

# The Alberta College of Paramedics



Alberta Occupational Competency Profile (AOCP)  
Upgrade "Gap" Training Program

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Emergency Medical Responder (EMR)

## Trauma and MCI Module

Study Guide

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# Acknowledgements & General Information

## INTRODUCTION

The overall goal of this program is to provide standardized upgrade “gap” education to ensure that all regulated practitioners of the Alberta College of Paramedics (College) meet the *Health Professions Act*, Paramedic Regulation and the scope of practice as defined by the Alberta Occupational Competency Profiles (AOCP) for the profession.

The Alberta Occupational Competency Profiles (AOCP) were developed through the facilitation of Dr. Bill DuPerron of Alberta Health and Wellness. Many College regulated practitioners were involved in compiling and organizing information about the roles and functions of paramedics, emergency medical technicians and emergency medical responders into the Profile.

The completion of the AOCP for the College is an important milestone for the profession. The document is a result of a collaborative partnership with the College and Alberta Health and Wellness plus the work and effort of members of the College.

The Competency Profile describes the vast expanse of competencies in Alberta at the present time as well as additional changes in scope of practice, which are identified in the Upgrade “Gap” Training Program. Each module in the “Gap” Training Program covers the additional competencies for a specific Competency Cluster as identified in the AOCP for each of the three disciplines regulated by the College. The Profile includes the knowledge, skills, attitudes, and judgments related to a variety of roles held by registered practitioners of the College.

## BACKGROUND

The Health Professions Act (HPA) governs all regulated health professions in Alberta. The HPA was passed by the Alberta Legislature in May 1999 and in December 2001 the Order in Council proclaiming the Health Professions Act was signed by the Lieutenant Governor.

The HPA replaces a regulatory system (the *Health Disciplines Act*) that included multiple statutes that had different registration, continuing competence and investigation and disciplinary processes. Under the HPA, previous legislated exclusive scopes of practice will be eliminated and replaced with an “overlapping scope of practice” model based on restricted activities. Restricted activities are health services that only authorized persons may provide.

## STRUCTURE OF THE HPA

The HPA will deal with processes such as registration, continuing competence, professional conduct, restricted activities, investigation and discipline that apply to all the professions. Each of the 28 professions will have their own regulation that will address in detail, profession specific areas such as required

qualifications for entry into the profession. The Paramedic profession is expecting to be governed by the HPA in the near future.

### **ABOUT THE AOCF**

Most of the competencies have been learned in basic education; other competencies have been acquired through advanced education, on the job training, and experience. All EMRs, EMTs and EMT-Ps have the basic competencies; however, competency on the job will vary depending on job requirements, and policy and procedure of the employing agency.

The Profile provides a cumulative view of the competencies within the Scope of Practice and within the general and specialized areas of that practice.

The College has developed the following educational module for upgrading the knowledge and skills of registered practitioners to meet the Alberta Occupational Competency Profiles (AOCF), the new Regulation and scope of practice.

### **HISTORY OF THE PROCESS**

On March 4, 2000, the Paramedic Association of Canada adopted the National Occupational Competency Profile (NOCP), which included both a new classification and generic competencies for four professional designation levels of Paramedicine.

On March 22, 2000, the Alberta College of Paramedics' Council made the commitment that the Alberta College of Paramedics AOCF would meet or exceed the NOCP.

### **ACKNOWLEDGEMENTS**

Alberta College of Paramedics  
Continuing Competency Ad Hoc Education Committee Members:

Douglas Britton, MEM, EMT-P, Chair  
Renee Linssen, EMR, Vice-Chair  
William Coghill, MEM, EMT-P, CHCA  
Ruth Farrow, EMT-P, MLT  
Christine Patterson, MEM, EMT  
Richard Poon, BSc., EMT-P, MEd  
Marilyn Ringness, BSc., EMT-P  
Barry Straub, EMT-P

Donna Lefurgey, CEO/Registrar  
Laurie Mitchell, Registration Division Leader

### **Package Development and Design**

Portage College Prehospital Care Programs  
Lac La Biche, Alberta

In collaboration with...  
Alberta College of Paramedics  
Continuing Competency Ad Hoc Education Committee

## **Module Creation and Research**

Portage College Prehospital Care Programs  
Lac La Biche, Alberta

In collaboration with...  
Alberta College of Paramedics  
Continuing Competency Ad Hoc Education Committee

## **About the Authors (Portage College)**

Portage College (formerly Alberta Vocational Center, Lac La Biche) was established in 1968. The College currently offers over 30 certificate and diploma programs in six areas of study: Business, Human Services, Native Cultural Arts, Trades and Technical, Health and Wellness and Academic Upgrading. Over 1800 students are served annually through campuses in 13 northern Alberta communities, with another 1,300 taking short term or customized training programs each year.

Portage College has been offering prehospital care training program since the mid 1980s. Portage College is currently approved by the Alberta College of Paramedics for the following Paramedicine programs:

Emergency Medical Responder (EMR)  
Emergency Medical Technician (EMT)  
Emergency Medical Technologist-Paramedic (EMT-P)

## **Disclaimer**

Portage College and the Alberta College of Paramedics have attempted to ensure that the information is in context relevant to the practitioner and is as concise as possible. Portage College has used a variety of resource materials in order to provide a solid base of up-to-date information.

If any of the information contained within this module contradicts the direction you have received from your employer/medical director, the policy of your employer should take precedence over the information in this module.

As a regulated practitioner of the Alberta College of Paramedics, while under the *Health Disciplines Act*, you may only deliver health services which fall within your scope of practice and is in accordance with the provisions of the *Health Disciplines Act* or the *Health Professions Act* when the HPA is implemented.

**Any content contained in this module that is beyond your scope or not within your current competence does not authorize you to deliver those health services. That is, if a given health service is not within your scope of practice and/or you have not yet attained the competency, you may not deliver that health service.**

# Alberta Occupational Competency Profile (AOCP) Training Program

## **Learning Goal**

This educational training is intended to review and upgrade the competencies of The Alberta College of Paramedics registered practitioners in order to meet the requirements of the new regulation under the Health Professions Act (2000) including the Alberta Occupational Competency Profile (AOCP) and scope of practice.

## **Program Objective**

To provide standardized education to registered practitioners to ensure that all regulated members of the Alberta College of Paramedics meet the regulation and defined scope of practice for the profession.

## **Program Format**

The Alberta Occupational Competency Profile (AOCP) training program will combine independent study modules and scheduled lab skills assessment sessions. Certification will be granted on successful completion of all program requirements.

