PRE-HOSPITAL CARE OF SPINE-INJURED ATHLETE

16th Annual
North Lake Tahoe Paramedic Refresher
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Objective

- To provide EMS professionals with practical recommendations & clinical considerations for managing on-field cervical spine injuries in athletes.

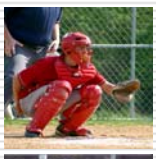
Discussion Points

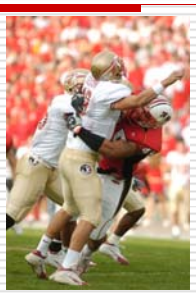
- Equipment Considerations
- Equipment-Laden Athlete Management
  - Football
  - Ice Hockey
  - Extreme Sports
  - Other Sports
- Unstable Athletic Environments
- Special Circumstances

Why is this Important?

- Sport participation constitutes 4th most common cause of c-spine injuries in US
  - American football is associated w/greatest number of c-spine injuries for all US sports (Avg. ~14 annually)
  - Avg. 15 catastrophic c-spine events annually in ice hockey in Canada & US
  - Incidence of catastrophic injuries in lacrosse, gymnastics, & ice hockey is > FB
  - Wildcard- sports equipment and/or unstable sports environments
- Inc. visibility of athletes vs non-athletic population
- Legal implications of treating athletes vs non-athletes

Equipment-Laden Athlete



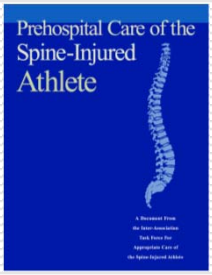


Equipment-Laden Athlete

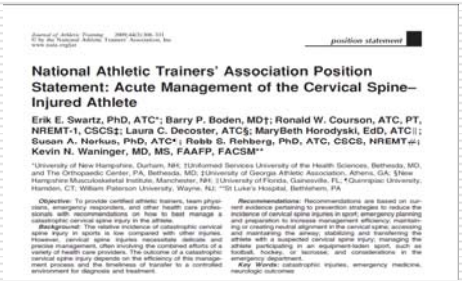
Unique factor in some athletic injuries is that the safety equipment that is designed to protect the athlete can become a hindrance to prompt care of the athlete in the event of a serious injury.

NATA Inter-Assoc. Consensus Statement

- **Involvement from >25 emergency & sports medicine organizations including-**
  - American Academy of Family Physicians
  - American College of Emergency Physicians
  - American Academy of Neurology
  - American Academy of Orthopedic Surgeons
  - **National Registry of EMTs**
  - **National Association of EMTs**
  - American Orthopedic Society for Sports medicine
  - American Association of Neurological Surgeons
  - American Medical Society for Sports Medicine
  - Orthopedic Trauma Association



NATA Position Statement



position statement

National Athletic Trainers' Association Position Statement: Acute Management of the Cervical Spine–Injured Athlete

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Objective: To provide certified athletic trainers, team physicians, emergency responders, and other health care professionals with recommendations on how to best manage a catastrophic cervical spine injury in the athlete.

Background: The relative incidence of catastrophic cervical spine injury in sports is low compared with other injuries. However, cervical spine injuries necessitate delicate and precise management, often involving the combined efforts of a variety of health care providers. The outcome of a catastrophic cervical spine injury depends on the efficiency of this management process and the timeliness of transfer to a controlled environment for diagnosis and treatment.

Recommendations: Recommendations are based on current evidence pertaining to prevention strategies to reduce the incidence of cervical spine injuries in sport, emergency planning and preparation to increase management efficiency, maintaining or creating neutral alignment in the cervical spine, accessing and maintaining the airway, stabilizing and transferring the athlete with a suspected cervical spine injury, managing the athlete participating in an equipment-laden sport, such as football, hockey, or lacrosse, and considerations in the emergency department.

