

The Other Trauma Triad of Death

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...And you are?

- Jennie L. Orr, RN, BSN
 - Critical care background
 - Trauma
 - DHMG Surgical Specialties Clinic
- Nothing to disclose

The Trauma Triad of Death



The Trauma Triad of Death



The Trauma Triad of Death



The Trauma Triad of Death



The Actual Trauma Triad of Death



Temperature

- Consequences of hypothermia

Cardiovascular	Decreased cardiac output and myocardial ischemia
	Decreased cardiovascular response to catecholamines (epinephrine)
	Impaired tissue oxygen delivery
	Arrhythmias such as atrial fibrillation and v fib
Bleeding	Decreased function of coagulation factors and platelets to make clot and thus stop hemorrhage
Infection	Decreased number and function of white blood cells
	Increased risk of wound infection, pneumonia and sepsis

Acidosis

- Consequences of acidosis

Cardiovascular	Decreased cardiac output and myocardial ischemia
	Decreased cardiovascular response to catecholamines (epinephrine)
	Impaired tissue oxygen delivery
	Arrhythmias such as atrial fibrillation and v fib
Bleeding	Decreased function of coagulation factors and platelets to make clot and thus stop hemorrhage
Infection	Decreased number and function of white blood cells
	Increased risk of wound infection, pneumonia and sepsis

The Basic Cheat Sheet

hypothermia	acidosis	coagulopathy
<ul style="list-style-type: none">- exposure<ul style="list-style-type: none">> blanket> turn up the heat- IV fluids<ul style="list-style-type: none">> warm> limit	<ul style="list-style-type: none">- IV fluid<ul style="list-style-type: none">> LR vs. NS	<ul style="list-style-type: none">- blood- TXA- stop the bleeding- limit fluid admin

The OTHER Trauma Triad of Death

- Physical Deconditioning
- Cognitive Decline
- Malnutrition
- Frailty / Swamp Sense
- This is NOT a talk about ABCDEF
 - Assess, prevent, and manage pain
 - Both SAT / SBT
 - Choice of analgesia and sedation
 - Delirium assessment, prevention, and management
 - Early mobility and exercise
 - Family engagement and empowerment

The OTHER Trauma Triad of Death—Not ABCDEF

- Why?
 - Secondary effects of hospitalization of which most of us are completely unaware last long after discharge
 - Post Intensive Care Unit Syndrome (PICS)
 - Persistent physical, mental, and cognitive dysfunction
 - ARDS, sepsis, mechanical ventilation
 - Unique considerations in trauma
 - Pre-existing health state—the young frail
 - Nature of injuries (i.e., TBI)
 - Unique metabolic response to trauma

Weird Stuff to Think About



Acute Physiology and Chronic Health Evaluation



Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity



American Society for Parenteral and Enteral Nutrition



Sequential Organ Failure Assessment

The Other Trauma Triad of Death: Physical Deconditioning

Physical Deconditioning

- Traumatic injuries
 - Fractures
 - Pelvic
 - Long bone
 - Extremity
 - Organ injury
 - Exploratory laparotomy
 - Open abdomen
 - Traumatic brain injury (TBI)
 - Skin injuries
 - Road rash
 - Lacerations

Physical Deconditioning

- Traditional treatment
 - Bed rest bias
 - Nurse
 - Family
- What does bedrest do, anyway? Are you actually resting? ...OR SLOWLY DYING?

REALLY, REALLY SLOWLY.

ONE HOUR OF TV AT A TIME.

Physical Deconditioning

- Death by bed rest
 - Immobility associated muscle loss begins within 48 hours of critical illness
 - Peaks during the first two to three weeks in the ICU, but up to 40% of muscle strength is lost in the first week
 - Duration of bedrest in the ICU is the only risk factor with strong, independent and consistent association with muscle loss across three, six, 12, and 24 month follow up after discharge
 - Definition of ICU bedrest is ICU LOS as 75% of patients did not routinely receive any mobilization during their ICU stay
 - Even acutely hospitalized older adults, able to walk independently, spend most of their time in bed
- ICU Acquired Weakness (ICU-AW)
 - Characterized by symmetrical and flaccid weakness of the limbs, with distal portions suffering greatest effect
 - Facial grimacing to painful stimuli with little withdrawal of limbs
 - Remember this muscle weakness affects respiratory muscles as well
- Muscle wasting, exercise intolerance, and decreased quality of life persist even after one year from ICU discharge