## **Independent Study Modules**

There are three EMR – AOCP continuing education modules to be completed.

1. Pharmacology
2. Airway Management
3. Trauma & Multiple Casualty Incident (MCI)

## **Lab Skill Assessment**

All skills identified for each module will be assessed during the lab skills assessment for that module.

## **Exam**

Mastery of the each module's content will be assessed through multiple-choice exams during the lab sessions. These exams are open book and can be found in each module following the module summary.

## EMR – Trauma & MCI Competencies

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This module meets the following competencies of the Alberta Occupational Competency Profile (AOCP).

### **I-6 Perform External Hemorrhage Control**

I-6-1 Demonstrate the knowledge and ability to control venous / arterial external hemorrhage through use of, including, but not limited to:

- Direct pressure
- Elevation
- Pressure dressing
- Pressure point
- Cold therapy
- Tourniquet
- Patient position – Trendelenburg's

### **1-8 Perform Spinal Motion Restriction**

I-8-1 Demonstrate the knowledge and ability to perform full spinal motion restriction utilizing appropriate equipment, including, but not limited to:

- Spine boards
- Head restraints
- Cervical collars

### **I-9 Perform Splinting**

I-9-1 Demonstrate the knowledge and ability to apply splinting, including, but not limited to:

- Traction splints
- Improvised splints
  - Pillows
  - Blankets
  - Kendrick Extrication Device (KED) / XP1
- Sling and swathe
- Wood splints
- Vacuum splints
- Air splints
- Wire splints
- Speed splints

**H-18 Multiple Casualty Incident (MCI)**

- H-18-1 Demonstrate the ability to apply principles of clinical decision making in a multiple casualty incident (MCI).
- H-18-2 Identify the principles of triage and the necessary components utilizing the Incident Command System:
  - Triage
  - Treatment
  - Transportation
  - Incident Command System (ICS)
  - Communication
- H-18-3 Demonstrate the ability to assume and function in the various multiple casualty incident roles.
- H-18-4 Demonstrate knowledge of management of a multiple patient situation.

# Trauma & MCI Module Overview

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## Introduction

Competent management of trauma patients is of the utmost importance due to the potentially life threatening injuries that can be sustained. The EMR must be well prepared to deal with the myriad of problems that he/she will be faced with when arriving on the emergency scene. The worst-case scenario is a mass casualty incident where there are not enough resources to care for all of the patients at the same time. In this situation, the EMR must be prepared with a triage and patient management system that is well known and rehearsed. In this module, we will review the management of the trauma patient and provide you with the fundamentals required to manage a multiple casualty incident.

## Learning Objectives

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Upon completion of this module the EMR will be able to

1. Define the correct approach to the trauma patient requiring spinal motion restriction.
2. Discuss and perform all aspects of hemorrhage control.
3. Demonstrate the knowledge and correct application of traction splints.
4. Define the correct approach to the multiple casualty incident using the START triage system and identify the necessary components utilizing the Incident Command System.

## Learning Activities

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### **Recommended Resources**

Each module identifies specific content students must cover to meet the module learning objectives.

### **Key Terms**

Students are to define the *Key Terms* identified for each learning objective.

### **Exam**

Mastery of the module content will be assessed through a multiple-choice exam during the lab sessions. This exam is open book and can be found in this module following the module summary.

### **Lab Skills Practice**

Students are to review the skills identified in the *Lab Skills Checklist* provided in Appendix A. Review of these checklists is essential preparation for the lab skill assessments, which are mandatory for successful completion of this module.

## Objective 1

### Define the Correct Approach to the Trauma Patient Requiring Spinal Motion Restriction.

The goal of this lesson is to review the proper approach and management of the trauma patient requiring spinal motion restriction. Although all EMR's have been taught this skill, it is important to review the steps regularly to ensure proper precautions are being taken on an ongoing basis. Any patient that presents with a mechanism of injury conducive to spinal injury should be assumed to have a spinal injury until proven otherwise. The old term "spinal immobilization" has recently been replaced with "*spinal motion restriction*" as it more accurately depicts what is actually occurring. Complete immobilization is not possible in the field, however motion restriction is. Having said that, following are the steps to be taken when managing a patient who requires spinal motion restriction.

Following is the order in which you should approach the trauma patient. If any of these items are not addressed, you risk missing something important, or become a victim yourself.

#### Scene Assessment:

- Personal Protection
- Scene Hazards
- Scene Arrival Time
- Number of Patients
- Resources
- Environment
- Mechanism of Injury

After the scene assessment, you should approach your patient from the feet if possible and ask them not to move. Explain that you are there to help and that your partner is going to gently hold their head to keep their neck still. Ask them their name and give them your name. From this point on you should address them by name and explain our actions to assist in keeping them calm. When the patient is critical, the primary survey, spinal motion restriction and transfer of the patient to the ambulance should not take longer than 10 minutes. Never delay transport with a critical patient to perform vital signs, blood glucose, splint extremities or to obtain a history. If the patient is not able to communicate with you and there is a bystander who knows the patient's history, consider taking them with you so you can get the information enroute to the hospital.

Following is the general flow of the Primary and Secondary survey. Every patient must get a full primary survey and if time permits a secondary survey.

## **Patient Assessment**

### **Primary survey:**

- General impression of patient & scene
- C-Spine control if required
- Bystander information
- Level of consciousness
- Airway
- Breathing
- Circulation
- Deadly wet check
- Rapid body survey
- Load and go decision

### **Secondary survey:**

- Reassessment of LOC, ABC's and Interventions
- Detailed survey
- On Going Exam

***Note: Critical patients should be reassessed every 5 minutes (minimum) and stable patients reassessed every 15 minutes (minimum).***

There are a number of devices required for spinal motion restriction. Depending on the situation you find the patient in, you will need to choose the device that is most appropriate for the situation. For persons in a small space such as a crushed car, you may find that the only rigid device that can be used is a short spine board or a commercial device like the ***Kendrick Extrication Device™ (KED)***. This type of equipment should be reserved only for patients who do not require rapid extrication, as they are time consuming to apply.

The scoop stretcher is often used to move patients onto a spine board particularly those with possible pelvic or femur fractures that should not be log rolled. Scoop stretchers are not suitable for full spinal motion restriction but rather are designed to move the patient onto the long spine board and then be removed.

Following is a list of items you may require in order to perform spinal motion restriction.

