Blast Injuries: Rehabilitation Management, Exercise and Fitness Considerations

CSM Anaheim, CA; 20 February, 2016

Robyn Bolgla MSPT, CTRS, CBIS
LTC, USAR, SP (Command General & Staff College Small Group Leader)
Polytrauma Program Coordinator, Physical Therapist
Department of Veteran Affairs
Disclosures - no relevant financial relationship exists

ACKNOWLEDGMENTS:

US Army Center for Health Promotion and Preventative Medicine

Amy Kaji, MD, MPH, Acute Care College, Medical Student Seminar

DoD Post Doctoral Research Team, JHTR, Vol.25, No.3, pp. 206-218, Margaret M. Weightman, PT, PhD, Karen L. McCulloch, PT, PhD, NCS; Michelle D. Peterson, DPT, PT, NCS
Learning Objectives

- Introduce mechanism of blast & concomitant injuries related to blast to include diagnosing traumatic brain injury (TBI) as it relates to the battlefield, evacuation and brief overview of the rehab process.

- Based on reviews of existing rehabilitation assessment, guidelines, research literature, and input from experts, provide intervention considerations related to activity intolerance, role the nervous and endocrine systems with participation in exercise, patient education & cognitive dysfunction, and chronic pain management.

- Discuss the role of fitness/conditioning in brain injury rehab, pain mng and suggestions to enhance treatment opportunities to advance positive outcomes.
TYPES OF BLAST INJURIES

• Primary
  – Due to direct effect of pressure

• Secondary
  – Due to effect of projectiles from explosion

• Tertiary
  – Due to structural collapse and from persons being thrown from the blast wind

• Quaternary
  – Burns, inhalation injury, exacerbations of chronic disease
Primary Blast Injury

- Unique to high explosives
- Due to impact of over-pressurization wave with body surfaces
- Most commonly involve air-filled organs and air-fluid interfaces
  - Middle ear
  - Lungs
  - Gastrointestinal tract
- Types of injuries
  - Blast lung
  - Tympanic Membrane (TM) rupture
  - Abdominal hemorrhage and perforation
  - Globe rupture
  - Traumatic brain injury (TBI) without physical signs of head injury
TM Injury

- TM - structure most frequently injured by blast
  - TM rupture
  - Ossicle dislocation
  - Disruption of oval or round window

- Symptoms may include hearing loss, tinnitus, vertigo, bleeding from external canal, mucopurulent otorrhea

- Otologic exam and audiometry for all

- TM rupture is sensitive marker, but absence does not exclude other organ injury
TM Rupture
Blast Lung

- Lung – 2nd most susceptible organ to blast injury
- Most common fatal primary blast injury among initial survivors

- Pulmonary barotrauma includes
  - Pulmonary contusions
  - Systemic air embolism
  - Free radical associated injuries
    - Thrombosis
    - Lipoxygenation
    - Disseminated Intravascular Coagulation (DIC)
Blast Lung

- Clinical triad of apnea, bradycardia, and hypotension
- Signs usually at initial presentation but may manifest as late as 48 hours after explosion
- Should be suspected if dyspnea, cough, hemoptysis, or chest pain
- Radiographic findings
  - Bihilar “butterfly” pattern
  - Pneumothorax or hemothorax
  - Pneumomediastinum and subcutaneous emphysema
- Prophylactic chest tube before general anesthesia and air transport if blast lung suspected
Blast Lung

Figure 204 (case 5).—Serial roentgenograms in blast injury.  A. Posteroanterior roentgenogram, 11 November 1943, 24 hours after injury, showing diffuse bilateral haziness and infiltration indicative of petechial pulmonary hemorrhage and edema.  B. Posteroanterior roentgenogram, 17 November 1943, showing clearing of lung field.  C. Posteroanterior roentgenogram, 7 January 1960, 16 years after severe blast injury. The only abnormality is slight emphysema of upper lobes. The diaphragms are at level of the eleventh ribs; their contours are rounded. Heart is also normal.
Pneumothorax
Blast Abdominal Injury

