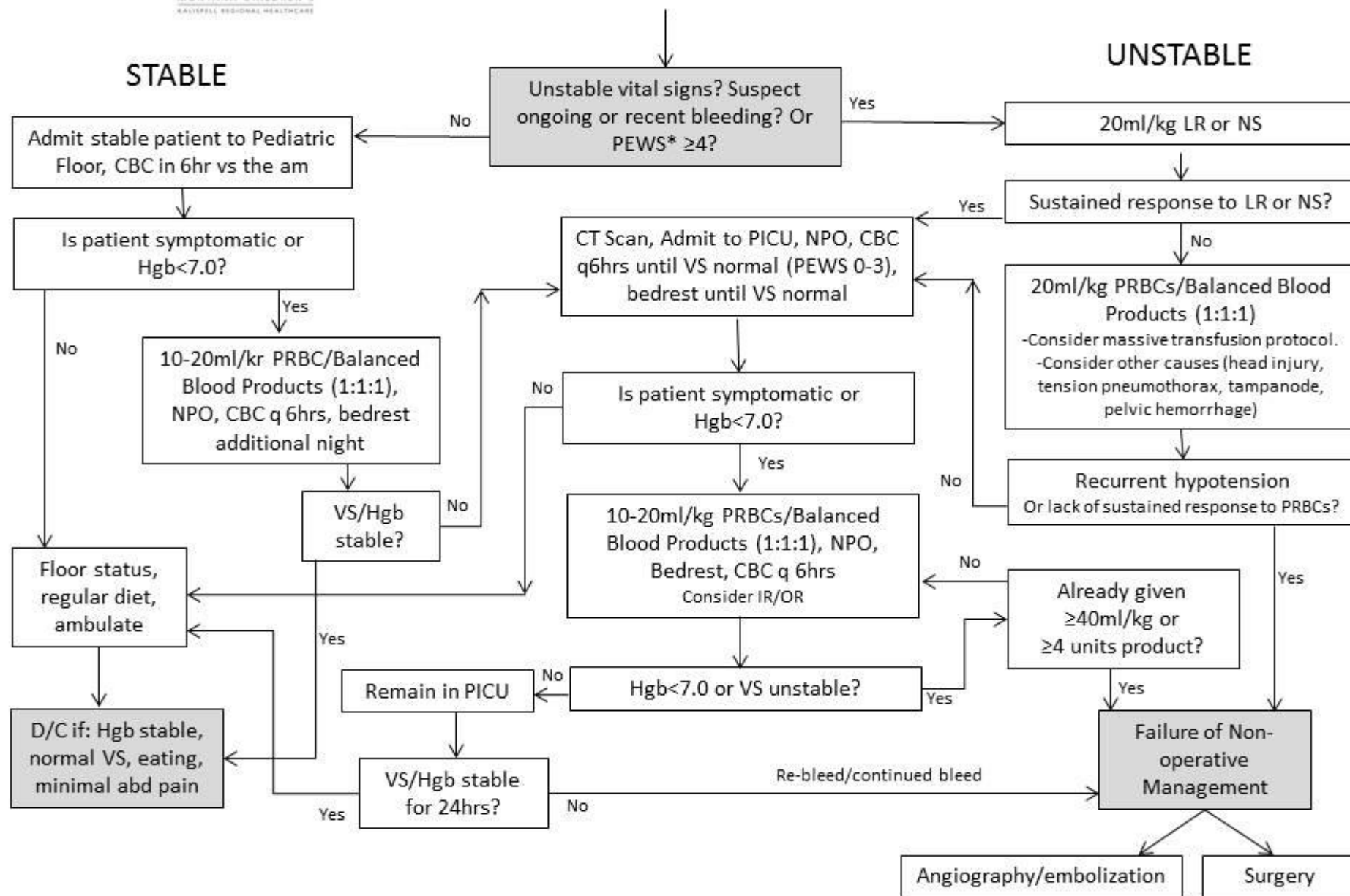


Suspected Pediatric Spleen or Liver Injury (Without Peritonitis)





Pediatric Blunt Trauma Solid Organ Injury Guideline: Spleen or Liver Injury


Purpose

To coordinate and standardize care of the pediatric patient with a blunt spleen or liver injury. These guidelines are based on combined recommendations from the *American Pediatric Surgical Association's (APSA) Evidence Based Guidelines* (2019) and the *ATOMAC Pediatric Trauma Research Consortium*.