Key Words: catastrophic injuries, emergency medicine, neurologic outcomes

"Athletic teams excel because they practice! It is not conceivable that EMS personnel responsible for c-spine management cannot practice and expect to excel at the time of an emergency"

Ron Courson, ATC, PT, NREMT-I, CSCS

University of Georgia

"In times of stress, you will always fall to the level of your training, not rise to the level of your expectations"

Cervical Spine Injuries

- **Guiding Principles-**
  1. **Exposure & access to vital life functions must be established or easily achieved in a reasonable & acceptable manner**
  2. **Neutral alignment of c-spine & maximal SAC should be maintained while allowing as little motion as possible at the head & neck**

Controversy

- **Facemask Removal vs Helmet Removal Considerations**
  - **Additional Equipment**
  - **C-spine alignment // SAC**
  - **Head / C-Spine Stabilization**
  - **Time**
  - **Available Personnel**
  - **Training / Expertise**

Research

- Removal of FB helmet w/o S' pads has shown to take c-spine out of neutral alignment & decrease SAC
- Increased torque & movement in rotating/retracting facemask vs removing
- **Facemask should be removed at the earliest opportunity, before transportation, & regardless of respiratory status**

Facemask Removal

- **Tools-**
  - **Screwdriver**
    - Power vs Manual
    - Suitable for all helmets
  - **FM Extractor**
    - Expensive
    - Suitable for all helmets
  - **Riddell Mini-Jaws**
    - Inexpensive
    - Does not work well w/all helmets / configurations

Facemask Removal

- **Tools-**
  - **Modified Pruning Shears / PVC Cutters-**
    - Inexpensive but must modify
    - Do not work w/all helmets / configurations
  - **Trainers' Angel-**
    - Obsolete / Does not work w/newer helmets
    - Requires good hand strength & multiple cuts

Facemask Removal

- **Tools (Other)-**
  - **Bolt cutters**
  - **Scissors**
  - **Knives**
  - **Scalpels**
  - **Cast saws**
  - **Rotary / Dremel Tools**

Facemask Removal

- **Research (Tools)-**
  - Screwdriver is superior tool for removal compared to FME & TA
    - Swartz et.al. (AJSM 2005:33(8):1-12)
  - Screwdriver is faster than cutting tools
    - Decoster et.al. (JAT 2005:40(3):169-173)
  - Screwdriver is faster & produces less torque than FME & TA
    - Jenkins, et.al. (JAT 2002:37(3):246-251)
  - FME has less resultant head movement vs. TA, PVC, & AP
    - Swartz, et.al. (JAT 2002:37(2):178-184)
  - FME is faster than AP, TA, & PVC cutters
    - Swartz, et.al. (JAT 2003:38(2):120-125)

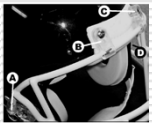
Backup Essential

- The screwdriver is an acceptable tool for FM removal. However, there is a significant hardware failure rate.
- Therefore, An appropriate cutting tool must be immediately available.
  - **COMBINED-TOOL APPROACH**

Decoster LC, Shirley CP, Swartz EE. Football face-mask removal with a cordless screwdriver on helmets used for at least one season of play. J Athl Train. 2005;40(3):169-173.

Facemask Removal

- **Helmet Brands / Types**
- **Loop Straps-**
  - **Standard**
  - **Shock Blocker**
  - **Stabilizer**
  - **Revolution**
  - **Revolution IQ**
  - **ION 4D**
- **Accessories**



Technique A for Cutting Forehead LP

- **Buttress & cutting blade must remain in contact with the helmet shell while cutting the fastener**
- Buttress on bar / blade || to long axis of forehead face mask bar near loop end

Success with Technique A

- Successful cut will completely transect the entire loop strap.

Alternate Forehead LP Technique

- Results in two additional cuts
- Requires less grip strength.
- 1st cut above facemask bar

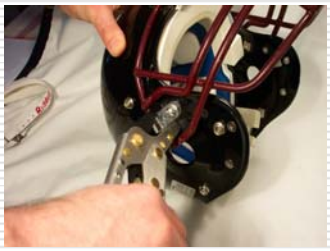
Alternate Forehead LP Technique

- Reposition cutting blade & make 2nd cut below facemask bar
- Leave the buttress on the face mask bar during repositioning

Success with Technique B

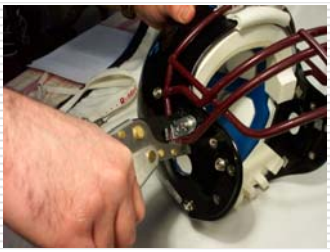
- Successful cuts will result in removal of a piece of the fastener sufficient to allow the face mask bar to pass.
- One may also be able to rotate the cut portion of the fastener still fixed by the screw for more clearance.