**Extrication & Spinal Motion Restriction Devices:**

- Long Board
- Short Board or KED™
- Rigid collar
- Straps
- Spinal motion restriction
- Tape
- Scoop stretcher
- Stretcher

Once c-spine control has been taken it must be maintained until the patient is fully restrained on the long board, with a cervical collar and head blocks. The patient is restrained to the long board by the following techniques: The cervical collar should be applied to the patient prior to moving. The patient is centered on the board with the head at the top of the board. This is done while C-spine control is being maintained and every move coordinated by the person who is holding C-spine. The straps are applied to the chest, abdomen and legs. The head is then secured with head blocks or towel rolls and secured to the spine board, once that has been completed, the practitioner that is maintaining C-spine control can let go of the patient.

Always ensure you reassess any interventions to establish their effectiveness, and remember to reevaluate the ABC's on an ongoing basis and with every intervention or move. If applicable, an early information patch to the hospital is recommended to allow them time to prepare for your arrival.

**Objective 1: Key Terms**

- Spinal Motion Restriction
- KED™

## Objective 2

### Discuss and Perform All Aspects of Hemorrhage Control

Early recognition and treatment of hemorrhage is essential to prevent shock and ultimately death. **Shock** (inadequate tissue *perfusion*) will develop with significant fluid loss, pump failure or vasodilation. You cannot treat one without considering the effect it has on the other. In this section we will review the process and pathology of shock followed by the treatment of hemorrhage.

#### Shock

To understand the progressive nature of shock it is important to understand what is normal. The circulatory system is a closed system through which blood is pumped. In order for the blood to be transported throughout the body, there must be sufficient blood volume and blood pressure. The mechanisms that create the blood pressure involve the force in which blood leaves the heart, and peripheral vascular resistance. Blood pressure is regulated by the amount of blood pumped by the heart, the heart rate, and by the constriction and dilation of the arteries. When the arteries constrict, the *peripheral vascular resistance* increases, causing an increase in blood pressure; when they relax there is less resistance and a decrease in blood pressure. To maintain a relatively constant blood pressure, the body must continuously adjust cardiac output and peripheral vascular resistance.

During each contraction of the left ventricle a volume (approximately 70 ml) of blood is ejected into the aorta. The blood then travels through the arteries. This volume of blood is referred to as the *stroke volume* and can be felt through the arterial pulse. The arterial pulse, produced by the pressure wave of blood, can be given a value, which we call the blood pressure (BP). When assessing for shock, blood pressure is a valuable tool. There are several factors that influence the blood pressure.

**Cardiac Output** - The pumping of the cardiac muscle is obviously important to the maintenance of the blood pressure. This mainly affects the systolic pressure.

**Elastic Recoil of Aorta and Large Arteries** - The force of the stroke volume expands the elastic walls of the aorta and large arteries. The recoil of the vessels advances the blood through the arterial tree. This occurs during diastole.

**Peripheral Vascular Resistance** - This is the chief determination of the diastolic pressure and depends primarily on the caliber of the arterioles.

**Volume of Blood** - Any great loss of body fluids will result in a decrease of blood volume.

**Viscosity of Blood** - The thicker the fluid the more energy required for the fluid to flow and higher risk of clot formation.

The three shock states associated with *hypovolemia* are:

- ***Low-volume Shock (absolute hypovolemia)*** – caused by major fluid loss.
- ***High-space Shock (relative hypovolemia)*** – caused by loss of vascular control as a result of spinal injury (most common), vasovagal syncope, sepsis, and some drug overdoses.
- ***Mechanical shock (obstructive)*** – pump failure caused by myocardial infarction, pericardial tamponade, tension pneumothorax, or myocardial contusion.

### **Signs & Symptoms of Shock**

The classic signs & symptoms associated with low volume shock are:

- ***Weakness*** – caused by inadequate oxygenation of the tissues resulting in acidosis.
- ***Thirst*** – caused by inadequate fluid volume in the blood vessels.
- ***Pallor (pale skin)*** – caused by vasoconstriction or hypovolemia.
- ***Tachycardia*** – caused by the release of catecholamines' and its effect on the heart.
- ***Diaphoresis*** – caused by the release of catecholamines' and its effect on sweat glands.
- ***Tachypnea*** – caused by stress, the release of catecholamines, inadequate oxygenation of tissue causing acidosis and ***hypoxia***.
- ***Decreased urinary output*** – caused by hypovolemia, hypoxia, and the release of catecholamines.
- ***Thready pulses*** – caused by vasoconstriction, tachycardia, and hypovolemia.
- ***Hypotension*** – caused by hypovolemia.
- ***Altered mental status*** – caused by poor cerebral perfusion.
- ***Cardiac arrest*** – caused by organ failure due to hypovolemia, hypoxia, and possible arrhythmias caused from catecholamine release.

### **Average Blood Volumes**

Adult	70 ml/kg
Small Children	65-70 ml/kg
Neonate	90 ml/kg

**Signs of Early Shock** – loss of about 15 – 25 % of blood volume – enough blood loss to have the patient present with slight tachycardia, pale skin, narrowed pulse pressure, thirst, and muscle weakness.

**Signs of Late Shock** – loss of about 30 – 45% of blood volume – all symptoms listed in early shock plus hypotension.

Shock is a progressive syndrome and once started, it can lead to death if untreated. Shock is said to pass through three stages:

**1. Compensatory Shock** - During this early stage, the body is still able to maintain normal function with a series of progressive compensating actions. As shock begins, there is a drop in pressure caused by fluid loss, decreased cardiac output, or dilation of the vascular system. When this occurs, the baroreceptors read a pressure change and epinephrine and norepinephrine are released to increase heart rate and contraction strength, and to cause vasoconstriction in an attempt to restore normal pressure. As long as the body's normal regulating mechanisms are able to maintain an adequate pressure, the patient will be able to compensate.

Sign – tachycardia

**2. Decompensated Shock (progressive)** - There comes a point when the body's compensatory mechanisms fail and normal function cannot be maintained. From this point on, the patient is in rapid decline. As the shock syndrome continues, the body will attempt to keep the heart, brain, lungs, kidneys and liver adequately perfused by shunting blood away from the peripheral vasculature. This does help to keep the vital organs functioning, but if it continues the cells in the tissues from which blood has been shunted will become hypoxic and cellular metabolism becomes anaerobic. This will cause the production of lactic and pyruvic acids and eventually lead to a metabolic acidosis.

Signs - tachycardia, cool/pale/clammy skin, decreasing blood pressure.