	STABLE Vital Signs in ED, No Ongoing or Recent Bleeding, or PEWS* 0-3	UNSTABLE Vitals Signs in the ED, Ongoing/Recent Bleeding, or PEWS* ≥4
Admit to	Pediatric Floor	PICU
Hospital LOS	1 day (if Hgb stable, vital signs normal, eating, minimal abdominal pain)	2 + days (if Hgb stable, if vital signs normal, eating, minimal abdominal pain)
Lab Tests	CBC admission, follow up CBC in 6hr vs in the am	CBC admission, q 6hrs until vital normal (PEWS 0-3)
Clinical Assessment and Monitoring	VS with PEWS q 2hrs x 8hrs, then q 4hrs; C/R monitor + pulse ox x 24hrs; Strict I/O	VS with PEWS q 1hr x 12hrs, then q 2hrs x 12hrs, then q 4hrs; C/R monitor + pulse ox x 24hrs, Strict I/O
Treatment and Procedures	Consider additional CBCs if Hgb dropping or clinical change Transfer to PICU for worsening vital signs or need for transfusion	NG/Foley as indicated Consider Transfusion of Balanced Blood Products (1:1:1): <ul style="list-style-type: none"> • If unstable vital signs after 20ml/kg crystalloid • Or Hgb <7 • Or Signs of ongoing bleeding • Consider massive transfusion protocol IR/OR: <ul style="list-style-type: none"> • If unstable despite balanced blood product transfusion • Angioembolization is not indicated for contrast blush on admission CT without unstable vital signs
Nutrition	Regular diet	NPO until vital signs and Hgb stable
Activity	No restrictions	Bedrest until vital signs stable
IV Fluids	Maintenance IV then saline lock with good PO intake	Maintenance IV while NPO then saline lock with good PO intake

Medications	Mild pain – Tylenol q 4hrs Moderate pain – Oxycodone q 4hrs Severe pain – Morphine q 2hrs prn No NSAIDS	Mild pain – Tylenol q 4hrs Moderate pain – Oxycodone q 4hrs Severe pain – Morphine q 2hrs prn No NSAIDS
Restricted activity for PE, full contract sports or play	Grade + 2 weeks	Grade + 2 weeks
Return to School	2-4 days (when off pain meds)	5-7 days (when off pain meds)
Follow up clinic visit	2 weeks	2 weeks

*PEWS: Pediatric Early Warning Score

 Pediatric Early Warning Score (PEWS)					
	0	1	2	3	Score
Behavior	Playing/ Appropriate	Sleeping	Irritable	<ul style="list-style-type: none"> • Lethargic/confused OR • Reduced response to pain 	
Cardiovascular	Pink OR capillary refill 1-2 seconds	Pale or dusky OR capillary refill 3 seconds	<ul style="list-style-type: none"> • Grey or cyanotic OR • Capillary refill 4 seconds OR • Tachycardia of 20 above normal rate 	<ul style="list-style-type: none"> • Grey or cyanotic AND mottled OR • Capillary refill 5 seconds or above OR • Tachycardia of 30 above normal rate OR • Bradycardia 	
Respiratory	Within normal parameters, no retractions	<ul style="list-style-type: none"> • >10 above normal parameters OR • using accessory muscles OR • 30+%FiO2 or 3+liters/min. 	<ul style="list-style-type: none"> • >20 above normal parameters OR • Retractions OR • 40+%FiO2 or 6+liters/min. 	<ul style="list-style-type: none"> • ≥5 below normal parameters with retractions or grunting OR • 50+%FiO2 or 8+liters/min. 	

*Score by starting with the most severe parameters first.
 *Score 2 extra for every 15-minute nebs (includes continuous nebs) or persistent post-op vomiting.
 *Use "liters/minute" to score regular nasal cannula.
 *Use "FiO2" to score a high flow nasal cannula.

Monaghan, A. (2005) Detecting and managing deterioration in children. *Paediatric Nursing*, 17, 32-35. Adapted for use at Children's of Minnesota.

	Heart Rate at rest	Respiratory Rate at rest
Newborn (birth – 1 month)	100-180	40-60
Infant (1 – 12 months)	100-180	35-40
Toddler (13 months – 3 years)	70-110	25-30
Preschool (4 – 6 years)	70-110	21-23
School Age (7 – 12 years)	70-110	19-21
Adolescent (13 – 19 years)	55-90	16-18

Guidelines

1. For Spleen and Liver Injury Grade see the American Association for the Surgery of Trauma's [Injury Scoring Scale](#)
2. PEWS should be calculated at patient presentation to initial medical facility. In the case of a transfer, this score should be calculated during the transfer center phone contact (using vital signs from initial presentation) in order to anticipate necessary level of care.