Technique A for Cutting Side LP



- Requires that the loop strap be centrally positioned within a face mask
- Must permit sufficient clearance to allow both the blade and buttress to be positioned within the face mask bars.
- Buttress & cutting blade must rest against the helmet

Technique B for Cutting Side LP



- Allows the cutting to tool to grip the bottom face mask bar for increased mechanical advantage over the fastener.
- Results in a single cut to transect the fastener at its mid-section.

Technique C for Cutting Side LP

- Results in two additional cuts per side
- Requires less grip strength.

Technique C for Cutting Side LP

- Successful cuts will result in removal of a piece of the fastener sufficient to allow the face mask bar to pass.
- One may also be able to rotate the cut portion of the fastener still fixed by the screw for more clearance.

Shockblocker Cutting Technique

- Hard plastic outer loop / pliable inner loop
- **Cut through top portion of outer & inner layers**

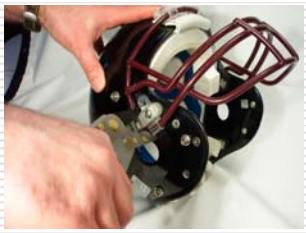
Successful Shockblocker Cutting Technique

- Inner and outer loops are relatively pliable & can easily be bent back out of the way
- **Push inner & outer layer out of the way**

Cutting the Stabilizer – Step 1

- Has two loops made of very thick plastic.
- **Cut secondary loop strap 1st**
  - Easier to cut when under tension

Cutting the Stabilizer – Step 2



- **Cut primary loop strap 2nd**
  - Cut loop strap at the valley where there is less plastic.

Successful Cut of Stabilizer

- Successful use of this technique will result in sufficient clearance for the face mask bars.

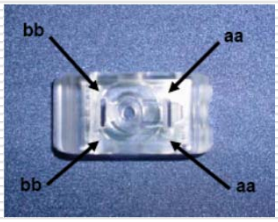
Revolution *(Traditional Loop Straps)*

- Apply pressure to t-nut on inside of helmet

Riddell Technical Service Bulletin; 2/2003

Revolution Cutting Technique

- **4 cuts per strap**
- Fore Access Slot *(aa)*
  - **Milled @ 12-15°**
- Aft Access Slot (bb)
  - **Milled ||**



Revolution Cutting Technique

- **Fore Access Slot**
  - Milled at 12-15°
  - Cutting blade must be inserted at the proper angle to ensure a clean cut.
  - Important to cut the fore access slots **BEFORE** cutting the aft.

Revolution Cutting Technique

- 2nd cut

Revolution Cutting Technique

- **Aft Access Slot-**
  - Milled perpendicular to the ground
  - Cutting blade goes into access slot perpendicular

Revolution Cutting Technique

- **Aft Access Slot-**

  - 2nd cut
  - Make sure blade contact with the helmet shell is maintained at all times when making all cuts.

Successful Cut of Revolution

- When both the fore and aft access slots are completely cut the ends of the fastener will fall away from the center, leaving ample clearance for the face mask bars.

Revolution IQ (Quick Release)

- Depress pin at center of head
- Pull side clip away
- Screwdriver may not be suitable back-up tool!

Riddell Technical Service Bulletin; Fall, 2007

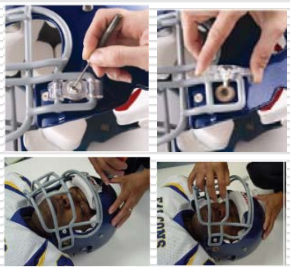
Facemask Removal

- Football Helmet-
  - Revolution IQ (Quick-Release)
    - Riddell Quick Release Pin Release Tool
    - Screwdriver
    - Ball Point Pen
    - Similar item

Riddell Technical Service Bulletin; Fall, 2007

Revolution IQ (Quick Release)

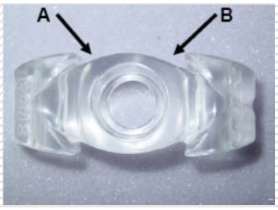
- Depressing button releases the mechanism that holds the face mask to the helmet.
- Still required to cut two top forehead fasteners which are loop straps.