**3. Irreversible Shock** - If shock progresses to the point when the cells in the vital organs begin to die due to inadequate perfusion, shock is said to be irreversible. Even if the cause of shock were then to be treated and reversed, the destruction to vital organs would be irreversible and would not function normally. *Metabolic acidosis* will lead to the production of substances that act as vasodilators. Blood will sludge, blocking vessels and causing further tissue ischemia. Eventually, the products of anaerobic metabolism cause widespread vasodilation, and the blood pressure will drop significantly. Inadequate perfusion will be system-wide, and cellular death begins. As inadequate perfusion of the tissues increase, the body will shunt blood away from the liver, kidneys and lungs in order to keep the heart and brain perfused. As a result, the liver and kidneys will become progressively ischemic and their malfunction will further accelerate the patient's decline.

### **Neurogenic Shock (Spinal Shock)**

The classic signs & symptoms of shock are not present in *neurogenic shock*. Due to the interruption of the sympathetic nervous system outflow from the spinal cord, there is no *catecholamine* release, which results in blood vessel dilation. Without the release of catecholamines the patient does not present with pale, cool, diaphoretic skin or tachycardia, however there will be a decrease in blood pressure. The patient may have paralysis or sensory deficits inferior to the level of the spinal cord injury. The neurological assessment is very important, as the patient may not present with the normal signs and symptoms of shock.

## **Hemorrhage Control**

In most situations, hemorrhage control can help to prevent shock. There are instances where the prehospital care provider can do little to control the hemorrhage, however field care and rapid transport may be life-saving measures in these cases. As with all field care, ensure you are wearing your personal protective equipment.

There are many actions that can be taken to control external hemorrhage as noted in the following list. It is important to ensure that any impaled objects are not removed unless they are interfering with airway control. Removal of impaled objects can lead to an increase in bleeding as the object tends to tamponade bleeding if left in place (similar to a plug in a sink).

***Direct Pressure*** can be applied to any open wound in an attempt to control bleeding. Direct pressure is usually applied using gauze or a dressing to protect the site from further contamination. The dressing is placed over the bleeding site and firm downward pressure is applied for at least 5 minutes. When releasing pressure if the dressing soaks through with new bleeding, apply an additional dressing and reapply firm pressure to the site. In the event of abdominal evisceration, do not apply pressure so firmly as to push the abdominal contents back into the abdominal cavity. Moist dressings should be applied over the eviscerated organs.

***Elevation*** of extremities can also assist with the control of bleeding. The injured limb should be above the level of the heart to reduce dependant pressure. This position is used to assist with the movement of blood into the body core to prevent shock. The reduction in the dependant pressure can also assist with lower extremity bleeding as it raises the legs higher than the heart. Direct pressure and elevation should be used together whenever possible.

***Pressure dressings*** should be applied to maintain control of bleeding or if bleeding continues with direct pressure and elevation. A pressure dressing is a bulky dressing with a bandage applied over it. The bulky dressing should be applied over the bleeding site and the bandage should be applied snugly so as to put sufficient pressure to stop the bleeding. In some cases you may need to hold additional pressure with your gloved hand to control bleeding. If bleeding comes through the dressing apply more dressings and bandage over them slightly increasing the tightness of the bandage. The tightness of the dressing should not be so tight as to cut off distal circulation. You should be able to feel a distal pulse with the dressing applied.

**Pressure points** are used when pressure dressings and elevation alone are not controlling bleeding. Application of pressure to arteries that lie near bone can assist with the control of bleeding. As wounds don't always bleed from only one vessel, applying pressure to a pressure point may not completely stop bleeding but will assist with the control of bleeding. The pressure points to be used for hemorrhage control are as follows:

- Superficial temporal artery is located over the temple area of the head.
- External maxillary artery is located at or about the angle of the jaw.
- Carotid artery located on the lateral side of the neck just below the angle of the jaw.
- Brachial artery is located in the antecubital space on the anterior surface of the forearm.
- Ulnar and radial arteries are located over the ulna and radius respectively on the anterior portion of the forearm around the wrist area. (The ulnar artery can be difficult to palpate.)
- Femoral artery is located in the inguinal area at or around the crease of the thigh when in a sitting position.
- Posterior tibial artery is located just under the medial malleolus.
- Dorsalis pedis is located over the dorsal aspect of the foot approximately in line with the second or third metatarsal.

You should practice locating these pulse points on your own body to ensure you are thoroughly familiar with their location in the event of an emergency. Realize that individual differences may make the location of these pressure points slightly different from person to person, however the general location will remain unchanged, except in extremely rare circumstances.

**Application of cold** can be used to control bleeding and swelling by causing vasoconstriction of the vessels in the area of the injury. Ensure you apply a sterile dressing over any open wounds prior to the application of a cold pack and never apply it directly to the surface of the skin as this can cause tissue damage. The application of cold packs would be useful when treating hematomas, joint injuries, and open and closed bone fractures.

**Tourniquets** are to be applied as a last resort in uncontrolled hemorrhage as they can cause damage to nerves, blood vessels and tissues. Their use is limited to the extremities as they are applied circumferentially. A tourniquet can be a piece of surgical tubing, a triangular bandage or even a belt or BP cuff. The general principle is the same in that once applied it constricts blood flow below the location of the tourniquet. The tourniquet should be applied just slightly proximal to the site of hemorrhage and the time of application carefully documented (often written at the site of the tourniquet). If using a blood pressure cuff you will need to watch the pressure gauge to ensure it is not dropping. Clamping the tubing may be necessary to maintain pressure. Regardless of the chosen type of tourniquet, it should only be applied firmly enough to stop or significantly slow the bleeding. Rapid transport should be carried out to ensure the least possible damage from the constriction and to get definitive treatment for the hemorrhage.

**Treatment for shock:**

- Appropriate PPE
- Administer high flow oxygen or positive pressure ventilations
- Control bleeding
- Spinal precautions as required
- Place patient in the *Trendelenburg position*
- Rapid transport
- Attach pulse oximetry (may not work in hypovolemia)
- Perform ongoing assessment

**Procedure for bleeding that can be controlled:**

- Control bleeding with direct pressure and elevation
- Place patient in trendelenburg position
- Administer high flow oxygen
- Rapid transport
- Attach pulse oximetry (may not work in hypovolemia)
- Perform ongoing assessment

**Uncontrolled bleeding after applying direct pressure:**

- Pressure point, elevation, cold therapy
- Place patient in trendelenburg position
- Apply tourniquet to extremity as a last resort to stop severe bleeding
- Administer high-flow oxygen
- Rapid transport
- Ongoing assessment

**Special Situations**

In the following situations, control of hemorrhaging is not possible without surgical intervention. With these patients, assessment, oxygen, and rapid transport are essential to survival. Ensure you let the hospital know early that you are coming, as they will need to prepare for your arrival.

