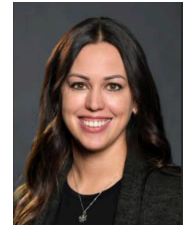


DPM NEWS

(585) 463-2900 | 44 Celebration Drive, Suite 2100 | dpm@urmc.rochester.edu

Pediatric Trauma Triage Balance: How M-GCS Tips the Scales

Lauren Pierson MSN, CPNP-PC, TCRN



The leading cause of death in children fourteen and younger in the United States (US) is injury, with 8.7 per 100,000 children dying from unintentional injuries (accidental) and 2.3 per 100,000 dying from intentional injuries (homicide, assault) in 2022 (Centers for Disease Control and Prevention [CDC], 2023). With a combined rate of 11 per 100,000 deaths related to injury, the rate of death related to injury is higher than a combined rate of 7.6 per 100,000 deaths related to malignant neoplasms, congenital conditions, cardiovascular conditions, and respiratory conditions such as influenza, pneumonia, Covid-19, and complications from asthma (CDC, 2023). Aside from mortality, pediatric trauma may also have long-lasting effects on the child who survives the traumatic injury, including a decline in their functional status (Burd et al., 2021). Burd and colleagues (2021) reviewed 323 pediatric patients with an abbreviated injury scale severity score of 3 or higher on any region of the body, indicating a serious injury to at least one body area. A functional analysis six months following hospital discharge revealed persistent impairments in 10.2% of the patients, which correlated with overall lower Pediatric Quality of Life Inventory scores (Burd et al., 2021).

Recognition of severe injury requiring prompt treatment is the first step toward achieving hemodynamic stability to support physical recovery (Gurien et al., 2022). Quick identification and system-wide notification of severe injury requiring the resources of a pediatric trauma team allows for rapid assessment of the patient with concurrent treatment and stabilization of injuries consistent with the principles of Advanced Trauma Life Support (ATLS: American College of Surgeons, 2018). This timely and accurate recognition requires a list of criteria or indicators that are consistent with a severe trauma that can be assessed quickly after the trauma has occurred to identify the children requiring a rapid trauma team response. High-quality and efficient communication between prehospital providers and the trauma center is critical to identifying severely injured patients prior to arrival. Identifying these patients prior to arrival at the trauma center allows for establishing trauma team resources before the patient arrives to begin a trauma assessment and stabilization immediately (Mora et al., 2022).

Triage Evaluation

As an American College of Surgeons verified level one trauma center, the regional trauma center is required to evaluate the trauma activation criteria and adjust as needed (American College of Surgeons, 2022). The trauma center must determine if the patients they are treating are receiving the appropriate trauma activation by calculating an under and over-triage rate (see Figure 1). An over-triage occurs when an injured patient receives a level-one trauma activation but does not require it (American College of Surgeons, 2022). An over-triage will activate all resources when they are not necessary, potentially

overburdening the system by assembling the trauma team and all potentially needed resources when they are not needed. It is important to avoid an unnecessary amount of over-triage because it can lead to staff burnout, unnecessary costs associated with assembling resources such as operating room on standby, and divert care from other patients (Gurien et al., 2022). Over-triage does not limit the resources available to the patient who receives the level one trauma activation; therefore, the American College of Surgeons allows a 50% over-triage rate (American College of Surgeons, 2022).

Under-triage describes a patient who requires the resources of a higher trauma activation but did not receive the level one trauma activation (American College of Surgeons, 2022). This limits the resources available to the patient immediately upon arrival at the trauma center and could potentially delay access to life-saving interventions (Gurien et al., 2022). Under-triage can negatively affect the patient, so the American College of Surgeons allows only a 5% under-triage rate (American College of Surgeons, 2022). Calculating an under and over-triage rate requires a retrospective review of patients compared to the level of trauma activation they received using variables such as Need For Trauma Intervention (NFTI) or injury severity scores to determine appropriateness (see Figure 2, American College of Surgeons, 2022).

Local Review

In 2022, 479 injured patients between the ages of 0 and 15 presented to the regional trauma center. Seventy-three patients had an abnormal mental status measured by emergency medical services (EMS) or initially upon arrival to the trauma center if driven by a private vehicle using the Glasgow Coma Scale (GCS) as an indicator of mental status. The current trauma activation criteria will activate the highest level of trauma response with a GCS of less than nine. GCS scores between 9 and 14 reflect an alteration in mental status but are not included in the trauma activation criteria. Of the 73 patients with an abnormal GCS determined by EMS, only 21 patients had a GCS of less than 9 to activate a trauma response based on mental status (National Trauma Data Bank, 2022).