Riddell Technical Service Bulletin; Fall, 2007

Cutting the QR

- Cut side mounting clips @ notched areas



Riddell Technical Service Bulletin; Fall, 2007

Cutting the QR

Riddell Technical Service Bulletin; Fall, 2007

Cutting the QR

Riddell Technical Service Bulletin; Fall, 2007

QUICK RELEASE™ FACE MASK ATTACHEMENT SYSTEM



- **PILOT REMOVAL STUDY (SWARTZ, ET AL) – UNIVERSITY OF NEW HAMPSHIRE**
  - 100% Success Rate in Removal Quick Release Attachment Clips
  - Average Minimum Time for Complete Face Mask Removal – 27.5 Seconds (n=19)
  - Average Minimum Time for QR Side Attachment Removal – 7.7 Seconds
  - "This represents an incredibly speedy removal and is an extremely important improvement in performance." – E.S.

Riddell Revolution Speed

- Uses loop strap fastener that is a little thicker and harder to cut than traditional loop straps.
- Persons with weaker grip strength may find better success with techniques using two smaller cuts-
  - one on either side of the face mask bar as described previous.

Riddell 360

Riddell VSR2-Y

- 6 loop straps
- PVC face mask

Schutt ION 4D

- Cut chin strap straps *(if connected to face mask)*
- **Roll face mask forward out of Energy Wedges**

Schutt

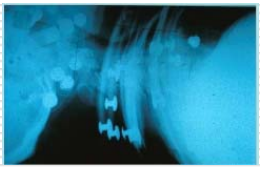
- **New Quick-Release Loop Straps-**
  - **New as of 2010**
  - **Quarter-turn w/screwdriver**

Helmet & S' Pad Removal

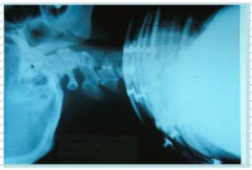
- **Athletic helmet & S' pads should only be removed on the field when-**
  1) **FM cannot be removed in reasonable amount of time**
  2) Airway cannot be controlled after FM removal due to design of helmet
  3) **Helmet & chin straps do not immobilize the head**
  4) Helmet prevents immobilization for transport in appropriate position

Helmet & S' Pad Removal

"All or None Principle"



Helmet w/shoulder pads on



Helmet removed *(note cervical extension)*

Helmet & S' Pad Removal

"All or None Principle"

Helmet & S' Pad Removal

- **Helmet Removal Prep-**
  1. Remove facemask
  2. Remove cheek pads
  3. Cut chin strap
  4. Deflate air bladder(s)

Helmet & S' Pad Removal

- **Wildcards-**

Helmet & S' Pad Removal

- **Shoulder Pad Removal Prep-**
  1. Cut jersey
  2. Cut front laces / material
  3. Cut axilla straps / belts
  4. Accessories
     - Posterior connector
     - Back flap / Flak jacket
     - Neck Roll / Collar
     - Biceps Pads

Helmet & S' Pad Removal

- **Wildcards-**


Riddell RIPKORD

- Only 2-3 trained people to remove equipment (not 10)
- Full medical access to airway
- Full medical access to chest for cardiac emergencies (CPR)
- Immediate use of AED (Automated External Defibrillator)
- Improved ability to utilize cervical collar
- Ability to immediately perform diagnostic testing

Helmet & S' Pad Removal

- Transfer c-spine stabilization
- Remove helmet at appropriate time
  (slight forward rotation; do not spread @ ear holes)


Helmet & S' Pad Removal

Helmet & S' Pad Removal

- *Dahl, et. al (JAB 2009: 25: 119-132)*
  - All produced motion, esp. @ C5-C6
  - No difference w/shear motion