- Colon – visceral organ most frequently affected
- Mesenteric ischemia from gas embolism may cause delayed rupture of large or small intestine
- Intestinal barotrauma more common with underwater air blast
- Solid organ injury less likely

- Signs and symptoms
  - Abdominal pain, nausea, vomiting, hematemesis
  - Rectal pain and tenesmus
  - Testicular pain
  - Unexplained hypovolemia
Blast Abdominal Injury

Intestinal Mucosa Edema
Other Primary Blast Injuries

- **Eye**
  - Globe rupture, serous retinitis, hyphema, lid laceration, traumatic cataracts, injury to optic nerve
  - Signs and symptoms include eye pain, foreign body sensation, blurred vision, decreased vision, drainage

- **Brain**
  - TBI due to barotrauma of gas embolism
  - Signs and symptoms include headache, fatigue, poor concentration, lethargy, anxiety, & insomnia
Globe Rupture
MIDLINE SHIFT

Image size: 512 x 512
View size: 1136 x 616
X: 0 px Y: 0 px Value: 0
WL: 1032 WW: 2085
Secondary Blast Injury

- Due to flying debris and bomb fragments
- Penetrating ballistic or blunt injuries
  - Leading cause of death in military and civilian terrorist attacks except in cases of major building collapse
- Wounds can be grossly contaminated
  - Consider delayed primary closure and tetanus vaccinations
IMPROVISED EXPLOSIVE DEVICE (IED) BLAST INJURY
RADIOGRAPHS
TAKEN DOWN RANGE
AMPUTATIONS AND ORIF PERFORMED DOWN RANGE (IN IRAQ)
Tertiary Blast Injuries

• Due to persons being thrown into fixed objects by wind of explosions

• Also due to structural collapse and fragmentation of building and vehicles

• Structural collapse may cause extensive blunt trauma
  – Crush syndrome
    • Damage to muscles and subsequent release of myoglobin, urates, potassium, and phosphates
    • Oliguric renal failure

  – Compartment syndrome
    • Edematous muscle in an inelastic sheath promotes local ischemia, further swelling, increased compartment pressures, decreased tissue perfusion, and further ischemia
Crush and Compartment Syndrome
Quaternary Blast Injuries

- Explosion related injuries or illnesses not due to primary, secondary, or tertiary injuries
  - Exacerbations of preexisting conditions, such as asthma, COPD, CAD, HTN, DM, etc.
  - Burns (chemical and thermal)
    - White Phosphorous (WP) from munitions causes extensive burns, hypocalcemia and hyperphosphatemia
  - Toxic inhalation
  - Radiation exposure
  - Asphyxiation (carbon monoxide and cyanide)
Treatment for Acute Gas Embolism (AGE)

- Recompression with 100% oxygen
- Left lateral recumbent position
- Hyperbaric oxygen (HBO) is definitive
  - Transfer may be necessary
- Aspirin may be helpful in AGE
  - May reduce inflammation-mediated injury in pulmonary barotrauma
  - Weigh bleeding risk in acute trauma setting
AGE

Three hyperbaric chambers, two monoplace and one multiplace, are in use at the Hyperbarics Medicine Department at West Jefferson Medical Center in Marrero, Louisiana.
Treatment of Burns

- **WEAR FIRE RETARDENT GLOVES GEAR FROG SUITS**

- Cover burns to minimize heat and fluid loss

- WP burns require special management
  - Copious lavage and removal or particles and debris
  - Rinse with 1% copper sulfate solution
    - Combines with phosphorous particles and impedes further combustion
  - Cardiac monitor
    - Hypokalemia and hyperphsophatemia common
  - Use moistened face masks to protect from phosphorous pentoxide gas exposure
  - Avoid use of flammable anesthetic agents and excessive oxygen
BLAST: HISTORICALLY IN U.S.

