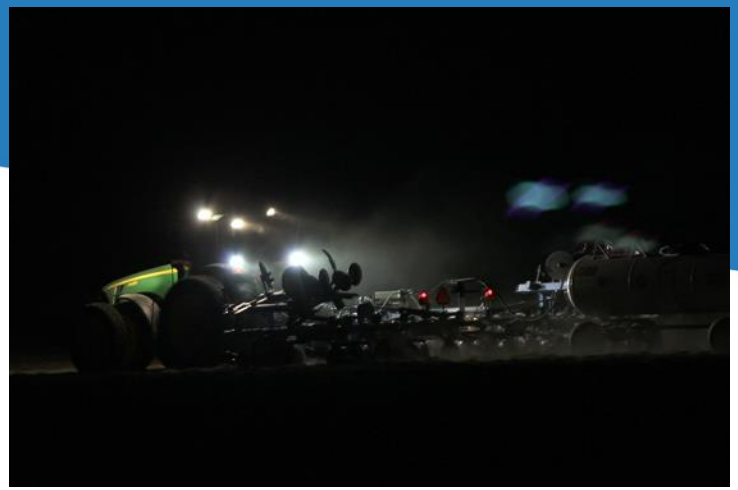
Agricultural and Industrial Related Accidents

Mercyhealth Prehospital and Emergency Services



Mercyhealth™

Agricultural Related Accidents

- 21/10,000 farmers will die each year from a farm related injury
- Tractor and equipment related deaths are the most common cause of fatalities, followed by grain bin accidents

<u>Most common farming injuries result from:</u>

- Over turning machinery
- Animal injuries
- Asphyxiation
- Falls
- Entanglements

Mercyhealth™

Always consider scene safety

- Unusual structures
- Confined spaces
- High rise structures
- Heavy machinery
- Livestock
- Chemicals/Toxic environments
- Remote locations

Mercyhealth™

Grain bin accidents

- Flowing grain presents risks for engulfment and suffocation
- Most full engulfment's in flowing grain result in fatality ~90% of full engulfment rescues are unsuccessful.
- The rate of grain flow in the center of a grain bin is so great that escape is almost impossible due to a whirlpool effect
- Survivors report covering their mouth and nose and not panicking.
- Partial entrapments have much better outcomes

Mercyhealth™

Responding to grain bin accidents

- A grain bin rescue should be treated as a confined space – an SCBA and harness are necessary
- Operations should be conducted assuming the victim is alive - do not start the unloading auger
- If the patient is partially submerged stay out of the bin, do not disturb the grain
- Monitor for allergic reactions due to dust and mold spores
- TIME IS CRITICAL

Mercyhealth™

Grain bin response continued

- Turn on the grain bin aeration fan to circulate air
- Find the access door towards the bottom of the bin for entry.
- It may be necessary to cut holes in the grain bin to remove some of the grain.
- Send only one rescuer in the bin for BLS level care.
- Again, TIME IS CRITICAL

Mercyhealth™

Silo related accidents

- Similar to grain bin response, consider them a confined space rescue and don a SCBA
- Materials inside may be hazardous, consider using a gas detecting monitor
- Turn on the silage blower to circulate fresh air
- If necessary, treat anyone with silo gas exposure immediately by moving them to fresh air

Mercyhealth™

Farm harvesting equipment injuries

- Injuries to the extremities are most common
- Fatality can result due to factors such as blood loss and remote locations
- Shut off the tractor
- Consult with an equipment expert (nearby farming neighbor or equipment dealer)for disassembly
- Depending on the machine you may need to disconnect the power take-off

Mercyhealth™

Tractor accidents

- Overturned tractors are the reason for most farm related fatalities
- Almost 85% of overturned tractors are side roll-overs; rear overturned tractor accidents are less common but result in fatalities more often
- Removing a victim from an overturned tractor will depend on the position of the victim, soil conditions, and the weight of the tractor