Physical Deconditioning

- ICU-AW
 - Affects 25 – 100% of critically ill patients
 - Axonal nerve degeneration and myosin loss
 - Critical Illness Polyneuropathy (CIP) and Critical Illness Myopathy (CIM)
- CIP
 - Axonal degeneration
 - Poorly understood
 - Microvascular changes result in increased permeability of the endoneurium, resulting in endoneurial edema, impairing the energy delivery to the axon
 - Axonal death

Physical Deconditioning

- ICU-AW
 - Critical Illness Polyneuropathy (CIP) and Critical Illness Myopathy (CIM)
- CIM
 - Muscle atrophy as a result of increased muscle breakdown and decreased muscle synthesis
 - Inflammation, immobilization, endocrine stress response, nutritional deficit, impaired microcirculation, and denervation all lead to muscle wasting
 - Bioenergetic muscle failure
 - Oxidative stress, mitochondrial dysfunction, ATP depletion
 - Sound familiar?
 - Recovers more quickly than CIP

Physical Deconditioning

- Defying passive dependency, moving towards mobilization
 - Looking for small, incremental steps that prime the pump for large gains
 - Searching for what can be achieved toward particular goals while working within limitations
 - “Physical activity sufficient to elicit acute physiological effects that enhance ventilation, central and peripheral perfusion, circulation, muscle metabolism and alertness [acting as] countermeasures for venous stasis and deep vein thrombosis.”
- Active mobilization
- Passive mobilization

Physical Deconditioning

- Defying passive dependency, moving towards mobilization
 - Active mobilization
 - Active/resistance range of motion (ROM)
 - “Sit ups” in bed (tilting)
 - Active repositioning
 - Sitting on the bed or chair
 - Dangling
 - Transfers
 - Walking
 - Passive mobilization
 - Passive ROM

Physical Deconditioning

- Defying passive dependency, moving towards mobilization
 - Opportunities for mobility
 - Patient bridges/scoots/rolls during bed change
 - Sits at the side of bed for assessment
 - Out of bed to chair for meals, medications
 - ADLs at sink rather than bedside table
 - ASKING THE PATIENT TO USE THEIR ARMS
 - Early PT / OT consults
 - Get on the radar
 - What the patient can do at each stage of their illness and recovery

MULTICOMPONENT PHYSICAL EXERCISE PROGRAMME FOR FRAILTY AND FALLS PREVENTION AMONG PEOPLE AGED OVER 70™

A

Severe functional limitation, mobility impairment
BY PERFORMING THESE EXERCISES, YOU SHOULD BE ABLE TO STAND UP FROM A SITTING POSITION.

A
B
C
D



Lift your arms while holding a small water bottle.

A
B



While sitting down, stretch your leg as much as possible.

A
B
C
D



Raise your arms above your head.

A
B
C
D



Tilt your head to the right and left.

HOW TO PERFORM THESE EXERCISES

- For weight exercises, a weight or resistance band should be chosen that will allow the patient to perform the exercise without interruptions at least 30 times but with a certain degree of effort to complete the activity.
- The session should begin by performing one set of 10 repetitions (i.e., 10 repetitions of the selected movement).
- The goal is to perform three sets of 10 repetitions.
- A one to three minute break should be done between exercises.
- The exercises should be performed on two days per week.
- To be effective, this programme should be followed for 12 to 15 weeks. After that time, one test (the SFBS, Gait velocity and the assessment for determining risk of falls) should be repeated. If your functional capacity has improved you can go through to the next level of exercises.

B

Moderate dependence, frail
IF YOU PERFORM THESE EXERCISES, YOU WILL NOTICE GREAT PHYSICAL IMPROVEMENT.

A
B
C
D



Squeeze a rubber ball with each hand as hard as you can.

B
C
D



Flex your knees, as if you were about to sit down, while holding on to a table.

A
B
C
D



Hold the back of the chair and push your chest forward until your arms are stretched.

B
C
D



Standing on one leg, cross your arms over your chest.

