

**PENN STATE SHOCK TRAUMA CENTER
PEDIATRIC TRAUMA PROGRAM MANUAL**

PENNSTATE



Children's Hospital

2005/2006

PEDIATRIC TRAUMA PROGRAM MANUAL

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PENN STATE CHILDREN'S HOSPITAL PEDIATRIC TRAUMA PROGRAM GUIDELINES FOR CARE

I INTRODUCTION

The Penn State Children's Hospital, Milton S. Hershey Medical Center is a Level I Regional Resource Trauma Center with Additional Qualifications in Pediatric Trauma, accredited by the Pennsylvania Trauma Systems Foundation.

We are privileged to be in a position to provide state of the art trauma care to the injured child and their family in Central Pennsylvania. We are indebted to all members of the Pediatric Trauma Team that participate in providing this service.

The information in this orientation manual provides an overview of the Pediatric Trauma Program as well as information essential to the care of the injured child. Please note that the "Trauma Center Manual" should be cross-referenced for aspects of trauma care that are similar for adults and children. We hope you find this information helpful.

It is updated regularly so your input would be appreciated.

Welcome to the Pediatric Trauma Team!

Robert E. Cilley, M.D.
Pediatric Trauma Program Director
Manager/CNS

Susan E. Rzucidlo, M.S.N., R.N.
Pediatric Trauma Program

PENN STATE SHOCK TRAUMA CENTER
Penn State Children's Hospital * Milton S. Hershey Medical Center
OVERVIEW OF PEDIATRIC TRAUMA PROGRAM - 2004

DEMOGRAPHICS			CAUSE OF INJURY (PTOS)			POST ED DESTINATION		
Total <18 years	596		MVA	118	28%	PIMC	150	36%
State Qualifiers	418		Fall	135	32%	PICU	117	28%
			Pedestrian	21	5%	FLOOR	85	20%
			Bicycles	28	7%	OR	60	1%
			Animal\Farm	27	7%	INJURY SEVERITY SCORE		
Age Groups (In Years)			Assault \ Abuse	18	4%	1-8	140	34%
<1	42	10%	Gunshot\ Stab	8	2%	9-12	95	23%
1-5	101	24%	Other	63	15%	13-15	26	6%
6-10	83	20%	PLACE OF INJURY			16-24	93	22%
11-14	88	21%	Street/Hwy	133	32%	25-40	50	12%
15-17	104	25%	Home	107	26%	41-49	4	1%
Sex			Rec/Sport	44	11%	50-74	5	1%
Males	287	69%	Farm	17	4%	75	1	<1%
Females	131	31%	Public Bldg	22	5%			
-			COUNTY OF INJURY			PRIMARY PAYOR CLASS		
Survival Rate			Adams	7	2%	Medicaid Managed Care	69	17%
Survivals	410	98%	Berks	9	2%	Commercial	69	17%
Deaths	8	2%	Cumberland	30	7%	Comercial Managed Care	100	24%
-			Dauphin	51	12%	Self Pay	48	11%
Type of Injury			Franklin	10	2%	UTILIZATION		
Blunt	401	96%	Lancaster	34	8%			
Penetrating	8	2%	Lebanon	40	10%			
Burn	9	2%	Mifflin	5	1%			
Type of Admission			Perry	6	1%			
Scene to PSCH	263	44%	Schuylkill	13	3%	Average Hosp Days	2.9	3.9
Direct Admit	56	13%	York	18	4%	Average ICU Days	3.9	1.2
Transfers in	219	37%	TRAUMA ACTIVATIONS			Average IMC Days	1.6	1.0
Transfers out	4	<1%	Level 1	89	21%	Average ISS	12.1	13.3
ADMITTING SERVICE			Level 2	191	46%	DISCHARGE DESTINATION		
Pediatric Trauma	311	74%	Attending presence	242	85%	Home	369	88%
Neurosurgery	34	8%	Nonresp	79	19%	Rehabilitation	26	6%
Orthopaedics	52	12%	Direct	56	13%			
Pediatrics	10	2%	PREVENTION ACTIVITIES					
PREVENTION ACTIVITIES			Number Programs	57		Seats checked	5224	
			Number Participants	7677		Car seats given	290	
			Media Placements	22		Helmets given	600	