*Hemopneumothorax* is a condition where there is blood and air in the pleural space causing the lung to collapse. When auscultating the patient, air entry will be *absent* on the affected side due to the bleeding into the pleural space causing hypovolemia. The positive pressure from the bleeding and the air entering the pleural space will push the heart to the unaffected side causing the trachea to shift out of midline. This condition can cause mechanical shock.

*Cardiac or Pericardial Tamponade* is a condition when blood fills the space between the pericardial sac and the heart making it difficult for it to pump blood effectively. This condition is life threatening and scene time must be kept to a minimum.

**Blunt or penetrating trauma** to the abdominal region can result in injury to hollow and solid organs, rupture or penetrate the diaphragm and cause serious internal hemorrhaging. The solid organs in the abdomen consist of the liver, spleen, kidneys, and pancreas. Solid organs are extremely vascular and can bleed freely which will lead to hypovolemic shock if not treated rapidly. The hollow organs in the abdomen consist of the stomach, large and small intestines, urinary bladder, ureters, and gallbladder. This is important, as hollow organs tend to spill gastric contents into the abdominal cavity which can cause inflammation and lead to septic shock. Additional organs in females are the uterus, fallopian tubes, and ovaries are in the abdominal region. Injuries to the abdomen can result in rapid, extreme blood loss, which may or may not be apparent. It is important to recognize the signs and symptoms of internal abdominal injury. Many types of trauma will produce punctures or lacerations to the abdominal wall resulting in hemorrhaging. Some of these injuries result in evisceration and possible underlying organ damage.

**Pregnancy** causes several changes to occur within the mother's body, which can affect how her body compensates for hemorrhage. Remember that you have two patients in this situation, mom and baby. Following is a summary of these changes:

- Blood volume increased by about 45%
- Heart rate increases by 10 - 15 beats per minute
- Blood pressure decreased 10 – 15 mmHg
- Stroke volume progressively decreased throughout the pregnancy
- Cardiac output increases by 1 to 1.5 liters/min during the 1<sup>st</sup> trimester, 6 – 7 liters/min during the 2<sup>nd</sup> trimester and is maintained at that level throughout the 3<sup>rd</sup> trimester
- Due to the increasing size of the uterus and fetus there is increasing intra-abdominal pressure on all organs causing increased risk of injury and hemorrhaging
- A blood loss of 30 – 35% can happen before changes in maternal blood pressure or heart rate are detected

Blunt trauma to the abdomen can cause the amniotic sac to rupture and induce labor. It can also result in the placenta being detached from the uterine wall called abruptio placentae. This condition can lead to hemorrhaging and can be life threatening to both the mother and fetus.

## **Objective 2: Key Terms**

- Shock
- Perfusion
- Peripheral vascular resistance
- Stroke volume
- Hypovolemia
- Hypoxia
- Metabolic acidosis
- Neurogenic shock
- Catecholamines
- Trendelenburg position
- Cardiac or pericardial tamponade

## Objective 3

### Demonstrate the Knowledge and Correct Application of Traction Splints

The EMR will encounter various types of fractures in accident situations. Proper care of the fracture will improve the recovery time and prevent or minimize complications. With all extremity injuries, it is important to assess distal neurovascular (nerves and vessels) status both before and after splinting. This should include evaluating the pulse, capillary refill, sensation and motion distal to the point of injury. Damage to muscle and nerves, blood vessels or skin tissue, restriction of blood flow, excessive bleeding, pain and possible paralysis are some of the complications that can occur. Splinting devices available today are: Speed Splints™, B-Splints™, Sam Splints™, Hare Traction Splint™, Sager Traction Splint™, vacuum splints and air splints.

Muscles are a special form of tissue that contracts or shortens when stimulated, produces body movement, maintains posture, and produces body heat. There are three major types of muscle; skeletal, smooth and cardiac. Skeletal muscles are voluntary and under conscious control. Smooth muscles are involuntary and not under conscious control. Cardiac muscles are involuntary and not under conscious control.

The skeletal system has 206 bones that give form to the body, protects the organs, allows body movement, and produces blood cells and stores minerals. The components of the skeletal system are the axial skeleton and the appendicular skeleton.

The axial skeleton consists of the skull, the spinal column, and the rib cage. The skull consists of the cranium and the face. The spinal column consists of 33 vertebrae and is divided into 5 sections: 7 cervical, 12 thoracic, 5 lumbar, 5 sacral (fused) and 4 coccygeal (fused). There are 12 pairs of ribs that attached to each thoracic vertebra and form the rib cage. The upper 10 pairs of ribs are attached directly to the sternum while the lower two are referred to as “floating” and held in place by cartilage.

The appendicular skeleton consists of the shoulder girdle, the pelvic girdle, and the upper and lower extremities.

Fractures are breaks in a bone and can be opened or closed. Signs of a fracture are:

- Deformity
- Tenderness
- Grating sound upon movement (crepitus)
- Swelling and discoloration
- Loss of use or painful use of body part
- Exposed fragments

Possible complications of fractures include the following:

- Shock associated with bleeding
- Loss of distal circulation and death of tissue
- Compromise of nerves and loss of function
- Long bone fracture can lead to pulmonary embolus and death of patient
- Open fracture in extended situations can lead to death of bone tissue

### **Purpose and Rules for Splinting**

Splints are designed to help reduce movement of an extremity, alleviate pain and reduce chances of complications such as damage to body tissue, restriction of blood flow, excessive bleeding and possible paralysis. It is important for the practitioner to check the *circulation, motor and sensory (CMS)* of the extremity to determine if there is compromise of the area distal to the injury site.