B



Walk, alone or with help, until you are able to walk for one minute without help.

C1

C2

Slight dependence, Pre-Fall
THE GOAL OF THESE EXERCISES IS THAT YOU WILL BE ABLE TO ENJOY WALKING.

B
C
D



Stretch an elastic band, wrapped around your wrists, opening your arms.

B
C
D



While supporting your feet on the ground, stand up without leaning on the arms of the chair.

C
D



Lean on a table while standing on one foot and holding your other foot with your arm behind you, keeping your other leg stretched.

C
D



Maintain your balance for 10 seconds while standing on the balls of your feet, and then support on yourself on your heels.

C



Begin by walking for four minutes until you are able to walk for 15 minutes.

C



Begin by walking for eight minutes until you are able to walk for 30 minutes.

D

Autonomous, non-frail
DO NOT STOP EXERCISING! IF YOU STOP, YOUR GLOBAL HEALTH CAN QUICKLY GET WORSE.

B
C
D



Stretch an elastic band, wrapped around your wrists, separating your arms diagonally.

D



Walk on your tiptoes and then on your heels for 10 seconds each.

D



Walk in a straight line while picking up objects from the floor.

D



Walk in sets of 15 minutes each, resting for 30 seconds between sets.

E

Risk of falling

- Perform these exercises three days per week.
- Evaluate the need for nutritional supplements and vitamin D if a deficiency is found.
- Reduce polypharmacy (specially psychotropics).
- Reduce environmental and architectural barriers.

vivifrail
www.vivifrail.com

Physical Deconditioning



The Other Trauma Triad of Death: Cognitive Decline

Cognitive Decline

- As many of six out of ten survivors of critical illness will have significant cognitive impairment years after ICU stay
 - 80% cognitively impaired at three months after ICU stay
 - > 70% cognitively impaired at one year after ICU stay
 - Delirium is an important predictor of post discharge cognitive decline
 - Memory most frequently affected domain, but executive function also suffers
- Post-operative cognitive dysfunction (POCD)
 - Anesthetic, pain medications
 - Immobilization
 - Physical / psychosocial stress
 - Up to 10% of elderly patients receiving anesthesia for more than two hours will experience short term impairment of memory and concentration for three months or more

Cognitive Decline

- Protective factors
 - Higher levels of education
 - Adequate medical treatment with compliance
 - No substance use
 - Healthy diet
 - Regular exercise
 - Cognitively stimulating hobbies
 - Social engagement
- Sounds EXACTLY like a trauma patient

Cognitive Decline

- Give thought to medications
 - Anesthetic agents (propofol)
 - Benzodiazepines (lorazepam)
 - Anticholinergic agents
 - Diphenhydramine
 - Erythromycin
 - Metoclopramide
 - Promethazine
 - Reduce polypharmacy
- Rethink your job—what does caring for the patient mean?
 - Engagement
 - A more awake patient can engage more readily in activities, helping to avoid passive dependence while supporting orientation and a sense of security
 - Choices

Cognitive Decline

Digit span: exercising attention and short-term memory

Pick a card containing 4 sets of 2 digits, 3 digits, or 4 digits. Start with the combinations of 2 digits, increase the number for a higher level of difficulty.

Example:

The attending nurse picks one of the options below (eg, 8: 5-2-8) and reads it to the patient. The patient is asked to point to the correct combination.

A: 5 - 6 - 2
B: 5 - 2 - 8
C: 8 - 2 - 3
D: 2 - 5 - 9

The patient may point or tilt his head when the nurse points at the correct answer. When the patient is not undergoing mechanical ventilation, the digits may also be vocally repeated.

Sample cards:

A: 1 - 9
B: 1 - 7
C: 9 - 1
D: 2 - 3

A: 5 - 6 - 2
B: 5 - 2 - 8
C: 8 - 2 - 3
D: 2 - 5 - 9

A: 3 - 6 - 1 - 8
B: 6 - 3 - 8 - 4
C: 6 - 3 - 4 - 1
D: 1 - 6 - 8 - 4

Digit game: exercise for enhancement of the selective attention and the (verbal) working memory

The patient is shown the digits below on a separate card:

1 2 3
4 5 6
7 8 9

The nurse reads 3 digits out loud, and the patient is asked to repeat (verbally or by pointing at) the correct numbers.