Fifty-six patients of the 479 injured patients had an altered mental status assessed by pre-hospital providers prior to arrival using the GCS. The GCS scale has three sections: eyes, verbal, and motor (Lee et al., 2023). Of the 56 patients who had an altered mental status, 27 patients were NFTI positive, which is an evaluation tool used to determine if the patient received the appropriate trauma response, showing favorable results in the pediatric population (see Figure 4, Shahi et al., 2021). The NFTI-positive patients represent the patients who require the resources that are made available with level 1 trauma activations (Shahi et al., 2021). Twenty-three, or 85%, of those patients had a GCS that was affected in more than one area, and ten of these patients did not have a trauma activation occur. There was a total of 23 interventions among 16 under-triaged patients that were required without a level 1 trauma activation, which would have provided immediate access to these life-saving measures, see Figure 4.

A total GCS score is useful for predicting severe injuries requiring rapid intervention, but the ease of reporting only the motor component may improve efficiency in the trauma system (Chou et al., 2017). Efficiency in the prehospital handoff is an indicator of good communication that is complete without unnecessary details, which can potentially create confusion (Wood et al., 2014). This efficiency in high-quality communication promotes quality decisions based on information exchange (Gallego Sanchez et al., 2021). In a systematic review of 18 retrospective studies, four of which included pediatric patients only, the total GCS score was only slightly more sensitive at predicting in-hospital mortality compared to the motor score only, with a pooled mean difference in the area under the operating curve of 0.030; 95% CI 0.024 to 0.036; $I^2 = 0\%$ (Chou et al., 2017). When the same 56 patients were evaluated, only the motor

score was reviewed, and 22 patients had an abnormal motor score. Twelve patients did not activate a level 1 trauma response and required a total of 21 interventions.

Will M-GCS replace T-GCS in the Future?

The total GCS score is still used as a valuable trauma triage assessment. However, the efficiency and efficacy of the motor GCS is a valuable predictor of the local pediatric trauma population's needs immediately upon arrival at the trauma center. An accurate motor GCS communicated to the trauma center prior to arrival will assist in establishing the necessary resources for the injured child. The components of a pediatric GCS can be challenging to memorize when considering the differences in the developmentally non-verbal child. Thankfully, resources are available. Communication specialists at the regional trauma center are equipped with the following chart to quickly determine if there is a deficit in the motor component of the overall GCS. Please contact your leadership team to review what other pediatric resources are available.

GCS		Motor Score Verification	
E		2 years and older: "Are they obeying commands?"	
V		Yes	
M		No	
Total		Younger than 2 years: "Are they making normal spontaneous movements?"	
		Yes	
		No	

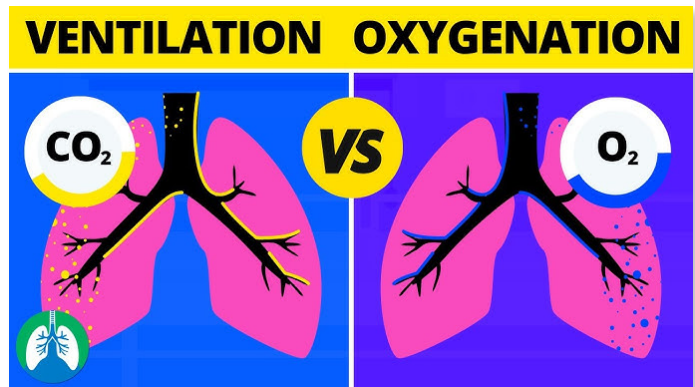
References and figures are on page 6

BLS Care for Trouble Breathing is Anything but Basic

Tyler Lemay MD, NRP

Trouble breathing is among the most common reasons 911 is called, and many of the sickest patients we take care of start off as 'difficulty breathing.' There are dozens of reasons a patient can have trouble breathing, but we don't have to make a final diagnosis to be helpful - we just need to put the problem into one of two categories: ventilation or oxygenation.

As a brief refresher, the lungs have two basic functions. Oxygen needs to come in from the environment, be exposed to red blood cells which latch on and deliver it to every cell in the body. This is 'burned' along with glucose to make the majority of energy the body needs. We call this cellular respiration, and the end products are energy, water and CO₂. That CO₂ has to go somewhere, so the blood carries it back to the lungs where we breathe it out - the other major function! Oxygen in, burn



sugar to produce energy, CO₂ out. As long as your brain, muscles, airways, lungs, blood and heart are working properly the system just hums along making all the energy you need to read this insightful newsletter article.