1. **Ground-based (Tilt)-**
   - Tilted pt 50 deg @ waist
   - ↑ posterior motion
   - ↑ lateral motion
2. **Lift & Slide (Levitation)-**
   - ↑ anterior motion
   - ↑ lateral motion (due to lateral position of person stabilizing c-spine)
3. **Log Roll-**
   - Largest lateral displacement
   - ↑ transverse motion

Special Circumstances

- **Traditional Spider Straps usually do not fit w/larger athletes**

- **Helmet comes off during contact**
  - Take S'-pads off?
  - Padding beneath head?

Special Circumstances

- **CPR / AED use-**

Ice Hockey

- **Follow FB protocols**
  - Masks can usually easily flip up
  - Unscrew or cut if mask does not flip
  - Goalie masks have cut able straps on sides & posterior aspect
  - ***If helmet does not provide adequate immobilization or c-spine alignment, remove helmet & S' pads***

Ice Hockey / Figure Skating

- **Spine Board Considerations-**
  - Entrance onto ice-
    - Personnel
    - Yak-Trax / Ice-spikes
    - Stretcher / equipment
  - Towel under knees
  - Loss of body heat
  - Shock
  - **AED on ice??**

Other Sports

- Lacrosse
- Field Hockey
- Baseball / Softball



Extreme Sports

Extreme Sports

- Helmets







Other Considerations

- **Eject Helmet Removal System-**
  - Small air bladder w/attached tube
  - Inflator- bulb or CO2
  - 2 versions-

Other Considerations

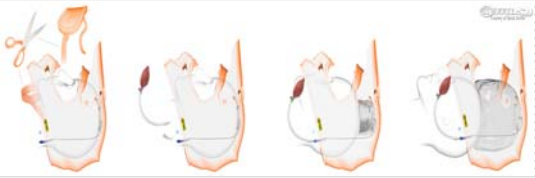
- **Eject Helmet Removal System-**
  - Auto / Motorcycle Helmet Kit-
    - 2" diameter system placed in helmet prior to use

Other Considerations

- **Eject Helmet Removal System-**
  - EMS / First Responder System-
    - inserted past forehead & then inflated

Other Considerations

- Eject Helmet Removal System-



Extreme Sports

- Harnesses-
  - Alpine Star

Extreme Sports

- Harnesses-
  - Leatt

Extreme Sports

- Harnesses-
  - HANS

Extreme Sports

- Other Equipment-

Extreme Sports

- Other Equipment-
  - Boots / Bindings

Extreme Sports

- **Variables-**
  - Vehicles / Animals
  - Terrain / environment
  - Other injuries

Unstable Environments

- **Track & Field-**
  - High Jump / Pole Vault
  - Steeplechase

- **Gymnastics-**
  - Mats
  - Trampoline
  - Foam / "Resi" Pit

Unstable Environments

- **Location / Positioning of pt**
- **Available equipment-**
  - Ladder
  - Plywood / Pallets
  - Spine board
  - Additional Mats

- **Accessing Patient**
- **Patient care**

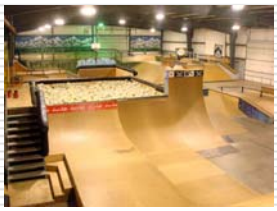
Foam Pit

- **Issues-**
  - **UNKNOWN!!!**
  - Location & position of pt
  - Unstable foam pieces
    → Movement
  - Mechanism / Velocity of Injury
  - Size / Design of pit
  - Availability of equipment & rescuers (min. of 6)
  - Knowledge of rescuers
  - **TEAM**work

Gymnastics Foam Pit

- **Typical size-**
  - **10' x 20'**
  - **6' – 15' deep**
- **Construction-**
- **Filling-**
  - **Foam chunks**
  - **"Resi" material**
- **Other considerations-**
  - **Location in room**
  - **Surrounding equipment**
  - **Access**

Extreme Sports Foam Pit



S.T.O.P. TECHNIQUE

- Stop All Activity
- Talk to the Injured Athlete
- Observe the Injured Athlete-
  - ABCs
  - Location / Positioning
  - Movement
- Prevent Further Injuries