PENN STATE CHILDREN'S HOSPITAL PEDIATRIC TRAUMA PROGRAM SUMMARY 2005

The Pediatric Trauma Program at Penn State Children's Hospital, Milton S. Hershey Medical Center serves a ten county area of South Central Pennsylvania (Adams, Berks, Cumberland, Dauphin, Franklin, Lancaster, Lebanon, Perry, Schuylkill, York) as the only Level I Regional Resource Trauma Center with Additional Qualifications in Pediatric Trauma. Care is provided for nearly 600 injured children younger than 18 years each year. We are a referral resource for children's care for an additional twenty-two counties. The primary ten county area has a population of over 2.1 million including nearly half a million children less than fifteen, while the larger thirty-two county area includes nearly 1 million children less than fifteen with a total population of 4.5 million.

Penn State Children's Hospital at Milton S. Hershey Medical Center is based on the concept of a "hospital within a hospital" which, although it occupies the same building and shares some of the same resources as the adult hospital, is geographically, professionally and administratively distinct from the adult hospital. The Children's Hospital resides on the seventh floor of the Medical Center and includes a pediatric medical/surgical unit, a dedicated Oncology Unit, a Neonatal Intensive Care Unit, an Intermediate Care Unit with monitored beds, and the region's only Pediatric Intensive Care Unit. Pediatric support services as well as appropriate parent and patient lounges and Child Life activity centers are also located on the seventh floor.

Blunt trauma accounts for the majority of our patients. Vehicle-related injuries are the most common, while falls represent the next leading cause of injury. One-half of the injury victims are brought directly from the scene and one-half are transferred from other institutions. We have developed pediatric trauma referral guidelines with several area trauma centers.

The Director of the Pediatric Trauma Program is a pediatric surgeon who is dedicated to the Pediatric Trauma Program. The Pediatric Trauma Program Manager/Clinical Specialist is, likewise, dedicated to the Pediatric Trauma Program. Patients admitted to the pediatric trauma service are admitted to the Penn State Children's Hospital at the Milton S. Hershey Medical Center. The primary medical services caring for injured children are staffed by pediatric surgeons, pediatric critical care intensivists, neurosurgeons, and orthopedic surgeons. Other surgical subspecialists including urology, plastic and reconstructive surgery, otolaryngology and ophthalmology care for injured children and adults. Pediatricians are available as consultants for the care of the injured child.

The attending coverage for the Pediatric Trauma Service is from the Division of Pediatric Surgery. Dr. Robert E. Cilley, Dr. Peter W. Dillon, and Dr. Andreas H. Meier are the attending surgeons. Each is Board Certified in General Surgery and Pediatric Surgery. Dr. Cilley, the Pediatric Trauma Program Medical Director, is also Board Certified in Surgical Critical Care. Residents are assigned to the service at the PGY IV, II and I level (four residents total).

Pre-Hospital Care:

Care for the injured child is initiated through the Emergency Department Communications Center. The Communications Center receives communication from incoming emergency vehicles and provides medical command to several Advanced Life Support Units in addition to the coordination of our own aeromedical and ground transportation. We also have direct links to other emergency departments and county communication centers. The Pediatric Trauma Program Response System is activated by the emergency medicine attending physician based on the triage decision scheme of the American College of Surgeons Committee on Trauma which has been customized for triage of injured children. Activation of the trauma response system alerts the pediatric trauma team comprised of pediatric surgeons, surgical residents, anesthesiologists, emergency medicine physicians, pediatric critical care medicine specialists, nurses, chaplain, CT technicians, clinical laboratory, blood bank, radiology, and the operating room. The pediatric trauma team response is two-tiered: Level I – for the severe, multisystem injured child, and Level II. The team is notified of the "level", status and

estimated arrival time of the child. With the paging of the “pediatric trauma response” the team assembles in the trauma room and prepares for the child’s arrival.