Along comes a problem - somebody takes a larger than intended dose of opiate and stops breathing, or a cold virus triggers someone's asthma which restricts air movement in and out of the lungs, or maybe a blood clot in the leg travels to the lung and plugs up the pulmonary artery so no blood can reach a large segment of the lung. The patient feels short of breath and calls you for help - so which problem do they have?

If the oxygen is low, we call this type 1 respiratory failure, or hypoxia (or hypoxemia.) This group of patients can't get enough oxygen to the cells that need it. For most patients, most of the time we can place a pulse oximeter on a warm finger, maybe shield it from the flickering light in the back of the rig and after a few seconds we get an SPO₂ - the percent of hemoglobin that is currently carrying oxygen. Numbers like 95% or 99% mean the oxygen side of the equation is probably working. If we find a patient short of breath with SPO₂ 84% and start them on a non-rebreather, many of these patients will improve, buying time to start other treatments or safely transport them to the hospital. Positive-end-expiratory-pressure (PEEP) will also help these patients, more on that below. Oxygen for a few minutes won't hurt most patients, so applying oxygen to all patients in respiratory distress is completely reasonable, but don't expect that NRB to make your patient better if you started with a nice reliable SPO₂ reading of 97%.

Problems with ventilation, or type 2 respiratory failure, or hypercarbia are what we call issues getting rid of that pesky CO₂. Patients with COPD are a classic example, their lungs have gradually broken down over decades (often due to tobacco use) and they don't move much air on a good day. They run into an allergy or cold virus and they can't keep running the marathon of moving air in and out of their lungs and the CO₂ starts to build up. Unfortunately as CO₂ levels rise they make the patient sleepier and their breathing slows down. More CO₂, more sedation, slower breathing... the problem will get worse and worse unless we do something to improve their ventilation. To fix these patients we need to move more air - with excellent BVM ventilation! We don't have CO₂ capnography on every ambulance, but patients with respiratory distress who are slowing down, tiring out, or struggling to move enough air should make you suspicious. Help these patients breathe with a two person technique, excellent mask seal and improve the size of their breaths if too small, or breath faster if they're breathing too slowly. Moving more air in and out of the lungs means the CO₂ will clear and they should start breathing better on their own.

Many patients will fit nicely into one of these categories, but some patients will have both! Imagine that overdose patient who has been taking 3 breaths per minute for the six minutes it took you to respond. Is their oxygen low? Definitely. Is enough CO₂ getting out? Probably not. What do we do for patients with both problems?

It turns out that excellent BVM with two people, a great seal, an OPA or NPA and jaw thrust, hooked up to supplemental oxygen with a PEEP valve on your bag is the perfect initial treatment for patients with both problems. We add extra oxygen from the tank and improve the surface area with the PEEP valve which addresses any type 1 respiratory failure, and we provide breaths at a safe size (chest rise) and rate (12/min or one every 5 seconds for adults, 20/min every 3 seconds for kids) which addresses any type 2 respiratory failure. This works for patients with either problem, so it's a great option if you're not sure and your patient is crashing.

Ultimately, the lungs have two jobs. Patients can have issues getting enough oxygen in, or getting all that CO₂ out. In EMS we have two jobs too! We can decide which bucket we think they fit in and start fixing oxygen problems with oxygen, or ventilation problems with BVM. After we've provided that lifesaving care we can start job #2, moving the patient towards the hospital.

Tyler Lemay, MD, NRP, big fan of healthy lungs!

New MLREMS Awards Categories - Nomination Now Open!

MLREMS PIER Committee

We are thrilled to announce some exciting updates to our annual MLREMS awards program, designed to recognize the outstanding contributions of individuals and agencies in our region's emergency medical services (EMS) community. This year, we've introduced new categories to honor the exceptional dedication and innovation that make a real difference in prehospital care.

New Annual Award Categories

- **Administrative Support Person of the Year:** this award shines a well-deserved spotlight on those behind the scenes who support our EMS agencies through their exceptional organizational skills, dedication, and tireless work. Whether managing schedules, handling communications, or providing logistical support, these individuals play a crucial role in keeping our systems running smoothly and effectively.
- **EMS Agency Innovation Award:** this award celebrates EMS agencies that are leading the way in innovation, whether through new technologies, creative problem-solving, or novel approaches to patient care. We want to recognize those agencies pushing the boundaries of what's possible to improve service delivery and enhance patient outcomes.

Spot Awards for Exceptional Acts of Service

In addition to our annual awards, we're introducing two new Spot Awards to recognize extraordinary acts of courage and service in real time.