- Few US bombings have caused mass casualties
  - First World Trade Center Attack 1993
  - Oklahoma City Bombing 1995
    - Fuel and fertilizer used to create a bomb
    - 518 injuries and 168 deaths
  - Atlanta Olympic Park Bombing 1996
  - World Trade Center and Pentagon 2001
  - Explosive Device Attacks at Abortion Clinics
  - Boston Marathon Bombing 2013
New York City
September 11, 2001
Madrid, Spain
March 11, 2004
BOSTON MARATHON  April 15, 2013
Bing.com/images accessed 20141012
Fatalities from terrorism in Israel by year, 1948-2014
OEF OIF OND
IED’s, RPG’s, MORTAR ROUNDS, SMALL ARMS FIRE, ECT...
Bag with Bomb

The FBI displayed a knapsack similar to the one that contained a bomb. (CNN/file)

Can you tell which bag contains the bomb?
Classification of Explosives

- **High Order (HE) Explosive**
  - Produce a high pressure shock wave
  - Examples include TNT, C-4, Semtex, dynamite

- **Low Order (LE) Explosive**
  - Produce a subsonic explosion
  - Examples include pipe bombs, molotov cocktails

- **Manufactured Explosive**
  - Standard military-issued quality-tested weapon

- **Improvised Explosive Device (IED)**
  - Use a device outside its intended purpose
  - Commercial jet as a guided missile
  - Loaded with metallic objects to inflict penetrating injury
WP Smoke Hand Grenade
WP Burn Victim

Thanks to CPI donor support, Ha is expected to walk again.
Photo: Imbert Matthee 2003
General Considerations

DISTANCE FROM AND TYPE OF EXPLOSION PREDICT INJURY SEVERITY

- Confined space vs. open space
  Increased number of penetrating and primary blast injuries if closed space

- Intensity of explosion pressure wave declines with cubed root of distance away from explosive
  Standing at 3m has 9x greater pressure than if at 6m

- Blast wave reflected by solid surfaces
  Closer to a wall may sustain a greater primary blast injury
General Considerations

- Half of all initial casualties seek medical care over first hour

- Expect upside down triage
  - Most severely injured arrive after less injured who bypass EMS and self-transport to closest hospitals

- Secondary devices
  - Initial explosion attracts law enforcement and rescue personnel who will be injured by second explosion
REFERENCES


WOUNDED WARRIORS COMMISSION

PRESIDENT’S EXECUTIVE ORDER 2007- CARE FOR AMERICA’S RETURNING WOUNDED WARRIORS - DOLE-SHALALALA COMMISSION INCLUDED BEST PRACTICE BLAST MANAGEMENT, TBI, BURNS

DONNA SHALALALA - PRESIDENT OF UNIVERSITY OF MIAMI, FORMER SECRETARY OF HEALTH FOR PRESIDENT CLINTON

BOB DOLE - FORMER SENATOR, PRESIDENTIAL CANDIDATE AND WWII DISABLED VETERAN

35 RECOMMENDATIONS
TBI CLASSIFICATIONS
MILD, MODERATE, SEVERE

A TBI is classified as moderate or severe when a patient experiences any of the following:

• Is knocked out or blacks out for more than 30 minutes

• Has memory loss or is confused for hours, days or weeks

• Has an abnormal brain scan (CT or MRI)
TBI CLASSIFICATIONS
Mild Brain Injury and Concussion

Definition: The term “mild brain injury” can be misleading. The term “mild” is used in reference to the severity of the initial physical trauma that caused the injury. It does not indicate the severity of the consequences of the injury.
DEFINITION  MTBI = CONCUSSION  
(CAN BE USED INTERCHANGEABLY)

TRAUMATICALLY INDUCED STRUCTURAL INJURY, PHYSIOLOGICAL DISRUPTION OF BRAIN FUNCTION from an EXTERNAL FORCE INDICATED BY NEW ONSET OR WORSENING OF AT LEAST ONE OF THE FOLLOWING CLINICAL SIGNS:

ANY PERIOD OF LOSS OF OR A DECREASED LEVEL OF CONSCIOUSNESS

LOSS OF MEMORY IMMEDIATELY BEFORE OR AFTER THE INJURY

ALTERATION IN MENTAL STATE AT THE TIME OF THE INJURY - CONFUSION, DISORIENTATION, SLOWED THINKING ECT; NEUROLOGICAL DEFICITS (WEAKNESS, LOSS OF BALANCE, CHANGE IN VISION, PRAXIS, PARESIS/PLEGIA, SENSORY LOSS)

INTRACRANIAL LESION

VA/DoD Clinical Practice Guideline for Management of Concussion/MTBI 2009
The type of tissue where your breast cancer arises determines how the cancer behaves and what treatments are most effective.

- **Milk ducts** Ductal carcinoma is the most common type. Forms in the lining of a milk duct, can remain within the duct as noninvasive cancer (ductal carcinoma in situ) or break out of the ducts (invasive ductal carcinoma).

- **Milk-producing lobules** Lobular carcinoma within the lobules of the breast, where breast milk is produced. When it breaks out of the lobules, it's considered invasive lobular carcinoma.

- **Connective tissues** Rarely breast cancer can begin in the connective tissue (mm, fat and blood vessels). Cancer that begins in the connective tissue is called sarcoma. Examples of sarcomas that can occur in the breast include tumor and angiosarcoma.

- **Subtypes** Cancer cells with unique appearances = tubular, mucinous, medullary and papillary.

- **Breast Cancer Grade** = degree of difference between the cancer vs normal cells. Graded 1-3 scale, grade 3 = most different & aggressive
MILD TRAUMATIC BRAIN INJURY (MTBI)

SIGNATURE WOUND

Operation Enduring Freedom OEF

Operation Iraqi Freedom OIF

Operation New Dawn OND
Rehabilitation services provide adaptive and remedial interventions designed to address impairments and activity limitations associated with TBI.
Rehab providers play an essential role to the mission of the Military & Veteran Affairs for over 75 years.

Army Medical Specialist Corps mission: “to apply Corps unique skills to maximize the health and enhance the readiness of Warriors across the full spectrum of operational missions and environments (retrieved December 9, 2007 from https://amsc.amedd.army.mil/ , Army Medical Specialist Corps)
VA MISSION - HONOR OUR VETERANS
*maintain troop levels  *return soldiers to duty

*ensure best possible recovery and rehab for those who are unable to return to duty
SURVEILLANCE

Active duty, reserve and guard are at increased risk for sustaining a traumatic brain injury (TBI) compared to their civilian counterparts.

Weightman MM, PT Recommendations for Service members with MTBI, June, 2010
Overall Casualties in OIF, OND, and OEF, October 7, 2001- July 28, 2015

<table>
<thead>
<tr>
<th>Operation</th>
<th>Deaths (Hostile/Non-Hostile)</th>
<th>Wounded in Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Iraqi Freedom</td>
<td>4,424</td>
<td>31,951</td>
</tr>
<tr>
<td>Operation Enduring Freedom</td>
<td>2,355</td>
<td>20,071</td>
</tr>
<tr>
<td>Operation New Dawn</td>
<td>66</td>
<td>295</td>
</tr>
<tr>
<td>Operation Inherent Resolve</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Operation Freedom’s Sentinel</td>
<td>3</td>
<td>33</td>
</tr>
</tbody>
</table>

Battle-Injury Major Limb AMPUTATIONS
OEF, OFS, OIF, OND, OIR
October 7, 2001-June 1, 2015
1,645 TOTAL

(APPXIMATELY)
77% were in the Army
19% were in the Marines
2% were in the Air Force
2% were in the Navy

https://www.fas.org/sgp/crs/natsec/RS22452.pdf accessed 2/6/16
TRAUMATIC BRAIN INJURIES TBI 2000-2015