#### **General rules for splinting are:**

- For spinal motion restriction: if a spinal injury is suspected and resistance or pain is noted when placing the head and neck into the neutral position **STOP!** The head will have to be supported in the position found when applying spinal motion restriction devices
- Remove or cut away clothing
- Ensure manual immobilization
- Cover all open wounds with a sterile dressing
- Do not replace protruding bones
- Straighten angulated fracture before splinting - use gentle traction (do not move if pain or resistance)
- Pad each splint carefully to prevent pressure and discomfort to the patient
- Immobilize the joint above and below the fracture or dislocation
- Splint before moving if not critical
- Joint injuries are splinted in position found unless circulation compromised
- Improvise splints if required
- Ensure knots from slings do not put pressure on bone or tissue
- Always check circulation and sensation above and below the fracture site

### **Types of Splints**

Splints come in many forms to aid in the immobilization of fractures and dislocations associated with musculoskeletal injuries. There are rigid, formable, soft, vacuum and traction splints.

**Rigid Splints** – Rigid splints are firm and durable and are constructed with cardboard, hard plastic, metal or wood. These splints are very effective in immobilizing injuries but require adequate padding for patient comfort. A common type of rigid splint used in the prehospital setting is B-Splints™. They come in a variety of sizes that will allow the practitioner to apply them on any extremity that requires splinting. They are yellow and black in color and have velcro to secure them in place. Another type of splint commonly used is the Speed Splints™. They are yellow, made of cardboard, are disposable, and come in different sizes to fit extremities.

**Formable Splints** – consists of material that can be shaped to match the form of the injured extremity. A common type of formable splint used in the prehospital setting is the Sam Splint™. Sam Splints™ are made of flexible aluminum and polyethylene foam that can be manipulated to the position of the injury. It is then secured in place with bandages, tape etc.

**Soft Splints** – consist of splints that use air pressure or padding to immobilize injured extremities. Pillows or blankets are examples of a soft splint that are commonly used in the prehospital setting for ankle or foot injuries. Air splints are applied to the injured extremity in the appropriate position and pumped up with air forming a rigid formed splint.

**Vacuum Splint** – conform to the shape of the injured extremity. Once the vacuum splint is applied and shaped around the limb a vacuum device is applied to the valve and the air is withdrawn, immobilizing the limb in the appropriate position.

**Traction Splints** – Traction splints were developed after World War I where the Thomas traction splint was widely used. The use of this traction splint was found to decrease the mortality rate from femur fractures on the battlefield. Today traction splints are commonly used in the prehospital setting, with two models being the most common. These are the Hare Traction Splint™ and the Sager Traction Splint™. These splints help to relieve pain, prevent bone ends from overriding and help relax muscle spasms. They cannot be used if the patient has a fractured pelvis, lower legs, or fracture / dislocation of the knee. Traction splints are applied by placing a padded device against the groin and gently applying traction until the limb is immobilized and the pain reduced. A maximum of 10% of the patient's weight or 15 lbs (7 kg) of traction is allowed, as required to obtain pain reduction or return of a distal pulse. These splints can only be used on a mid shaft femur fracture.

- The **Hare Traction Splint™** is the modern version of the Thomas traction splint. Place the splint under the injured leg until the pad is resting against the bony prominence of the buttocks. A ratchet at the opposite end connects to a foot harness and pulls traction from the foot against the pelvis. The size of this splint is large and very cumbersome to use on patients. Loading tall patients with a Hare Traction Splint™ can become complicated due to the splint extending beyond the stretcher and beyond the back door.
- The **Sager Traction Splint™** is smaller, lighter and can be used for bilateral femur fractures. This splint has a padded bar at the top that is fitted snugly against the pubic bone. The foot harness helps to support traction along the long axis of the femur, once the sliding segment of the splint is activated.

When splinting a femur fracture it is important to assess pedal pulses before and after splinting. If the situation is critical, it is not a priority to apply the traction splint. Instead you should secure the injured leg to the uninjured leg and transport as soon as possible.

It is important to perform an accurate assessment before and after splinting an injury. Assessing CMS of the extremity before splinting will tell the practitioner if there is circulation compromise. By assessing before splinting, the practitioner will know if the circulation compromise was preexisting or a result of the splinting.

### **Objective 3: Key Terms**

- Hare Traction Splint™
- Sager Traction Splint™
- CMS

## Objective 4

### Define the Correct Approach to a Multiple Casualty Incident Using the START Triage System and Identify the Necessary Components Utilizing the Incident Command System

*Triage* means to sort or to categorize. All too often, much effort is expended helping patients who are not salvageable and die shortly thereafter, while persons who are less injured and salvageable, succumb to shock decreasing their chance of surviving.

The practice of triage in multiple casualty incidents is based on a set of established criteria and should be followed whenever patients are many and resources are few. Assessment of patients' severity is based on the following:

- a. Abnormal physiological signs
- b. Obvious injury (including mechanism of injury)
- c. Concurrent disease factors that might affect the patient's prognosis

Triage is a continuous process during a major incident. Constant monitoring of patient status may indicate a need to change the initial categorization and priority of treatment.

#### Primary vs. Secondary Triage

Primary triage:

- a. Used to rapidly categorize patient condition for treatment
- b. Document location of patient and transport needs
- c. Label patient with triage labels, tags, or tape
- d. Focus on speed to sort patients quickly
- e. No care, other than immediate lifesaving airway or hemorrhage management should be rendered during primary triage

Secondary triage:

- a. Used at treatment area
- b. Patients are re-triaged
- c. May not be necessary at small incidents

#### START Triage System

The *START* (Simple Triage and Rapid Transport) triage system uses a 60 second assessment that focuses on the following:

- Ability to walk
- Respiratory effort
- Pulses/perfusion
- Mentation (Neurological status)

The START technique as mentioned above uses the following four criteria to assess patients:

- 1. Assess the patient's ability to walk** - Patients who can walk and understand basic commands are classified as walking wounded and transport is delayed. Delayed patients are to remain in their location for further assistance or to walk to a treatment site. If the patient cannot walk, the respiratory rate is assessed.
- 2. Evaluate breathing and rate** - If breathing is absent, the patient is classified as dead or dying. If the patient has a respiratory rate of less than 10 or more than 30 breaths/min indicates critical status.
- 3. Assess pulses/perfusion** - If there is no pulse, the patient is classified as dead or dying. The presence of carotid pulse and absence of radial pulse indicates critical status and if both the carotid and radial pulses are present, mental status should be assessed before assigning a triage classification.
- 4. Assess mental status** - Asking the patient to perform two simple tasks can assess mental status. Quickly ask the patient to touch their nose with their index finger, and assess to orientation to time, place and self. Patients who can perform these types of tasks would be classified as delayed. If the patient failed to follow these types of commands they would be considered critical.

