

Pediatric ATV Injuries: A Look At The Data

ATVs (all-terrain vehicles) are motor vehicles that are designed for use on uneven surfaces. Full-size ATVs can weigh up to 600 pounds and reach speeds of 75mph. There are up to 7 million ATVs currently being used in this country.

Unfortunately, young riders make up a disproportionate number of injuries and fatalities. About a third of all ATV-related deaths and ED visits involve riders under the age of 16. The risk factors for ATV injuries are well known:

- No helmet
- Risk-taking behaviors
- Male (seems to go along with the previous one)
- Large engine
- Small child
- 3-wheeled ATVs
- Driving on public roads
- Riding with a passenger

The University of Connecticut published a recent study in which they surveyed youths at four major agricultural

TRAUMA CALENDAR OF EVENTS

WESTERN TRAUMA ASSOCIATION

LOCATION: SHERATON STEAMBOAT RESORT & VILLAS

STEAMBOAT SPRINGS, CO

DATE: MARCH 2-7, 2014

TRAUMA, CRITICAL CARE & ACUTE CARE SURGERY

LOCATION: CAESAR'S PALACE, LAS VEGAS, NV

DATE: MARCH 31-APRIL 2, 2014

fairs covering the 4 major geographic areas of the state. **The average age that the kids began riding was 9 years.** The majority rode for fun, but more than a third admitted to racing informally with friends. 70% engaged in double-riding, 59% rode alone without family present, and 46% rode after dark. Most kids were trained on ATVs by family or friends, although 25% were self-taught. The majority wore appropriate clothing and 80% wore a helmet.

Nearly half of these kids admitted to being involved in at least one ATV crash. The most frequent type of crash was a rollover, followed by collision with a stationary object. 10% were pinned under the ATV. Commonly reported causes of the crash were poor driving conditions, lack of experience, and lack of strength to control the ATV. **Those who reported crashing were also more likely to engage in risky ATV behavior like racing, riding after dark, riding without supervision, or riding a large ATV.**

This study points to the need for additional education and training for both children who want to ride an ATV and their parents. The only way to reduce the number of children injured or killed by these vehicles is to make sure both groups understand the need for safe riding practices.

Reference: Campbell et al, J Pediatric Surg 45:925-929, 2010.

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DVT In Children

Deep venous thrombosis has been a problem in adult trauma patients for some time. Turns out, it's a problem in injured children as well although much less common (<1%). However, the subset of kids admitted to the ICU for trauma have a much higher rate if not given prophylaxis (approx. 6%). Most trauma centers have protocols for chemical prophylaxis of adult patients, but not many have similar protocols for children.

The Medical College of Wisconsin looked at trends prior to and after implementation of a DVT protocol for patients < 19 years old. They used the following protocol to assess risk in patients admitted to the PICU and to determine what type of prophylaxis was warranted:

VTE Prophylaxis Guidelines

For patients at **high risk of VTE**¹ with **low risk of bleeding**²:

- anticoagulate with low molecular weight heparin at 0.5mg/kg subcutaneous, t daily until hospital discharge

For patients at **high risk of VTE**¹ with **high risk of bleeding**³:

- apply sequential compression devices
- on PICU day 7 obtain screening ultrasound of bilateral lower extremities, and upper extremity if CVL is present

For patients at **low risk of VTE**⁴:

- no anticoagulation or other clinical intervention indicated

Risk Factors for VTE:

- projected immobility > 5 days
- Glasgow Coma Scale less than 9
- presence of CVL
- spinal cord injury
- complex lower extremity fracture
- operative pelvic fracture
- use of inotropes
- CPR during resuscitation
- exogenous estrogen
- chronic inflammatory state
- history of previous clot
- known thrombophilia
- current malignancy

Risk Factors for Bleeding:

- intracranial bleed
- solid organ injury
- planned surgical intervention or invasive procedure in the next 24 hours
- heparin allergy
- high risk of severe bleeding
- renal failure

¹High risk of VTE defined as age greater than 13 years OR age less than 13 years with four or more risk factors for VTE.