MILD  269,580
MODERATE  27,728
SEVERE or PENETRATING  8,287
NOT CLASSIFIABLE  21,704
TOTAL:  327,299

Traumatic Brain Injury (TBI) 2000-2015 Q1 by Classification and Service, Deployed and Not Previously Deployed Combined (as of June 5, 2015)

https://www.fas.org/sgp/crs/natsec/RS22452.pdf accessed 2/6/16
Military spent est. $100 million on direct & purchased care for TBI patients ... AND $10.1 million on prescription costs for diagnosis of TBI. (2008)

COST

CARING FOR TBI/PSYCHOLOGICAL HEALTH

2011 REQUEST $1.1 BILLION

DEPARTMENT OF THE ARMY
RESEARCH GRANT: 2007

POST DOCTORAL TEAM TO
ESTABLISH PT/OT CLINICAL
MANAGEMENT PROTOCOLS FOR
MILD TRAUMATIC BRAIN INJURIES
Physical Therapy

Recommendations For Service

Members With Mild Traumatic Brain Injury

Margaret M. Weightman, PT, PhD; Robyn Bolgla, MSPT, CTRS; Karen L. McCulloch, PT, PhD, NCS; Michelle D. Peterson, DPT, PT, NCS

J Head Trauma Rehabil Vol. 25, No. 3, pp. 206-218

Copyright© 2010 Wolters Kluwer Health | Lippincott Williams & Wilkins
PATIENT CLIENT EDUCATION
Verbal and written educational info of MTBI symptoms:
HA
Memory and Attention difficulties
Reassurance - recover in weeks or months - typically < 3 months
PR&R / R2D MTBI education handouts

MTBI SYMPTOMS & REHAB, EXERCISE, FITNESS CONSIDERATIONS

ACTIVITY INTOLERANCE

VESTIBULAR DYSFUNCTION

HIGH LEVEL BALANCE DYSFUNCTION

POSTTRAUMATIC HEADACHE (HA)

TEMPOMANDIBULAR DISORDERS TMD

ATTENTION AND DUAL-TASK PERFORMANCE DEFICITS

PARTICIPATION IN EXERCISE
REHAB CONSIDERATIONS BLAST STUDIES: BLAST WAVE VS BLUNT TRAUMA/IMPACTS TO THE BRAIN

HELMETS PROBABLY HAVE LITTLE EFFECT ON PRESSURE OF BLAST WAVE

NEUROLOGICAL SYSTEM DEGRADES 15-30% OF SERVICE MEMBERS WITH BLAST INJURY WILL DEGRADE - CAN WALK AND TALK BUT ONE YEAR LATER SIGNIFICANT COGNITIVE, SPEECH AND MOTOR SKILL FAILURE

HOW TO TREAT?
R&R REST (1? 7? 30 DAYS?)
ANTIOXIDANTS TO ENHANCE NEUROLOGICAL FUNCTION AT A PHYSIOLOGICAL LEVEL

READINESS TESTS - DUAL TASKS (walk, talk, chew gum) EVALUATION FUNCTION AFTER PHYSICALLY STRESSED (under conditions of hypoxia - Bleiberg)
REHAB, EXERCISE, FITNESS CONSIDERATIONS

U.S. Central Command reports escalating # of concussions suffered by US service members deployed to Afghanistan

July - September 2010 more than 1000 concussions identified, more than twice the number diagnosed in the previous four months.

New guidelines to manage blast exposures - Service members within 165 feet of a blast MUST be removed from the battlefield for at least 24 hours & examined for concussion.

Armed forces health surveillance center numbers for 2000 - 2010 Q4. as of 17 February 2011.
PAST TBI RESEARCH VS EMERGING EVIDENCE

“An inconsistent response is one of the most striking results produced by a lesion of the cerebral cortex”
Head, H (1926) Aphasia and kindled disorders of speech, Cambridge University Press, pp 145-147

“Concussion begets concussion” - 2/3 higher rate after initial concussion will get second concussion.”
mTBI Power Point Present, 6/20/2008, Bleiberg J, PhD Natl Rehab Hosp. Ft Bragg Studies, Ft. Rucker study

Among service members exposed to blast, post concussion symptoms increased as a function of cumulative blast exposures
J Neurotrauma Reid et al, 2014 Jul 18
Repetitive Traumatic Brain Injury, Psychological Symptoms, and Suicide Risk in a Clinical Sample of Deployed Military Personnel

Depression, PTSD, and TBI symptom severity significantly increased with the number of TBIs. An increased incidence of lifetime suicidal thoughts or behaviors was associated with the number of TBIs. # of TBIs was associated with greater suicide risk even when the effects of depression, PTSD, and TBI symptom severity were controlled for. A significant interaction between depression and cumulative TBIs was also found.