**Note: *Repositioning the airway and controlling severe hemorrhage are the only initial treatments in primary triage.***

Triage in the field involves setting priorities for both care and transportation of the injured patient. The usual method for identifying priorities is the use of tags of different colors, or one tag with tear-off color bars on the bottom. These tags are not always readily available. Another method would be to "tag" patients with red, yellow or green surveyor's tape.

Assessment is used to classify victims by one of the following categories:

- a. Delayed (can wait > 1 hour = Green)
- b. Urgent (can wait but less than 1 hour = Yellow)
- c. Critical (Requires immediate care and transport = Red)
- d. Dead or dying Critical (obvious mortal injuries or cardiac arrest = Black). This allows rescuers to quickly identify victims at greatest risk of early death and advise other rescuers of the patient's need for stabilization.

### **Other Considerations**

Should one of the rescuers become injured and is unable to work at full capacity; he should be classified in the Red group and transported immediately. Likewise, if one of the victims is a relative of a rescuer, that victim should be bumped up to the Red Category and transported immediately. This treatment is done to maintain a calm, concerted effort at the site. If such patients remain at the scene, they tend to distract practitioners and make it difficult for them to work to their full capabilities. For the same reason, a hysterical patient or one accompanied by a hysterical relative should be transported sooner than normal or removed from the scene as soon as possible. Generally, it is wise to transport children before adults in the same category, since children tend to cause high rescuer anxiety leading to less than optimal response to other patient's needs. This policy has been proven effective in maintaining rescuer moral.

**NOTE:** For more information on the START system refer to [www.start-triage.com](http://www.start-triage.com), for information on pediatric multiple casualty incident triage refer to [www.jumpstarttriage.com](http://www.jumpstarttriage.com)

### **Medical Incident Command**

The Incident Command System (ICS) was first developed in the 1970s. The structured flexibility of the ICS can be used in any type of incident for any emergency service agency. An ICS must be established immediately. Depending on the incident more than one person may have to take control of the different components. It is best to have one person in control with one person in charge of each of the five components.

The five components of a *Medical Incident Command System (MICS)* are:

#### **1. Medical Command:**

- Establish liaisons with on-scene Incident Commander
- Establishes working MICS with appropriate sectors
- Ensures that proper rescue/ extrication services are activated
- Ensures law enforcement involvement as necessary
- Ensures that helicopter landing zone operations are safely coordinated
- Determines the amount and type of additional medical resources and supplies so they can prepare for casualties
- Designates assistance officers and their location
- Maintains an appropriate span of control
- Works as a conduit of communications between subordinates and the Incident commander

#### **2. EMS Staging Officer:**

- Maintains a log of available units and medical supplies
- Coordinates physical location of incoming resources
- Coordinates incoming personnel
- Provides updates to Medical Command as necessary

**3. Triage Officer:**

- Ensures proper utilization of the initial assessment triage system or other local protocol
- Ensures that triage tags or other visual identification technique is properly completed and secured to the patient
- Makes requests for addition resources through Medical Command
- Provides updates to Medical Command as necessary

**4. Treatment Officer:**

- Establishes suitable treatment areas
- Communicates resource needs to Medical Command
- Assigns, supervises, and coordinates treatment of patients
- Provides updates to Medical Command as necessary

**5. Transport Officer:**

- Ensures the organized transport of patients off-scene
- Ensures an appropriate distribution of patients to all local hospitals to prevent hospital overloading.
- Completes a transportation log
- Contacts receiving hospitals to advise them of the number of patients and condition.
- Provides updates to Medical Command as necessary

**Objective 4: Key Terms**

- MCI
- Triage
- START System
- Medical Incident Command System
- Triage Officer
- Transport Officer

## Summary

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Trauma is one of the leading causes of death among young people. Proper management, early recognition and transport are paramount to decrease morbidity and mortality of the trauma patient. Proficiency with all aspects to the care of the trauma patient, with regard to assessment, decision-making and timely application of skills learned in this module are of the utmost importance for the EMR. These skills require practice and ongoing theory review to maintain competence.

## Exam

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1. When placing a patient who is in the later stages of pregnancy on a spine board what precautions do you want to take?
  - a. Tilt the board to the right approximately 20 – 30 degrees
  - b. Tilt the board to the right approximately 45 degrees
  - c. Tilt the board to the left approximately 15 – 30 degrees
  - d. Tilt the board to the left approximately 10 degrees
  
2. Stable patients should be assessed every \_\_\_\_\_ minutes.
  - a. 3 minutes
  - b. 10 minutes
  - c. 15 minutes
  - d. 5 minutes
  
3. Unstable patients should be assessed every \_\_\_\_\_ minutes.
  - a. 3 minutes
  - b. 10 minutes
  - c. 15 minutes
  - d. 5 minutes
  
4. Which of the following devices is considered a spinal immobilization device?
  - a. Long Board
  - b. Short Board
  - c. KED
  - d. All of the above
  
5. You have a 25-year-old patient who was in an MVC at highway speed. She presents as unresponsive with a weak, fast radial pulse and increased respirations, which are clear and easy. She is pale and cool to the touch. You are preparing to apply spinal motion restriction equipment. Before you leave the scene you should also:
  - a. Do a full set of vitals, including blood glucose reading
  - b. Find out if anyone knows the patient and can give a history
  - c. Perform a secondary survey
  - d. Apply splints as required
  
6. What is the correct sequence when trying to control bleeding?
  - a. Pressure point, direct pressure and elevation, and tourniquet
  - b. Direct pressure and elevation, tourniquet, and pressure points
  - c. Tourniquet, pressure point, direct pressure and elevation
  - d. Direct pressure and elevation, pressure point, tourniquet

7. Pericardial Tamponade is defined as:
  - a. A condition when blood fills the space between the pericardial sac and the heart making it difficult for it to pump blood effectively
  - b. A collection of blood filling the pleural space
  - c. A collection of air filling the space between the pericardial sac and the heart making it difficult for it to pump blood effectively
  - d. A collection of blood between the epicardium and myocardium
  
8. Inadequate tissue perfusion and oxygenation is referred to as:
  - a. Respiratory failure
  - b. Myocardial infarction
  - c. Clinical Death
  - d. Shock
  
9. Hemopneumothorax is defined as:
  - a. A collection of Blood filling the pleural space
  - b. A collection of Blood filling the lungs
  - c. A collection of Blood & Air filling the pleural space
  - d. A collection of Blood & Air filling the lungs
  
10. Which of the following is a late sign of shock?
  - a. Tachycardia
  - b. Hypotension
  - c. Tachypnea
  - d. Hypertension
  