Mercyhealth™

Hazardous materials

- Consider hazardous materials when responding to all farming related accidents
- Assume all spills and exposures are toxic
- Contact poison control
- Wear appropriate PPE/SCBA for all unknown spills, haz-mat related exposures are identified
- Identify labels and use ERG/call CHEMTREC
- DECONTAMINATE PATIENT AND CREW MEMBERS

Mercyhealth™

Manure pit response

- High hydrogen sulfide gas content – can cause unresponsiveness in seconds when exposed
- Below ground manure pit rescues present the greatest risk to first responders
- Use an SCBA and air monitor device when dealing with manure pit related accidents
- Manure pits present multiple risks including drowning and hazardous material exposure risks

Mercyhealth™

Anhydrous Ammonia related accidents

- Spring is typically the season for anhydrous ammonia – found in fertilizer
- Can be extremely dangerous if not handled properly; about 80% of anhydrous ammonia accidents are the result of misuse
- Response to an anhydrous ammonia leak requires a Level A chemical suit and SCBA
- No amount of PPE will protect someone from the severe cold of the liquid (-28 degrees F when released from the tank) - consider severe burns
- Mild exposure to anhydrous ammonia can cause irritation to eye, nose and lung tissues; prolonged exposure can cause suffocation

Mercyhealth™

Responding to Anhydrous Ammonia accidents

- Move the patient to fresh air immediately
- Provide ventilations if patient is not breathing
- If burns present, consider treating for shock – keep warm
- Irrigate skin, eyes and decontaminate patient with copious amounts of fresh water

Mercyhealth™

Farm animal related accidents

- Animals who are frightened, sick or injured can cause serious injuries to people
- Consider contacting law enforcement if you are unable to get to a patient safely due to an animal, they may need to shoot the animal
- Approach all animals with caution
- Consider contacting animal control or local large animal veterinarian, if time allows

Mercyhealth™

Power Take-Off Accidents

- The PTO on the tractor transfers power from the tractor to trailing equipment
- All tractors are designed to operate the PTO at either 540 or 1,000 revolutions per minute in a clockwise direction.
- PTO's lacking the proper shielding and protective equipment can grab the victims hair or clothing causing catastrophic entanglements.

Mercyhealth™

Responding to PTO accidents

- Turn the tractor off
- Secure the PTO on both ends so it cannot rotate
- Secure the wheels of the machine
- Consult with a nearby neighbor farmer or farm expert for help with freeing the victim, do not try to manipulate the machine yourself, if you are not familiar with it
- You may need to consider transporting the patient still entangled

Mercyhealth™

Hydraulic operated equipment

- Hydraulic systems operate at high pressures and can support tremendous weight; you may need to release the pressure to free the patient
- Hydraulic failure can cause equipment to lower unexpectedly; can cause
- Hydraulic fluid from hydraulic hoses is very hot and can cause severe burns; do NOT cut hoses, the fluid is hazardous and can ignite a fire

Mercyhealth™

Farming related amputations

- Portable farm augers transport grain, feed, or fertilizer
- Common injuries involve: entanglements, auger collapse related trauma, and electrical injuries
- Augers are responsible for most farming related amputations

Mercyhealth™

Responding to auger related injuries

- Check for power lines and turn off the power, if possible
- If able, lower elevator, stabilize the auger
- Keep in mind the auger may be loaded with grain, may need to consider unloading it to reduce some of the weight
- Block the wheels
- If extricating a complex entanglement, consider MD-1 response
- You may need to disassemble or cut the auger to get the victim out

Mercyhealth™

Heat-related injuries

- Approximately 2.5 million farmworkers across the United States face dangerously hot conditions daily
- Symptoms of heat stress including dizziness, nausea, fainting, vomiting, fatigue, poor coordination, and seizures
- Use passive cooling measures; move patient to cooled environment, apply cold packs to groin and arm pits, start IV fluids – avoid overshoot causing hypothermia and shivering which generates heat