²Low risk of bleeding defined as no risk factors for bleeding.

³High risk of bleeding defined as one or more risk factors for bleeding.

⁴Low risk of VTE defined as age less than 13 years AND three or fewer risk factors for VTE.

VTE = venous thromboembolism; PICU = pediatric intensive care unit; CVL = central venous line; CPR = cardiopulmonary resuscitation

The need for and type of prophylaxis was balanced against the risk for significant bleeding, and this was accounted for in the protocol.

Here are the factoids:

- The overall incidence of DVT decreased

significantly (65%) after the protocol was introduced, from 5.2% to 1.8%

- The 1.8% incidence after protocol use is still higher than most other non-trauma pediatric populations
- After the protocol was used, all DVT was detected via screening. Suspicion based on clinical findings (edema, pain) only occurred pre-implementation
- Use of the protocol did not increase use of anticoagulation, it standardized management in pediatric patients

Bottom line: DVT does occur in injured children, particularly in severely injured ones who require admission to the ICU. Implementation of a regimented system of monitoring and prophylaxis decreases the overall DVT rate and standardizes care in this group of patients. This is another example of how the use of a well thought out protocol can benefit our patients and provide a more uniform way of managing them.

Reference: Effectiveness of clinical guidelines for deep vein thrombosis prophylaxis in reducing the incidence of venous thromboembolism in critically ill children after trauma. J Trauma 72(5):1292-1297, 2012.

Identifying Sick Pediatric Trauma Patients Early

We all have a pretty good idea of when an inpatient adult trauma patient is getting into trouble. Most rapid response teams have a set of criteria that are used by nursing personnel to initiate an RRT response. However, children who are beginning to decompensate can show it in more subtle ways. Fortunately, there is a tool that can be used to identify children who are showing early signs of developing problems.

The Pediatric Early Warning Signs tool (PEWS) is an objective system for assessing the potential for deterioration in a child. It can be customized based on institutional needs, and typically has behavioral, cardiovascular, and respiratory components. At our pediatric trauma center, we added a urinary output component as well. Scoring for each component ranges from 0 (best) to 3 (worst).

Pediatric Early Warning Score

	0	1	2	3
Behavior	Playing/ Appropriate OR Sleeping comfortably	Irritable and consolable	Irritable and NOT consolable	Lethargic, Confused or Reduced Response to pain
Cardiovascular	Pink or capillary refill time < 1- 2 seconds	Pale OR capillary refill time 3 seconds	Grey or capillary refill time 4 seconds, OR heart rate 20 above or below normal rate for age	Grey and mottled or capillary refill time > 4 seconds, OR heart rate 30 above or below normal heart rate for age
Respiratory	Within normal rate, no retractions, AND SpO2 98- 100% on RA	RR > 10 above normal limits, OR SpO2 98- 100% on any O2 device OR SpO2 94-97% on RA OR using accessory muscles	RR > 20 above normal limits OR SpO2 90-93% OR Retractions	RR 5 below normal OR SpO2 < 90% OR Retractions and/or grunting
Output	Reaching target urine output goal of 0.5-1mL/kg/hour (over the last 4 hours) AND 0-1 BMs/emesis events in the last 12 hours	2 BMs/emesis events in the last 12 hours	3 BMs/emesis events in the last 12 hours	< 0.5mL/kg/hour of urine output (over the last 4 hours) OR > 3 BMs/ emesis events in the last 12 hours

Score	Action
0-3 (Green)	No action needed, reassess as per order
4-6 (Yellow)	Notify Charge Nurse, Call Junior Resident, & notify Staff Physician
7 (Red)	Call the Rapid Response Team, Call Staff Physician and Junior Resident

A single '3' in any category, immediate notification the Junior Resident & Staff MD

The total score is calculated, and is used to classify the child as green (benign) to red (immediate action needed). Again, these thresholds can be adjusted by each hospital. At our center, nursing calculates the PEWS score every 4 hours on non-ventilated patients.