Bryan, CJ, Clemans, TA. JAMA Psychiatry 1-6 2013

“Preinjury resilience and mood as predictors of early outcome following mild traumatic brain injury.”

Preinjury depressed mood and low resilience are significant contributors to the severity of post injury anxiety and post concussion symptoms, even after accounting for effects of other specific host factors.

BLAST EMERGING EVIDENCE & REHAB CONSIDERATIONS

• Retinal and optic nerve functional loss

• Molecular changes

• Blast waves effect on myelin membranes

• Biomarkers

• Significant white matter damage (corpus collosum, cingulate gyrus, brain stem) not see on traditional MRI BUT found on fMRI, Diffusion Tensor Imaging DTI

Federal Interagency Conference on TBI 2011, Kevin Lim MD, Mathew Harper PhD, Rahul Bhowmik
Longitudinal study explores white matter damage, cognition after traumatic axonal injury

- Traumatic Axonal Injury a form of TBI can have detrimental effects on the integrity of white matter and lead to cognitive impairments.
- White matter integrity measured via diffusion tensor imaging (DTI)
- Neuropsychological assessments measured cognitive performance: processing speed, attention, learning and memory at both stages after injury.
- DTI may be used to detect changes in white matter day 1 after a TBI & chronic stage (7 months post). Also found to significantly correlate with cognitive processing speed.
- Day 1 white matter integrity was compromised due to swelling in the brain. Swelling subsided over time and brain began to repair itself; however, many damaged neurons unable to repair themselves began to die off - appears to slow the speed of cognitive processing.
Stroke-fighting drug offers potential treatment for traumatic brain injury
October 7, 2014, Henry Ford Health System

Stroke drug administered as a nasal spray may help heal similar damage in less severe forms of traumatic brain injury.

Animal studies show the brain's limited ability to repair itself after trauma can be enhanced when treated with the drug tPA, or tissue plasminogen activator.
Aerobic Exercise

Aerobic exercise increases the muscles' ability to obtain nutrients and oxygen from blood and discharge waste products.
Serotonin neurotransmitters implicated in depression. Many anti-depressants increase serotonin levels.

Exercise may improve your mood via releasing serotonin and other endorphins, exercise can be useful in treating depression.
Aerobic Fitness, Serotonin, Endorphins & Exercise

Endorphins, neurotransmitters found in the pituitary gland and nervous system = body's natural pain medication.

Interact with human opiate receptors, reduces perception of pain.

Endorphins, serotonin, produced in response to stress & pain, & exercise.

Why?? Brain may perceive exercise is pain, releases serotonin and endorphins. The rise in fatty acids caused by exercise may acidify the blood, triggering endorphin release?
Army PRT (Physical Readiness Training)

Special Conditioning Programs

...are appropriate for Soldiers who have difficulty meeting unit goals or Army standards. These programs are not punitive; their purpose is to improve the physical readiness of Soldiers. Special conditioning programs designed to accommodate these needs will be conducted during normal duty hours.
Exercise induces changes in MENTAL STATUS: analgesia, sedation, anxiolytics, and a sense of wellbeing.

The mechanisms underlying these changes remain unknown.

Recent findings show exercise increases serum concentrations of endocannabinoids, suggesting a possible explanation for a number of these changes.