Mercyhealth™

Industrial Accidents

Top most common workplace injuries include:

- Trips, slips, falls
- Machine related injuries
- Fire and explosions
- Electrical Injuries

Mercyhealth™

Slips, trips, falls

- Industrial accidents present a lot of the same hazards as agricultural accidents; ALWAYS consider scene safety
- Falls accounted for 14,200 deaths in 2011 and were the second leading cause of accidental death in the U.S.
- Consider cervical spine precautions for slips, trips, falls
- May need to immobilized injured extremities
- Falls may be the result of:
  - Slippery, cluttered, or unstable walking/working surfaces
  - Unprotected edges
  - Floor holes and wall openings
  - Unsafe positioned ladders
  - Misused fall protection

Mercyhealth™

Machine related accidents

- In all machine and vehicle related accidents, make sure machine/vehicle is turned off and secured
- Injuries may be from moving parts, sharp edges, and hot surfaces which can cause serious workplace injuries such as crushed fingers or hands, amputations, burns, or blindness.

Mercyhealth™

Fires/Explosions

According to the most recent fire statistics from the National Fire Protection Association (NFPA), an average of 37,000 fires occur at industrial and manufacturing properties every year.

- Consider hazardous and combustible dusts, chemicals, liquids and gases, and the possibility for secondary explosions
- Know the hazards of the workplace – consult with the MSDS
- Always wear appropriate PPE
- Be prepared to treat severe burns

Mercyhealth™

Blast injuries

- Result from explosions from examples like natural gas, fireworks, improvised (man-made), explosive devices or grain elevators
- Every explosion has three phases:
  - Primary phase injuries – due to pressure wave of the blast
  - Secondary phase injuries – due to flying debris propelled by force of the blast or blast wind
  - Tertiary phase injuries – occurs when the patient is thrown away from the source of the blast

  Injuries sustained during the secondary and tertiary phases are most obvious and more easily accessed and treated. Injuries from the primary phase are often missed and often go untreated even though those injuries can be just as severe.

Mercyhealth™

Electrical Injuries

There are four main types of electrical injuries:

- Electrocution (fatal)
- Electric shock
- Burns
- Falls caused as a result of contact with electrical energy

Mercyhealth™

Electrical Injuries continued

- High voltage power line injuries account for 7% of burn center admissions and often lead to deep muscle necrosis and the need for amputation.

<u>Complications of electircal injuries include:</u>
Rhabdomyolysis (muscular injury)
Compartment Syndrome
Thrombosis or aneurysm formation in blood vessels
Cataract Formation (weeks to years - usually associated with head/chest)
Bowel Perforation, Intra-abdominal hemorrhage

Mercyhealth™

Electrocution

- Recent incidents have shown that electrocution victims can be revived if immediate CPR or defibrillation is provided. While immediate defibrillation would be ideal, CPR given within approximately 4 minutes of the electrocution, followed by advanced cardiac life support (ACLS) measures within approximately 8 minutes, can be lifesaving (OSHA).

Mercyhealth™

Special resources to consider

- MD-1
  - Airway management (RSA), needle decompression, pericardiocentesis, ultrasound, CyanoKit, chest tube, tourniquets, pain control, scene rehab, field amputation
  - Direct physician medical overview
  - Multiple patients (triage, treatment, transport)
- (Fire) Special Operations
  - Hazmat, dive teams, USAR, confined space, high/low angle rescue
- Air Medical

Mercyhealth™

Refresher on GCS (Glascow Coma Scale)

Response	Score
Eye opening	
Opens eyes spontaneously	4
Opens eyes in response to speech	3
Open eyes in response to painful stimulation (eg, endotracheal suctioning)	2
Does not open eyes in response to any stimulation	1
Motor response	
Follows commands	6
Makes localized movement in response to painful stimulation	5
Makes nonpurposeful movement in response to noxious stimulation	4
Flexes upper extremities/extends lower extremities in response to pain	3
Extends all extremities in response to pain	2
Makes no response to noxious stimuli	1
Verbal response	
Is oriented to person, place, and time	5
Converses, may be confused	4
Replies with inappropriate words	3
Makes incomprehensible sounds	2
Makes no response	1

Mercyhealth™

Multi-system trauma patient

- Approximately 90 percent of trauma patients have a simple or single injury that involves only one body system but a multi-system trauma patient has multiple injuries or involvement with more than one body system.