PATIENT ACCESS

- Considerations-
  - Location of patient
  - General impression (S.T.O.P.)
  - Available equipment
  - Training
- Four (4) Methods-
  - Wall Edge of Pit
  - Gymnastics Mats
  - Ladder
  - Direct Entry

PATIENT ACCESS

- Direct Entry-
  - Quickest
  - No special equipment
  - Most potential for patient movement
  - Enter slow & with due care
  - Move foam as you proceed
  - Preferred technique if patient has ABC compromise

PATIENT ACCESS

- **Wall Edge of Pit-**
  - Quick & Easy
  - No special equipment
  - Location, Location, Location!
  - Surrounding Equipment
  - How far is too far?

PATIENT ACCESS

- **Gymnastics Mat-**
  - Use standard 4" mat
  - Mat distributes weight of person across pit
  - Always available
  - Some movement may be transferred to patient
  - Rescuer must spider crawl on mat to reach patient
  - Use caution when placing the mat in the pit

PATIENT ACCESS

- **Ladder-**
  - Make sure ladder spans the pit
  - Place just above patients head
  - Provides stable platform for assessment & c-spine immobilization
  - Always available w/FD
  - Easiest & least movement of direct access methods

PATIENT ACCESS

- **Foam Removal-**
  - Remove from around patient's face
  - Remove excess foam w/ caution upon entering
    - Only remove foam that will not allow body to move
    - Subsequent rescuers remove foam after they reach specific area
  - Do not remove foam beneath patient
    - Provides support
    - Will cause movement
    - Will cause sinking

PATIENT ACCESS

- **Rescuer #1-**
  - Approach victim with due care-
    - Minimize movement of foam
  - Move foam from face of pt.
  - Check ABCs / Critical Interventions
    - **Unstable = Immediate Extrication**
  - Stabilize c-spine

PATIENT ACCESS

- **Rescuer #2-**
  - **Entry-**
    - **Mat**
    - **Direct**
    - **Wall Edge**
  - **Apply neck collar**
  - **Stay @ neck/ shoulder region**
  - **Critical interventions**

PATIENT ACCESS

- **Rescuer #3-**
  - Entry-
  - Positioned opposite of #2 @ neck/shoulder region
  - Critical interventions
- **Additional Rescuers (#4, #5, #6)-**
  - Position rescuers on mats opposite each other
    - 2 on one side; 1 on other

PATIENT IMMOBILIZATION

- **Considerations-**
  - Location in pit
  - Positioning
    - Prone
    - Supine
    - Side-lying
  - Equipment-
    - Spine board
    - Miller Board
    - KED
    - Vacuum mattress
    - Scoop Stretcher

PATIENT EXTRICATION

- **Considerations-**
  - Location in Pit
  - # of Rescuers
  - Equipment available
  - Patient size
- **Methods-**
  - Rapid Extrication
  - Mat
  - Ladder
  - Direct Lift
  - Remove by means of first entry??

PATIENT EXTRICATION

- **Rapid Extrication-**
  - Unstable patient
  - ABCs take priority
  - Maintain c-spine stabilization at all times
  - Use as much caution & care as possible, but priority is on ABCs & rapid extrication
  - Rapidly move to spine board & extricate
    - If spine board or similar device is not immediately available, lift with caution

PATIENT EXTRICATION

- **Mat Method-**

PATIENT EXTRICATION

- **Ladder Method-**

OTHER CONSIDERATIONS

- Face Down patient
- Unstable patient
- Seizure Patient
- Combative Patient
- Orthopedic Injury
- KED / Ped-board use
- Scoop stretcher use
- Other sports utilizing foam pit

Take Home Messages

- **TEAM** Approach
  - ***Leadership / Followship / Relationships***
  - ***"Leave Your Ego At The Door"***
  - ***Train Often & Train Together***
- Mental Rehearsal
  - ***"Expect the Unexpected"***
- **TEAM** must carefully weigh all factors & make educated decisions on what best fits into their individual situations

Thank You!

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