This exercise may be shortened or lengthened to decrease or increase difficulty.

Also, the digits may be repeated in the order the nurse read them or in reverse order.

Sample card:

1 2 3
4 5 6
7 8 9

Memory task: exercise of the attention, working memory, and long-term memory

Ask the patient to name the days of the week chronologically (automatism) starting on Sunday. When successful, also ask the patient to do it in reverse order (challenge), starting at Sunday.

Variation: Vary the weekdays with months, starting at December, chronologically, and in reverse order.

Challenge: Use the alphabet.

When the patient is unable to speak, use the cards, and let the patient point out the right order.

Sample cards:

Wednesday
Sunday
Friday
Tuesday
Saturday
Monday
Thursday

October May
February November
July January
April June
December March
August September

L G A D W
T Z M J O
S C E Q N
Y P F U X
K H B V R
I

Blocks test: exercise for the enhancement of selective attention and visual working memory

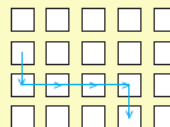
The patient is shown a card with 20 blocks. The attending nurse points out a route, after which the patient is asked to repeat the route that was shown.

The exercise can be made more challenging by increasing the number of blocks of the route, or by asking the patient to repeat the route in reverse order. Maximum exercise time: 3 minutes.

Easy: 1 to 4 blocks.

Challenge: 5 blocks or more/reverse order.

Sample card:



Cognitive Decline

Executive functioning: for exercising the working memory, attention, and purposive functioning

The attending nurse gives the patient different tasks during a maximum of 3 minutes.

Easy task: sorting items based on color, shape, or both.

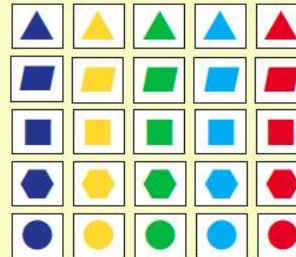
Challenge task: Calculating change.

Examples: The price of some fruit is €/\$3. I pay €/\$5. What should be my change?

When the fruit is discounted 10%, how much change would I get?

(Price will be €/\$2.70, so the change will be €/\$2.30.)

Sample cards:



Bells test: for exercising visual selective attention

Use the card below. Ask the patient to point out the bells.

For variation, the other figures may also be used, or the patient may be asked to tell you which figures are on the top (bottom, left, right) line of the card.

Sample card:



Difference searching

The patient receives a card with one of the pictures below. The pictures contain 5, 6, or 10 differences. Limit the training to a maximum of 5 minutes.

1. Find the 5 differences:



Appendix 1 Continued

Continued

Cognitive Decline



The Other Trauma Triad of Death: Malnutrition

Malnutrition

- More than 50% of patients admitted to the ICU are malnourished. How can you tell?
 - Inefficient energy intake
 - Weight loss
 - Loss of muscle mass
 - Loss of subcutaneous fat
 - Localized or generalized fluid accumulation
 - Diminished functional status as measured by handgrip strength
 - Swamp sense

Malnutrition

- Most ICU patients are underfed with their nutrition goal rarely, if ever, reached
 - Lack of timely nutrition orders
 - Slow increases to goal
 - Time advancing to goal contributed to 41% of cumulative caloric deficit and 53% of cumulative protein deficit
- Surgical patients receive even less than medical patients
 - Frequent interruptions for procedures/operations, imaging, routine nursing care
 - Holding feeds for too long prior to procedures
 - ASA practice guidelines

Malnutrition

- Metabolic Response to Critical Illness
 - Catabolic stress state
 - Systemic inflammatory response
 - Increased complications
 - Infectious morbidity
 - Multiple organ dysfunction
 - Prolonged hospitalization
 - Disproportionate mortality

Malnutrition

- Metabolic Response to Trauma
 - Utilization of lean body tissue for gluconeogenic substrates and immune repair
 - Hormonal milieu overrides traditional starvation response (lean body mass is preserved)
 - Loss of skeletal muscle which is amplified by inactivity (bed rest) and immobility
 - Decreased muscle protein synthesis
 - Chronically, critically ill trauma patients (recovery > 14 days) show persistent inflammation, immunosuppression, and catabolism
 - Patients with TBI may have a resting energy expenditure (REE) 100 – 200% above baseline predicted REE