- High incidence of morbidity and mortality
- Need for identification and treatment of immediate life-threatening injuries, rapid transport to the most appropriate trauma facility

Mercyhealth™

Golden Hour? Maybe?

- "Golden Hour" – once established as a time parameter for best chance of survival for trauma patients to receive definitive care, but for some trauma patients, consider "Platinum 10 minutes" which refers to the on-scene time EMS should spend doing an initial assessment, caring for life threats and preparing for transport, all being accomplished within 10 minutes of arrival on scene

- A patient with a lacerated spleen may have less than an hour for best survival chances due to the amount of blood loss with a splenic laceration

Mercyhealth™

Shock management for trauma patients

Initial assessment will help identify if cellular perfusion is adequate

- Check to see if airway is open and patent using jaw thrust; if that fails, use head tilt chin lift carefully
- Breathing; the respiratory pattern will reflect the adequacy of ventilation (if the patient is acidotic, they will have in an increase in rate and depth of ventilation in an attempt to reduce carbon dioxide and compensate for the acidosis)
- Circulation – check for any uncontrolled arterial bleeding and apply direct pressure, hemostatic gauze and/or tourniquet, if needed

Treat for shock – KEEP WARM!

- IV (18 gauge or larger) Normal Saline @ KVO or an appropriate bolus of 500ml (Adult) or 20 ml/kg (Peds), or saline lock. If multiple boluses needed, use Lactated Ringers as preferred solution
- Consider 2nd IV
- In hemorrhaging adult patients without closed head injury, practice permissive hypotension and maintain SBP of 90mmHg.

Mercyhealth™

BLS Level Trauma Care

Amputation care

- Control bleeding
- Find and bring all amputated parts to hospital with patient
- Wrap in moist sterile dressings and place in waterproof bag
- Place waterproof bag on ice or cold packs

Avulsions/Degloving

- Do not replace flap or loose skin, handle gently
- Dress with saline soaked sterile dressings
- Apply direct pressure to control bleeding

Mercyhealth™

Crush Injuries with gloves or shoes on

- Leave gloves or shoes on unless actively hemorrhaging and direct wound care is necessary

Eviscerations

- Do not place organs back into body
- Dress in saline soaked sterile dressings

Impaled Objects

- Do not remove, it is likely slowing the bleeding
- Secure with bulky dressings

Eye foreign bodies

- Copiously irrigate both eyes with sterile water or saline

Mercyhealth™

ALS level hemorrhagic shock treatment

- Use of tourniquet, sustained tachycardia despite pain control/sedation, clinical signs/symptoms of shock such as altered mental status, pale skin, or suspected internal bleeding do the following -

- Hang blood tubing!
- Over 12 years old: TXA 1 Gram IV/IO over 10 minutes for SBP < 90 mm Hg or heart rate > 110 beats per minute.
- Under 12 years old: TXA 15mg/kg(maximum dose 1 Gram) IV/IO over 10 minutes for unstable age based vital signs (less than 80 mm Hg younger than 5, less than 90 mm Hg 5 years and older).
- In the event of prolonged scene and transport time LR is the preferred fluid for hemorrhagic shock resuscitation. LR is not compatible with blood transfusion and a secondary IV access with blood tubing and NS, or flushing the line with NS would be required.

Mercyhealth™

ALS level crush injury treatment

Adult Crush injuries greater than 1 hour assume hyperkalemia and treat!