Score category and actions are as follows:

- Green (0-3 points) - no action, reassess as ordered
- Yellow (4-6 points) – notify charge nurse, resident and attending physician
- Red (7 or more points) – call rapid response team, resident and attending physician
- A score of 3 in any category – call resident and attending physician

We are in the process of validating this tool. Our hope is that it will reduce the number of RRT and code calls by identifying deterioration at a much earlier stage.

Want to download this instrument? Use the QR code or URL below.



Scan the QR code, or
enter this URL in your browser:
<http://bit.ly/hv2jAX>
(case sensitive)

Pneumothorax In Children

Sports related pneumothorax rarely occurs without rib fractures, which are themselves uncommon in children. The usual mechanism is barotrauma, most likely from an impact while the glottis is closed. The typical presentation is that of pleuritic chest pain, which may be followed by dyspnea. Focal chest wall tenderness is typically absent. Teenagers tend to engage in more strenuous activity and are more likely to actually sustain a rib fracture, so they may have focal tenderness over the fracture site.

Spontaneous pneumothorax in children is also uncommon. However, it is a very different entity. It may be related to blebs in the lungs, and may be more common in children who were born prematurely. **The recurrence rate after successful treatment is approximately 50%** (in small series). Recurrence is not predictable by looking for blebs on chest CT. The recurrence rate is significantly lower after VATS.

Bottom line: A child who complains of pleuritic chest pain, and especially dyspnea, should undergo a simple PA chest xray. If a pneumothorax is present, consider the following:

- **Insert a small chest tube or catheter if needed**, the smaller the better. (I'm stilling looking for the answer to the question of how big a pneumothorax is big enough)
- **Don't use high inspired oxygen**; it doesn't work. (Read my older blogs from)
- **Don't get a chest CT** for either the initial pneumothorax or any recurrences (too much radiation, too little utility)
- **If this is a spontaneous pneumothorax, caution the parents on the possibility of recurrence**
- **If a spontaneous pneumothorax does recur, consult a pediatric surgeon to consider VATS pleurodesis**
- **When can the child return to sports?** There is absolutely no good literature. I recommend the usual time it takes most soft tissues to return to full tensile strength after injury (**6 weeks**).

References:

Management of primary spontaneous pneumothorax in children. Clin Pediatr, online ahead of print, April 11, 2011.

Sports-related pneumothorax in children. Pediatric Emergency Care 21(4): 259-260, 2005.

Pediatric Pneumomediastinum

Pneumomediastinum seen on chest x-ray after blunt trauma always attracts attention. Possible sources may be related to very serious injuries to the aerodigestive tract. When seen in children, it causes considerable anxiety, which usually results in a very detailed workup and lots of imaging.

Children's Hospital of Boston looked at the National Trauma Data Bank, as well as 19 years worth of their own records to see whether all the attention is justified. They found 193 patients in the NTDB that met their criteria, and most were in their late teens and had other significant injuries. Of the 17 with isolated pneumomediastinum, none had any other significant injury.

When reviewing their own patient records, they found 18 with pneumomediastinum, and all but one was seen on plain chest x-ray. Most were transferred to the hospital from referring centers, and had been involved in sports-related mechanisms. Half had undergone studies in addition to a chest x-ray before transfer. All were discharged home without any surgical interventions.

Bottom line: Pneumomediastinum is rare in children, even older ones. If associated with significant aerodigestive injuries, it was never an isolated occurrence. Other signs or symptoms were present. Pediatric patients presenting with an isolated pneumomediastinum can be safely observed, using chest x-ray and physical examination alone. More sophisticated studies (CT, barium studies) are not indicated.

Reference: Clinical outcomes and diagnostic imaging of pediatric patients with pneumomediastinum secondary to blunt trauma to the chest. J Trauma 71(4):904-908, 2011.

			
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