Malnutrition

- Nutrition support (traditional) vs. nutrition therapy (innovative)
 - Nutrition support
 - Adjunctive care for preservation of lean body mass and support through the stress response to critical illness
 - Nutrition therapy
 - Helps attenuate the metabolic response to stress
 - Prevents oxidative cellular injury
 - Favorably modulates the immune response
- Nutrition therapy seeks to preserve lean body mass, maintain immune function, and avert metabolic complications

Malnutrition

- Why does enteral nutrition (EN) matter?
 - Supports functional integrity of the gut
 - Maintains tight junctions between the intraepithelial cells
 - Stimulates blood flow
 - Induces release of trophic, endogenous agents (cholecystokinin, gastrin, bombesin, bile salts)
 - Maintains structural integrity of the gut
 - Maintains villous height
 - Supports gut associated lymphoid tissue (GALT) which in turn supports mucosal associated lymphoid tissue (MALT)
 - GALT = Secretory IgA producing immunocytes (B cells and plasma cells)
 - MALT is located in the lungs, liver, and kidneys

Malnutrition

- Why does enteral nutrition matter?
 - Loss of the functional integrity of the gut occurs within hours of initial insult/injury
 - Increased bacterial challenge—GALT engages with enteric organisms
 - Not just normal gut flora but also Escherichia, Enterobacter, Klebsiella (GNR)
 - Increased risk for systemic infection
 - Increased risk for multiple organ dysfunction syndrome (MODS)

Malnutrition

- Provision of enteral nutrition:
 - Maintains gut integrity
 - Prevents ileus
 - Modulates the stress and systemic immune response
 - Attenuates disease severity
 - Acts as stress ulcer prophylaxis
 - Decreases infectious morbidity
 - Central line infections
 - Pneumonia
 - Abdominal abscesses
 - Decreases ICU length of stay

Malnutrition

- But they're too sick...
 - Don't have to wait for full bowel sounds, passing gas
 - Don't have to wait for cessation of vasopressors
 - Hold for hypotension (MAP < 50)
 - Hold for initiation of vasopressors / addition of new vasopressor / increase in vasopressor dose
 - These factors increase the risk of subclinical gut ischemia / reperfusion injuries
 - Don't have to stop for diarrhea
 - Investigate infectious causes
 - Consider adding soluble fiber
 - Proceed with caution in patients with a bowel injury and/or repair

Malnutrition

- But they're too sick...
 - Don't wait for ability to start EN
 - If EN not feasible, and patient is a high nutrition risk, have a VERY low threshold for beginning parenteral nutrition (PN)
 - Don't wait for abdominal closure
 - Use of EN in patients with open abdomens without bowel injury accelerates time to fascial closure and reduces intraabdominal complications
 - Don't wait for placement of post-pyloric feeding device
 - May feed via gastric route
 - Minimize risk of aspiration by keeping the HOB 30 – 45 degrees, decreasing sedation, checking placement of the feeding device every four hours, and ensuring bowel function (i.e., stooling)
 - Bowel care on every patient, every time

Malnutrition

- Considerations
 - Early percutaneous endoscopic gastrostomy (PEG)
 - Pleasure feeds vs. feeds for therapeutic goals
 - Consider shorter hold times prior to procedure or even continuing feeds during procedure
 - Eliminate gastric residual volume (GRV) as a means of gauging tolerance to feeding
 - GRVs do not correlate to incidences of pneumonia, regurgitation, or aspiration
 - If insist on using GRVs, do not hold feed for $GRV < 500\text{ mL}$
 - Check phosphate levels in patients having difficulty weaning from the vent
 - Decreased phosphate is an occult cause of respiratory muscle weakness