- Calcium Chloride and Sodium Bicarbonate are not compatible
- Add 50meq Sodium Bicarbonate per liter of NS and initiate 500ml/hr infusion and give 1 liter bolus of this fluid just prior to extrication
- Consider Calcium Chloride 20mg/kg(max 1,000mg bolus) and 1meq/kg Sodium Bicarbonate(max 50meq bolus) slow IV/IO for peaked T-waves, widened QRS, or ventricular irritability
- Albuterol 10mg via nebulizer

Mercyhealth™

ALS level pediatric crush Injury

Pediatric Crush injuries greater than 1 hour assume hyperkalemia and treat!

- Calcium Chloride and Sodium Bicarbonate are not compatible
- Pediatrics use 1meq/kg Sodium Bicarbonate in the NS infusion, infu at:
  - 10kg: 4ml/kg/hr
  - 10-20kg: 40ml/hr plus 2ml/kg/hr for each kg between 10-20kg
  - >20kg: 60ml/hr plus 1ml/kg/hr for each kg above 20kg

- Bolus at 20ml/kg just prior to extrication
- Consider Calcium Chloride 20mg/kg(max 500mg bolus) and 1meq/kg Sodium Bicarbonate(max 50meq bolus) slow IV/IO for peaked T-waves, widened QRS, or ventricular irritability
- Albuterol less than 1 year old 2.5mg, older than 1 year old 5mg nebulizer

Mercyhealth™

ALS level eye injury treatment

- Eye injuries:
  - Tetracaine 2gtts/eye may repeat every 5-10 minutes, max 3 doses
  - Irrigate both eyes copiously with sterile water or saline
  - Coach patient not to rub eyes

Mercyhealth™

Indications for spinal immobilization

- Significant mechanism of injury (MOI) without neck pain or neurologic deficit (numbness or tingling in extremities)
- Trauma patient complains of neck pain or neurologic deficit (numbness or tingling in extremities)
- Trauma patient has altered level of consciousness (from medical condition or drug use)
- Trauma patient significant distracting injury