- **MLREMS Valor Award:** this prestigious award honors EMS professionals who demonstrate outstanding bravery, personal risk, or courage during critical incidents. Whether responding to a high-risk emergency or performing life-saving actions under pressure, the Valor Award recognizes those who go above and beyond to protect and save lives.
- **MLREMS Meritorious Service Award:** the Meritorious Service Award recognizes individuals who demonstrate exemplary service over the course of their careers or during a significant event. It celebrates sustained excellence and a commitment to improving EMS and patient care within the community.

Nominate Today – Recognition Awaits!

These awards are our opportunity to celebrate the incredible talent, dedication, and innovation within our EMS community. Whether you're nominating a colleague, an agency, or even yourself, your submission helps ensure our heroes are recognized for their hard work and commitment to excellence.

Don't miss your chance to nominate! Nominations packets have been sent to agency leaders, and submissions can be sent to mlrems@mlrems.org no later than February 1, 2025.

Let's make sure the remarkable professionals who make a difference every day get the recognition they truly deserve. Together, we can honor the people who are the heart and soul of our EMS community.

Let's make this year's awards the best yet!

Selected Upcoming Events (see [MLREMS.org](https://mlrems.org) for a complete list)

Feb 11 - EMS Safety (Victor Farmington Ambulance)

March 13, 14 - NAEMT PHTLS (Victor Farmington Ambulance)

March 21-23 - 2025 NYS Weekend at the National Fire Academy

April 3 - NAEMT EPC Hybrid (Victor Farmington Ambulance)

May 5 - MLREMS Preceptor Course

References and figures from the Pierson article, pages 1-3

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Figure 1

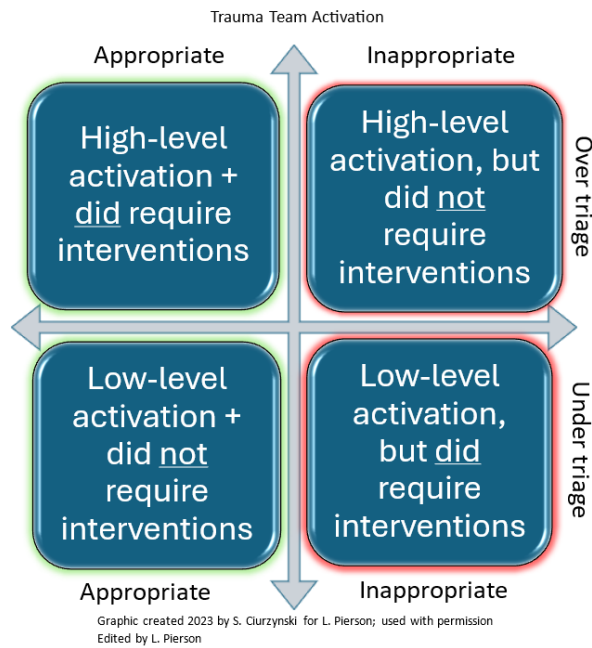


Figure 2

Trauma Triage Evaluation Tools

Cribari (Injury Severity Score) Method of Triage Analysis					
	Total Patients	ISS 0-15	ISS 15 +	Formula	Percent
Level 1	20	2	18	2/20	10% over-triage
Level 2	56	48	8	8/56	14% under-triage level 2
Consult	37	32	5	5/37	13% under-triage consults
Level 2 and consults	93	80	13	13/93	14% total under-triage

- ISS= Injury Severity Score
 - Number of patients for visual use only, does not reflect actual volumes
1. Denominator for over-triage is level 1 activations only
 2. Denominator for under-triage is lower-level activations only
 3. Level 2 and trauma consults can be combined for an overall under-triage rate
 4. Over-triage is calculated by lower injury severity scores divided by overall level 1 occurrence
 5. Under-triage is calculated by higher injury severity scores divided by overall lower level activations

Need for Trauma Intervention (NFTI) Method of Triage Analysis					
	Total Patients	NFTI -	NFTI +	Formula	Percent
Level 1	20	1	19	1/20	5% over-triage
Level 2	56	52	4	4/56	7% under-triage level 2
Consult	37	35	2	2/37	5% under-triage consults
Level 2 and consults	93	87	6	6/93	6% total under-triage

- NFTI = Need for Trauma Intervention
 - Number of patients for visual use only, does not reflect actual volumes
1. Denominator for over-triage is level 1 activations only
 2. Denominator for under-triage is lower-level activations only
 3. Level 2 and consults can be combined for an overall under-triage rate
 4. Over-triage is calculated by NFTI – scores divided by overall level 1 occurrence
 5. Under-triage is calculated by NFTI + scores divided by overall lower level activations

Figure 3

Need For Trauma Intervention Items

- Included Interventions
- Intubation
- Blood product
- Critical care
- Operative repair
- Interventional radiology
- Mortality

Figure 4

Needs Assessment: *Motor Score Only*