Trauma Resuscitation:

The Emergency Department has two state-of-the-art trauma rooms located at the ambulance entrance of the ED. There is a rapid CT scanner directly across from the trauma rooms and an elevator behind the rooms that provides direct access to the trauma operating room on the floor above. The resuscitation and initial care of the injured child follows the Advanced Trauma Life Support Model. At the conclusion of the primary and secondary surveys and the gathering of initial diagnostic tests, a catalog of injuries/problem list defines their care. Appropriate pediatric surgical and non-surgical specialists are consulted to augment the care of the injured child. Management guidelines and protocols are used to guide care in such areas as cervical spine immobilization and clearance, CT scanning, establishing intravascular access and tetanus prophylaxis. We pay particular attention to pain control and the comfort of the injured child. If the injured child requires operative care, the attending surgeon and/or subspecialty attendings will evaluate the best timing for the procedure. An operating room as well as anesthesiologists and OR staff are available for emergent cases.

Inpatient Phase of Care:

The Pediatric Intensive Care Unit (PICU) is a twelve-bed unit staffed by full-time pediatric critical care medicine specialists. This unit is the region’s only intensive care unit dedicated to the care of critically ill and injured children. Specialized services for the injured child include mechanical ventilation, sedation, pain control, nutrition, hemodynamic support and critical care nursing services. Protocol management of the severely head-injured child using national standards has been developed as a cooperative effort among pediatric neurosurgery, pediatric critical care medicine, and pediatric surgery. The PICU at Penn State Children’s Hospital is notable for its high acuity level and low standardized mortality rates.

Less severely injured children are admitted to either the Pediatric Intermediate Care Unit adjacent to the PICU or the Children’s Hospital Medical/Surgical Care Unit. Injured children are screened for nutritional, social service, and rehabilitation needs.

Discharge Planning, Follow-up, and Rehabilitation:

Pediatric trauma case management is provided by the pediatric trauma care coordinator and pediatric trauma program manager/CNS. Coordination of care is facilitated with other caregivers such as physicians, nurses, therapists and rehabilitation medicine, social workers, nutritionists, and the family. Discharge planning includes an ongoing reassessment of rehabilitation needs and coordination of the appropriate follow-up with the surgical specialists and primary care physicians. An outpatient head injury rehabilitation and mild brain injury follow-up care program complement the inpatient rehabilitation program for head injured children. Pediatric rehabilitation services for the management of brain, spinal cord and complex orthopedic injured children and families are available in our pediatric rehabilitation facility. The pediatric rehabilitation medicine physician follows injured children that may require ongoing rehabilitative care during their acute care stay. The pediatric therapists treat injured children in acute care and transition the rehabilitation plan to our rehabilitation facility. The pediatric trauma care coordinator contacts the family post discharge to assess the transition to home, followup visits and satisfaction with care.

Injury Prevention:

The Injury Prevention Program is a multidisciplinary initiative that seeks to reduce childhood injury in Central Pennsylvania. Programs throughout the Medical Center and the community focus on childhood injury prevention. Using trauma registry data, injury prevention initiatives are planned for high-risk populations. The Children’s Hospital is the lead agency for the Dauphin County SAFE

KIDS Coalition. Generous philanthropic funding has supported injury prevention health educator(s). An injury prevention information line, 717-531-SAFE (7233), supports community links for information and requests for services.

The Pediatric Trauma Performance Improvement Program:

The trauma program was originally accredited with Additional Qualifications in Pediatric Trauma in 1992. Our program was surveyed one year later in 1993 and again on a three-year cycle in 1996, 1999 and 2002. We have continued to assess our performance improvement activities to monitor and improve the care we deliver. For the last accreditation review in 2002, pediatric trauma morbidity and mortality review was a combined conference with the adult trauma program. The representation of subspecialists and nursing management was by “liaison” representation. It was recognized that pediatric focused practitioners for trauma care would enhance discussion and foster improvement in practice. In January 2003, the transition was made to a focused pediatric trauma morbidity and mortality case review conference. This has fostered engagement of pediatric specialists and new guidelines and changes in practice have occurred.

The Pediatric Trauma Program continually seeks to improve the care and services it provides to injured children in Pennsylvania. Our goal is to provide state-of-the-art trauma care to injured children in South Central Pennsylvania and to serve as a referral resource to community hospitals, Level II trauma centers, and other Level I trauma centers for the care of injured children throughout the areas of Pennsylvania served by our health care system.