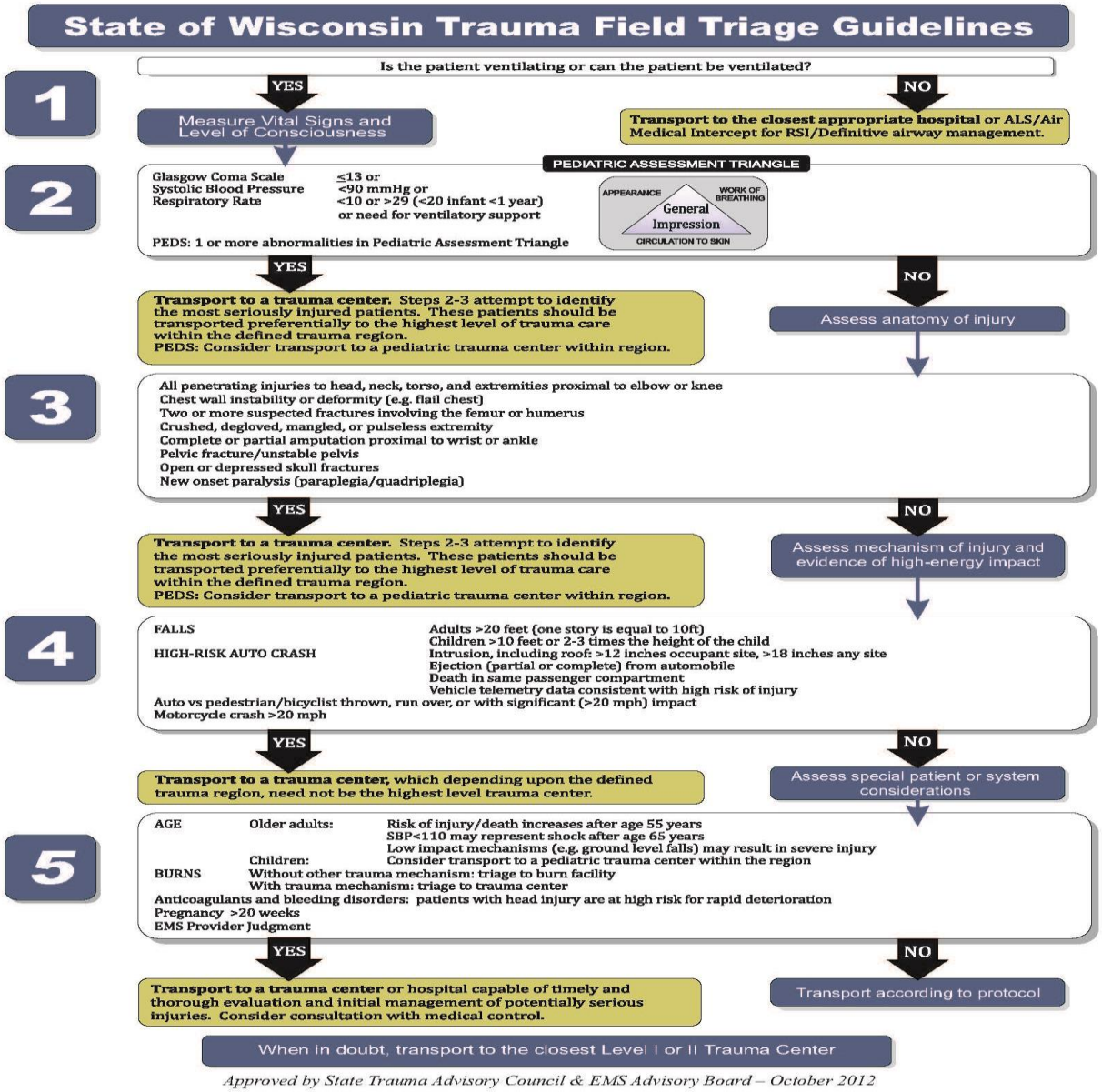
Mercyhealth™

Selective Spinal Immobilization

In the presence of a mechanism of injury for spinal trauma, Cervical collar application is optional if there is no:

- complaint of neck pain or tenderness on exam
- numbness, tingling or weakness in any extremity
- distracting injury
- evidence of alcohol or drug intoxication
- major trauma to the head or face
- history of loss of consciousness
- altered level of consciousness on exam
- If all the above criteria are met, have patient move their neck 45° to either side of midline, flex, and extend neck, and if still no pain, no immobilization is indicated

Mercyhealth™



Wisconsin Trauma Field Triage Guidelines

Mercyhealth™

Hospital Determination

- Closest, most appropriate hospital
- Air Medical should be considered early and utilized when ground transport would not provide the same level of care or timeliness in transporting the patient
- Scene times less than 30 minutes, ground transport is typically a more rapid means of transport.

- One Scene Times **< 10 minutes**, exceptions:
  - Life saving interventions
  - Extrication/ entrapment
  - Crush Injuries

Mercyhealth™

Hospital Trauma Centers

- **Level 1** – Regional Trauma Center – can manage all types of traumas, 24/7. (Froedtert, UW-Madison)
- **Level 2** – Area trauma center – can manage most traumas with surgical capabilities, 24/7. Care focuses on stabilizing more specialized trauma patients. (Mercy Janesville, Aurora Summit)
- **Level 3** – Community trauma center – some surgical capability; care focuses on stabilizing the seriously injured trauma patient and then transferring to higher level. (Mercy Walworth, Aurora Lakeland)
- **Level 4** – Trauma facility – small, community hospital in a remote area that can stabilize a seriously injured trauma patient, then transfers, usually no surgical services

Mercyhealth™

References

- https://www.agrisafe.org/
- https://osha.gov
- Prehospital Emergency Care 10th edition, Joseph Mistovich, Keith Karren, Howard Werman
- Mosby's paramedic textbook revised third editiion, Mick Sanders, Kim McKenna, Lawrence Lewis

Mercyhealth™