3. Patients with clinical instability may be removed from the pathway and treated as appropriate. Patients may be upgraded from the stable to the unstable category, but should not be downgraded once considered unstable. Location of admission is at the discretion of the admitting trauma surgeon.
4. Consider angioembolization vs operative intervention with ongoing evidence of bleeding despite balanced blood product transfusion. Angioembolization is not indicated for contrast blush (of liver or spleen) on admission CT without unstable vital signs.
5. Patients who have undergone splenectomy require vaccination with PCV13 pneumococcal vaccine 14 days after surgery or at the time of discharge (whichever comes first). A dose of PPSV23 pneumococcal vaccine is then recommended 8 weeks later and again in 5 years. Standard vaccination against meningococcus and haemophilus influenza B (HIB) is recommended before discharge. See the CDC's [pediatric immunization schedule](#) for dosing and timing recommendations.

Follow up imaging

1. Risk of delayed complications following spleen and liver injuries is low. (Risk of delayed splenic bleeding is reported as 0.2-0.3%, risk of delayed liver bleeding is slightly higher but all reported cases occur in patients with symptoms.)
2. Routine follow-up imaging for asymptomatic, uncomplicated, low grade injuries is not indicated. Consider imaging for symptomatic patients with prior high grade injuries.

Education/discharge planning

1. Contact sports/activities include but are not be limited to: recess, bicycling, skateboarding, roller-skating, rollerblading, running or jogging, jungle gyms, gymnastics, dance, skiing, snowboarding, sled riding, swimming, diving, surfboard, windsurf, basketball, soccer, football, hockey, wrestling, lacrosse, boxing, horseback riding/rodeo, martial arts, rugby, handball, and mountain climbing.
Non-contact physical activities are allowed and include walking, running on even surfaces (treadmill), stationary bike, swimming laps in a private pool. No public pools, diving, or playing with friends/siblings in the pool. No ocean swimming. Other allowed quiet activities include reading, coloring, arts and crafts, video games, television, etc.
2. Discharge follow-up appointment should occur at the end of physical activity limitation for clearance by the pediatric surgery trauma team.
3. All patients will be counseled on activity restrictions, safety instructions, and further injury prevention (seatbelt, helmet use, etc.).
4. Patients will be counseled to call for nausea, vomiting, increased or uncontrolled pain, fever greater than 101 degrees, shortness of breath, lethargy, dizziness, fainting, blood in urine, stools or vomit, or other concerns.

References

Gates RL, Price M, Cameron DB, Somme S, Ricca R, Oyetunji TA, Guner YS, Gosain A, Baird R, Lal DR, Jancelewicz T, Shelton J, Diefenbach KA, Grabowski J, Kawaguchi A, Dasgupta R, Downard C, Goldin A, Petty JK, Stylianos S, Williams R. “ *Non-operative management of solid organ injuries in children: An American Pediatric Surgical Association Outcomes and Evidence Based Practice Committee systemic review.*” J Pediatr Surg. 2019 Aug; 54(8):1519-1526.

Petty, J. (2019) “*Blunt Liver/Spleen Management: APSA Guidelines Update.*” Pediatric Trauma Society 6th Annual Meeting, San Diego, CA, USA.

<https://pediatrictraumasociety.org/meeting/multimedia/files/2019/Presentations/Thursday/0830-Petty.pdf>

Notrica DM, Eubanks JW, Tuggle DW, Maxson RT, Letton RW, Garcia NM, Alder AC, Lawson KA, St Peter SD, Megison S, Garcia-Filion P. “*Nonoperative management of blunt liver and spleen injury in children: Evaluation of the ATOMAC guideline using GRADE.*” J Trauma Acute Care Surg. 2015 79(4):683-693.

Akre M, Finkelstein M, Erikson M, Liu M, Vanderbilt L, Billman G. “*Sensitivity of the Pediatric Early Warning Score to Identify Patient Deterioration.*” Pediatrics. 2010 April; 125(4):763-766.

American Association for the Surgery of Trauma, *Injury Scoring Scale*, 2006,
<https://www.aast.org/resources-detail/injury-scoring-scale>

Casciani F, Trudeau MT, Vollmer CM. “*Perioperative Immunization for Splenectomy and the Surgeon’s Responsibility.*” JAMA Surgery. 2020 Nov; 155(11):1068-1077.

Center for Disease Control and Prevention, *Recommended Child and Adolescent Immunization Schedule for Ages 18 Years or Younger*, 2020, <https://www.cdc.gov/vaccines/schedules/hcp/imz/child-adolescent.html#note-mening>