorta, may have a delayed presentation.

Patients with a history of a rapid deceleration injury should be evaluated with a chest x-ray and possibly a chest CT, especially if the patient has persistent pain or dyspnea. In patients who appear clinically stable without a concerning mechanism of injury, further evaluation may not be necessary, with the exception of obtaining an ECG.

However, if the symptoms are severe or if there are worrisome findings on the chest x-ray, such as multiple rib fractures, hemo-pneumothorax, pulmonary contusion, or a wide mediastinum, the patient should be transferred to the ED for further evaluation.

Typically non life-threatening injuries

More common injuries in the ambulatory MVA patient are chest contusions, rib fractures, and occasionally a pneumothorax. A study done on alert blunt trauma patients presenting to the ED found that multiple rib fractures (> two ribs) was the most common serious thoracic injury, occurring in approximately 5% of patients.[7]

Multiple rib fractures can be a predictor of more serious injuries. Specifically, patients with pain of the lower ribs with pleuritic complaints *and* abdominal pain are at higher risk for both significant intra-thoracic and intra-abdominal injuries.[8] These patients should be assessed for hypoxia, tachypnea, abnormal lung sounds, and discomfort on the abdominal exam, with further work-up pursued accordingly.

The risk of serious injury is low among alert patients without discomfort, dyspnea, or tenderness. After thorough evaluation and risk assessment, the patient should be informed of the possibility of delayed presentations and discharged with specific instructions that include the need to return or go directly to the ED if severe pain, difficulty breathing, or lightheadedness develops.

Abdominal Pain and Blunt Abdominal Trauma

MVAs are the most common cause of blunt abdominal trauma (BAT) in the urgent care setting. Solid organs may be lacerated, vessels may be disrupted, or a hollow viscus may rupture, depending on the extent of the trauma. Splenic injury is the most common significant injury.

In alert patients without distracting injuries, the most

reliable symptoms and signs of BAT are pain, tenderness, or peritoneal signs. Patients with visceral injury present with local or general abdominal tenderness in 90% of cases—however, these signs are not specific; intra-abdominal injury can occur in conscious patients without significant tenderness.[9,10] The likelihood of intra-abdominal injury is low, however, if the patient is alert, hemodynamically stable, and free of abdominal pain and tenderness on exam.

The abdominal wall should be evaluated for ecchymosis, distension, and decreased bowel sounds. It has been found that bruising over the abdominal wall in the distribution of the seat belt indicates intra-abdominal injury in up to one-third of patients.[11] Abdominal distention may be a result of an ileus or gastric distention, while decreased bowel sounds may result from chemical peritonitis caused by blood or a ruptured hollow viscus.

Studies have shown the accuracy of the physical examination in BAT to be only 55% to 65%[12]; therefore, this should be coupled with observation over time and the use of specific diagnostic tests. Laboratory studies should be individualized to each patient, with the recognition that there may be nonspecific elevations of various enzyme levels in the setting of trauma.

A pregnancy test should be considered in all women of childbearing age.

Urinalysis should be considered, as microscopic hematuria associated with abdominal tenderness has been shown to be 64% sensitive and 94% specific in predicting intra-abdominal injury by abdominal CT.[13] There is no consensus, however, on the significance of microscopic hematuria in the asymptomatic patient. In the asymptomatic patient, close follow-up and a repeat urinalysis may be sufficient, while performing additional studies if the hematuria persists. Acute evaluation in the ED setting is advisable.

If there is suspicion of an abdominal injury, the patient should be referred for an ultrasound; this is considered first line in the stable patient because it is less invasive, requires no radiation or contrast, and has a 65% to 95% sensitivity in detecting as little as 100 ml of intraperitoneal fluid.[14,15] Abdominal CT scan should then be used if the ultrasound shows evidence of fluid, or if there is suspicion of injury to the solid organs.

Hollow viscous injuries such as small bowel perforations, which can present in a delayed fashion, require evaluation in the ED. This injury can be associated with the "seatbelt sign" of abdominal ecchymosis.

Conclusion

While patients involved in a major MVA will usually be evaluated in the emergency room, it is important to recognize the range of potential injuries and possible delayed presentations of life-threatening illnesses that may present to your urgent care center. As always, the thoroughness of the history and physical examination is crucial and should be used to direct appropriate radiography, diagnostic tests, and referrals.

Furthermore, the physician should be aware that the medical record could become a part of the *legal* record. Therefore, it is prudent to document each MVA visit meticulously, including the patient's complaints in his or her own words, as well as objective findings using diagrams and pictures when deemed necessary.

It is hoped that familiarity with the associated injuries that we may encounter in the urgent care setting will lessen that uncomfortable feeling we, as practitioners, often experience when evaluating a victim of a car accident.■

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