Endocannabinoids and exercise, A Dietrich, W F McDaniel
Accessed from bjsm.bmj.com on May 22, 2014 - Published by group.bmj.com
STRESS AND STRAIN
POSSIBLY TO THE BRAIN?
LOOKS NORMAL?
BUT...NOT QUITE RIGHT
LET US ALL TAKE A DEEPER LOOK
A rare view from the patient with occipital lobe damage!!!
EIGHT LEVELS OF CARE US MILITARY & VA SYSTEM

- I Buddy Aid to Battalion Aid Station
- II Forward Support Medical Company/Forward Surgical Team
- III Combat Support Hospital
- IV Evacuation Center (Landstuhl Regional Medical Center - Germany)
- V Military Medical Treatment Facility (MMTF) Inpatient and Outpatient
- VI Inpatient Rehabilitation Non-MMFT
- VII Outpatient Rehabilitation Facility (Non-MMFT)
- VIII Lifetime Care
PHYSICAL and OCCUPATIONAL THERAPY
DOWN RANGE LEVEL I, II, III
IRAQ and AFGHANISTAN
THE TRUE COST OF WAR....
AFTER BLAST???
PT/OT MTBI EVALUATION TO ASSIST WITH RETURN TO DUTY
DOWN RANGE OR EVACUATE CONUS
Military Acute Concussion Evaluation (MACE)
The purpose of the MACE is to evaluate a person in whom a concussion is suspected. The MACE is used to confirm the diagnosis and assess the current clinical status.

The MACE has been extensively reviewed by leading civilian and military experts in the field of concussion assessment and management.

While the MACE is not yet a validated tool, the examination section is derived from the Standardized Assessment of Concussion (SAC)

**MACE:** Determine whether and length of time of self reported loss of consciousness (LOC)

Orientation: Assess patients awareness of the accurate time Ask:
WHAT MONTH IS THIS?
WHAT IS THE DATE OR DAY OF THE MONTH?
WHAT DAY OF THE WEEK IS IT?
WHAT YEAR IS IT?
WHAT TIME DO YOU THINK IT IS?
FIT FOR DUTY AFTER MTBI
DUST OFF
AIR EVACUATION FROM DOWN RANGE TO LANDSTUHL REGIONAL LEVEL IV
PATIENT TRANSFERRED ON LITTER

AMBULANCE BUS
LEVEL IV LANDSTUHL

NATURAL HISTORY OF MTBI

May become symptomatic at time of incident or days or weeks after.

Symptoms often include HA, dizziness, nausea and vomiting, sleep disturbances, sensitivity to noise and light, slowed thinking and reaction time, memory problems, irritability, depression and visual changes (Carroll et al., 2004)

Majority of cases symptoms resolve within 3 months (Ruff, 2005). However, for 15-25% of those with MTBI, problems persist and impact normal function.

Miserable minority who present with persistent problems after 3 months may have post-concussive syndrome (PCS) (Mittenberg & Strauman, 2001; Ruff, 2005).
Inpatient rehabilitation Landstuhl Regional Medical Center approx. 72 hours evacuation standard/ evacuation cycle

(U.S. Army Photo/Michelle Barrera)
EVACUATION TO UNITED STATES

LEVEL V MILITARY TREATMENT FACILITIES (MTF)

INPATIENT REHAB & OUTPATIENT REHAB

WALTER REED MILITARY MEDICAL CENTER (Bethesda MD) and SAN ANTONIO MILITARY MEDICAL CENTER (Ft Sam Houston TX)

CENTER FOR THE ENTREPID
LEVEL V
CENTER FOR THE INTREPID

San Antonio Military Medical Ctr
Ft. Sam Houston TX

REHABILITATION INTERVENTIONS
CENTER FOR INTERPID REHAB
INDOOR RUNNING TRACK
Computer Assisted Rehabilitation Environment Simulator, (CAREN) Center of the Intrepid, San Antonio Military Medical Center TX Nov. 17, 2008. Army photo by D. Myles Cullen (released)
DRIVER SIMULATION

NAVY PHYSICAL THERAPISTS
Chronic Traumatic Encephalopathy (CTE) - progressive degenerative disease found in athletes, military veterans, and others with a history of repetitive brain trauma.