Malnutrition

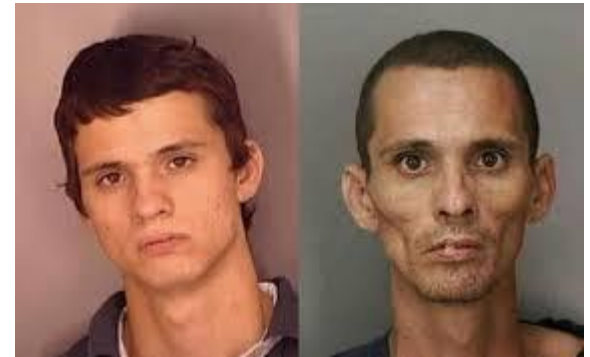
- Considerations
 - Patients with an open abdomen will require an extra 15 – 30 grams of protein per 1000 mL lost to drains
 - Abdominal wound is comparable to a burn—a large open wound covering about 40% of body surface area
 - Protein is the most important macronutrient for wound healing, supporting immune function, and maintaining lean body mass
 - The most critically ill patients will need protein supplementation IN ADDITION TO feeding formula

The Other Trauma Triad of Death: Frailty

Frailty

- Defined as a “multidimensional syndrome characterized by a decline in physiologic and cognitive homeostatic reserve that increases susceptibility to adverse events, unfavorable outcomes, often following relatively minor stressors.”
- Frailty is associated with an increase in occurrence of procedural complications, delirium, functional decline and disability, prolonged recovery, increased LOS, and increased readmission rates
 - Significant predictor of surgical complications such as anastomotic leaks, surgical site bleeding, and intra-abdominal fluid collections
- Dr. Bellal Joseph speaking tomorrow

Frailty

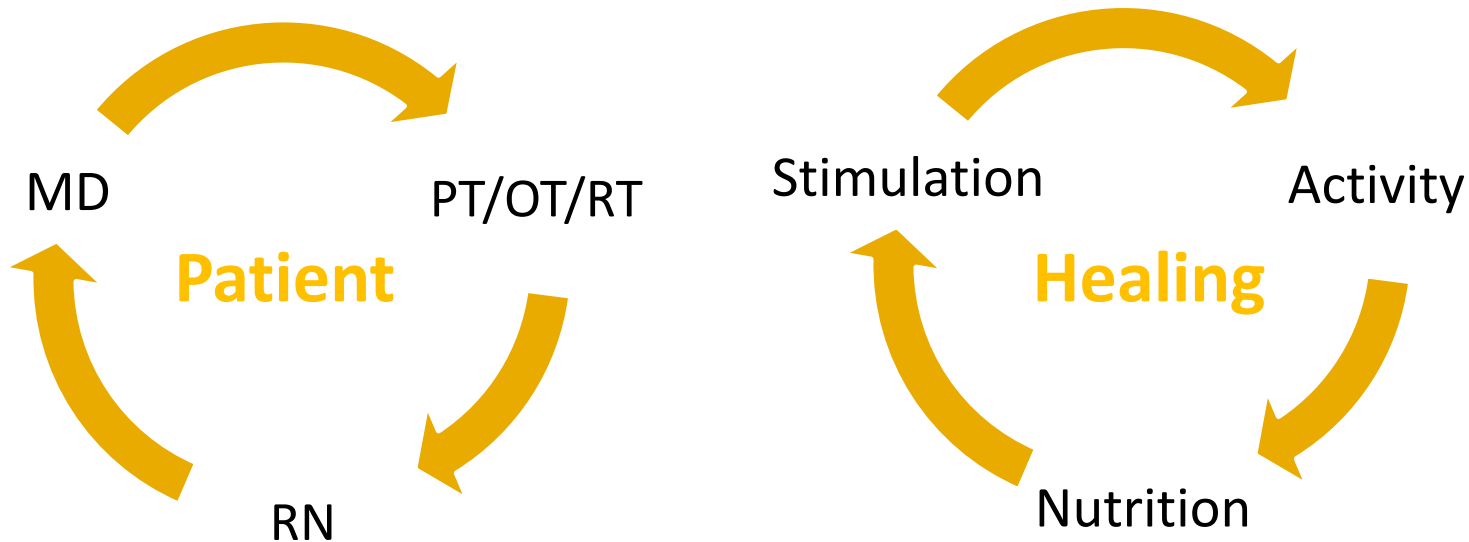


Swamp Sense

Final Thoughts

An Alternate Trauma Triad

- Engagement, communication, and accountability amongst nursing, medical staff, ancillary staff (PT/OT, nutrition)
- Patient-centric work that focuses on nutrition, activity, and stimulation



Thank you

Questions?