11. When a patient is suffering from bilateral femur fractures, what type of splint should be applied?
  - a. Vacuum Splint
  - b. Pillow Splint
  - c. KED
  - d. Sager Splint
  
12. When applying a traction splint, what is the maximum pressure used?
  - a. 25 lbs or 11 kg
  - b. 15 lbs or 7 kg
  - c. 10 lbs or 4.5 kg
  - d. 30 lbs or 14 kg
  
13. The importance of assessing the CMS in a patient with an extremity injury is:
  - a. To determine if there is a deformity in the extremity
  - b. To determine if the patient requires splinting
  - c. To determine if the patient needs treatment
  - d. To determine if there is adequate circulation, motor skills and senses of the extremity

14. Which of the following statements is true?
  - a. Fractured femur does not require splinting if a scoop stretcher is used to move the patient
  - b. Pulse distal to the fracture should be checked before and after application of a splint
  - c. Only fractures at a joint should be straightened with gentle traction
  - d. If there is numbness distal to a fracture, a splint should not be applied
15. What type of splint should be applied when there is a mid-shaft femur fracture?
  - a. Air Splint
  - b. Vacuum Splint
  - c. Hare Splint
  - d. B-splint
16. What are the colors associated with tagging patients at an MCI?
  - a. Purple, white, yellow, brown
  - b. Black, red, orange, yellow
  - c. Green, yellow, red, black
  - d. Red, white, black, blue
17. Which of the following treatments would be administered during the Primary Triage?
  - a. Reposition the airway
  - b. C-spine precautions
  - c. Manual stabilization of a fracture
  - d. CPR
18. Who is responsible for the tagging of patients at an MCI?
  - a. Transport Officer
  - b. Triage Officer
  - c. Treatment Officer
  - d. EMS Staging Officer
19. START stands for:
  - a. Simple triage and rapid treatment
  - b. Stay together and respond timely
  - c. Stat transfer and rapid treatment
  - d. Simple triage and rapid transport
20. While triaging a patient at an MVA, you observe that the patient has a respiratory rate of 24 breaths per minute, a weak carotid pulse, and no radial pulse. According to the START guidelines, this patient should be marked as:
  - a. Yellow
  - b. Red
  - c. Black
  - d. Green

# Glossary of Terms

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## Objective 1: Key Terms

***Spinal Motion Restriction*** – Restricting movement of the spine by using a rigid board like device, straps and head blocks.

***KED*** – Kendrick Extrication Device - A type of spinal motion restriction device used only with stable patients.

## Objective 2: Key Terms

***Shock*** – inadequate tissue perfusion.

***Perfusion*** – The passage of blood or fluid through the vessels of an organ

***Peripheral vascular resistance*** - The chief determination of the diastolic pressure and depends primarily on the caliber of the arterioles.

***Stroke Volume*** – The amount of blood pumped by the heart in one beat.

***Hypovolemia*** – Insufficient blood or fluid within the body

***Hypoxia*** – A deficiency of oxygen reaching the tissues of the body

***Metabolic acidosis*** – A condition caused by accumulation of acid or loss of base in the body

***Neurogenic shock*** – shock resulting from brain or spinal cord injury that causes an interruption of nerve impulses to the arteries causing dilation and hypovolemia

***Catecholamines*** – a group of chemicals of similar structure that act to increase heart rate and blood pressure; norepinephrine and epinephrine

***Trendelenburg position*** – Patient is positioned supine with the head lower than the feet

***Cardiac or pericardial tamponade*** – accumulation of excess fluid (blood) inside the pericardium.

## Objective 3: Key Terms

***Hare Traction Splint™*** – A type of traction splint

***Sager Traction Splint™*** – A type of traction splint

***CMS*** – Circulation, motor and sensation

## Objective 4: Key Terms

***MCI*** – Multiple Casualty Incident

***Triage*** – To sort or categorize

***START System*** – Simple Treatment and Rapid Transport System

***Medical Incident Command System*** – Implemented in any emergency situation where more than one person may have to take control of the different components

***Triage Officer*** – Responsible for triaging

***Transport Officer*** – Responsible for transporting of patients

## References

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- Portage College Prehospital Care 2004 curriculum from the Emergency Medical Responder, Emergency Medical Technician, and Paramedic programs.

# Appendix A

## Lab Skills Checklist

### SKILL GUIDELINES - APPLICATION OF HARE SPLINT™

- Student states PPE precautions
- List indications and complications
- Prepare equipment
- Place the patient on the stretcher / backboard and assess circulation in the injured extremity
- One practitioner will support the leg with gentle traction while the second practitioner exposes the injured leg, remove the shoe before applying the foot hitch. Assess CMS
- Use the patients other leg as a guide and extend the splint until you have the correct length
- Place the splint under the injured leg with the perineal cushion fitting under the ischial tuberosity
- Apply the hitching device to the ankle, crossing it over the anterior surface of the foot
- Position the support straps above and below the injury, below then knee and above the ankle
- Attach the S-Hook to the hitching device and turn the ratchet until tension is applied. The tension will be 10% of the patients weight or up to 15 lbs of pressure
- Reassess the CMS, release manual traction & secure in place

**Note:** Traction splints should not be applied on scene if the patient is in critical condition.

*Comments:*

*Instructor Name & Initials:* \_\_\_\_\_ *Date:* \_\_\_\_\_

## Lab Skills Checklist

### SKILL GUIDELINE – APPLICATION OF SAGER TRACTION SPLINT™

- Student states PPE precautions
- List indications and complications
- Prepare equipment
- Place the patient on the stretcher / backboard and assess circulation in the injured extremity
- One practitioner will support the leg with gentle traction while the second practitioner exposes the injured leg; remove the shoe before applying the foot hitch. Assess CMS
- Use the patients other leg as a guide to determine the correct length
- Place the splint between the patient's legs with the padded area in the groin, take care not to injure the genitals with the bar or strap
- Apply the hitching device to the ankle, ensure that circulation is not compromised
- Secure the foot hitch with the connectors – the Sager has 2 foot hitches and can have both legs secured with the T-Bar for Bilateral Femur Fractures
- Extend the splint to the proper tension of 10% of the body mass or up to 15 lbs (kg) of pressure
- Reassess the CMS, release manual traction & secure in place with elastic straps

**Note:** Traction splints should not be applied on scene if the patient is in critical condition.

*Comments:*

*Instructor Name & Initials:* \_\_\_\_\_ *Date:* \_\_\_\_\_