Brain trauma can cause a build-up of an abnormal type of a protein called TAU, which slowly kills brain cells. “protein gone haywire”.

Changes in the brain appear to continue to progress even after exposure to brain trauma has ended.

Possible symptoms: memory loss, confusion, impaired judgment, paranoia, impulse control problems, aggression, depression, eventually progressive dementia. Symptoms may appear months, years, or decades after trauma ends. Currently, diagnosed posthumously by brain tissue analysis.

http://concussionfoundation.org/learning-center/what-is-cte accessed 2/7/16
CTE found in 96% of NFL players

Quarterback Kenny Stabler died July 2015 at age 69, diagnosed with CTE NFL MVP, 1977 Super Bowl champion Oakland Raiders

76 of 79 Deceased NFL Players Found to Have Brain Disease

C.T.E. Found in an Ex-Giant Tyler Sash, Died at 27. Severity of C.T.E. in Sash’s brain similar to level in N.F.L. star Junior Seau who committed suicide in 2012 at age 43. Seau played 19 seasons in NFL, Sash only played in 23 games

Doctors grade C.T.E. on a severity scale from 0 to 4; Sash was at Stage 2

http://concussionfoundation.org/learning-center/what-is-cte
Accessed 20160207
http://www.nytimes.com/2016/01/27/sports/football/former-giants-safety-tyler-sash-found-to-have-cte.html?_r=0
accessed 20160130
O'Neal's status casts large shadow on Game 7

Michael Cunningham | South Florida Sun-Sentinel May 3, 2009 Miami

Heat-Hawks Game 7, 2009

Effects from a concussion may limit Jermaine O’Neal’s effectiveness...

O'Neal said he first knew the injury could be serious when he was sensitive to the aircraft’s cabin lights, severe HA, trouble sleeping

Symptoms much better over two days
Leon Spinks, Marine 1973-76 Olympic gold medalist 1976, heavyweight champion used VA services for about a decade... Lou Ruvo Center for Brain Health Dr Bernick co-author, professional fighters brain study - brain trauma from Leon’s boxing career affected his mood, memory and physical changes. 1st stage of the study 93 boxers & 131 martial arts fighters initial findings — repeated blows are linked with smaller volume of certain parts of the brain and slower processing speeds...wife Brenda “She’s been there through thick and thin.”

https://usatboxingjunkie.files.wordpress.com/2015/08/spinksrevised.png
Natasha Richardson dies after ski fall

Natasha Richardson, a film star, Tony-winning stage actress and a member of the famed Redgrave acting family, has died. She was 45. Richardson died after suffering injuries in a fall on a ski slope at a Quebec resort about 80 miles northwest of Montreal. She was talking and joking after the fall, resort officials said. But she was later taken to a hospital for treatment. full story

- 'Minor' head injuries may not be, experts say
- Richardson part of legendary acting family
- Actress had entertainment in her blood
- Time: Richardson always worth watching
- iReport.com: Share memories | AC360° Blog
REHAB THERAPISTS, FITNESS AND EXERCISE PROFESSIONALS provide pivotal contributions to the recovery, rehab, and reintegration of service members and civilians with blast injuries and MTBI

MULTIDISCIPLINARY TEAMS, PROFESSIONAL ASSOCIATIONS - MEDICAL FITNESS ASSOCIATION, AKTA, APTA, AOTA

DVBIC

CONCUSSION LEGACY FOUNDATION (formerly the Sports Legacy Institute) (NFL, NHL, COLLEGE AND HIGH SCHOOL SPORTS ...ONE AND DONE! led by Executive Director Chris Nowinski and Medical Director Dr. Robert Cantu

BRAIN INJURY ASSOCIATION of AMERICA www.biausa.org

RESEARCH to advance outcomes enhance quality of life

MILITARY GUIDANCE
KO2 = KO KO = KNOCK OUT, KNOCK OUT
QUESTIONS