II ORIENTATION TO THE PEDIATRIC TRAUMA PROGRAM ROLE OF THE SURGICAL RESIDENT

A. **Accepting Patients**

1. We accept all injured children at any time regardless of the circumstances of their injury, provided that they may be appropriately transported to the Medical Center.
2. Most calls come to the Emergency Department. Some come to the attending pediatric surgeon. They will occasionally come to residents on the Pediatric Surgery Service.
3. **Your responsibility is to avoid any barrier for the referring physician. Under almost all circumstances, accept the patient in transfer, contact the chief resident and/or the attending surgeon to facilitate admission of the patient.**

B. **Relationship to Other Services**

The Pediatric Surgery service is the primary admitting service for the multiply injured patient. Other services provide consultative and supportive care including Neurosurgery, Orthopedic Surgery, Plastic and Reconstructive Surgery, Urology, Otolaryngology, and Ophthalmology. Pediatric Critical Care Medicine provides concurrent care for patients in the PICU.

Other surgical services may admit patients if they are not multiply injured and they have a specific injury related to that service. Patients with an isolated head injury may be admitted to the Pediatric Neurosurgical Service.

Injured children may not be admitted to a pediatric medical service. They must be admitted to a surgical service.

Multi-system injured patients can be transferred to a subspecialty service when their condition is stable. Coordination of the transfer process is the primary responsibility of the chief surgical resident and attending. **Communication is with the attending of the accepting service.** The Pediatric Surgery Service should function as a consultative service after transfer of the patient.

C. **Role in the Emergency Department**

1. **Trauma Response**

- a. The Trauma Team Leader (TTL), who is in charge of the entire resuscitation including the coordination of all specialists and ancillary services stays at the foot of the bed and attempts to provide cognitive support rather than procedural support, if at all possible.
- b. Anesthesia and Respiratory Therapy occupy the corridor at the head of the bed.
- c. A physician-nurse team is placed on both the patient's left and right. The role of the physician left and physician right is assigned by the TTL. Additional residents will occupy the left or right position and can be given additional assignments.
- d. It is mandatory that all personnel in the trauma resuscitation obey universal precautions. This includes gown, gloves, cap, mask, shoe covers, and lead. The mask may be dropped to communicate with the child. It should, however, be worn so that it can be easily placed over the face.
- e. **ALL team members must document your name and arrival time on the sign in sheet.**

Pediatric Trauma Resuscitation Room Positions and Responsibilities

(Please refer to the diagram)

Flexibility to adapt to a particular patient's needs is required, but adherence to these guidelines will result in an orderly, efficient and safe resuscitative care for the injured child.

Foot of Bed Corridor: Trauma Team Leader PGY 4/5, Attending Pediatric Surgeon, ED Attending, Trauma Coordinator

- position is at the foot of the bed
- directs resuscitation, assigns tasks, prioritizes activities
- enforces compliance with universal precautions
- confirms that everyone signs in on the trauma sign-in-sheet
- thinking more than doing
- assisted by attending trauma surgeon, ED attending, trauma coordinator
- performs and assists procedures if required. For small children, attending surgeon may be assigned to perform procedures

Head of Bed Corridor: anesthesia and respiratory therapy

- constantly vigilant with airway and breathing portion of resuscitation
- intubation and initiation of mechanical ventilation
- maintains position at head of bed
- provides cervical stabilization during movement of patient at discretion of TTL
- passes NG or OG tube as directed by TTL
- responsible for monitoring devices
- responsible for use of "level 1" or "hotline" devices for fluid administration
- administration of medication for sedation and paralysis

Patient Right Corridor: Surgery Resident (PGY 1, 2 or 3), ED, ED EMT

- Doctor Right performs and assists with procedures along with Doctor Left as directed by TTL (IV access, blood sampling, urinary catheter placement)
- Nurse Right responsible for processing blood and urine samples (may be delegated but responsibility lies with NR), records on Trauma Flow Sheet, IV access if so directed by the TTL.
- ED EMT provides assistance to Nurse Right as needed.

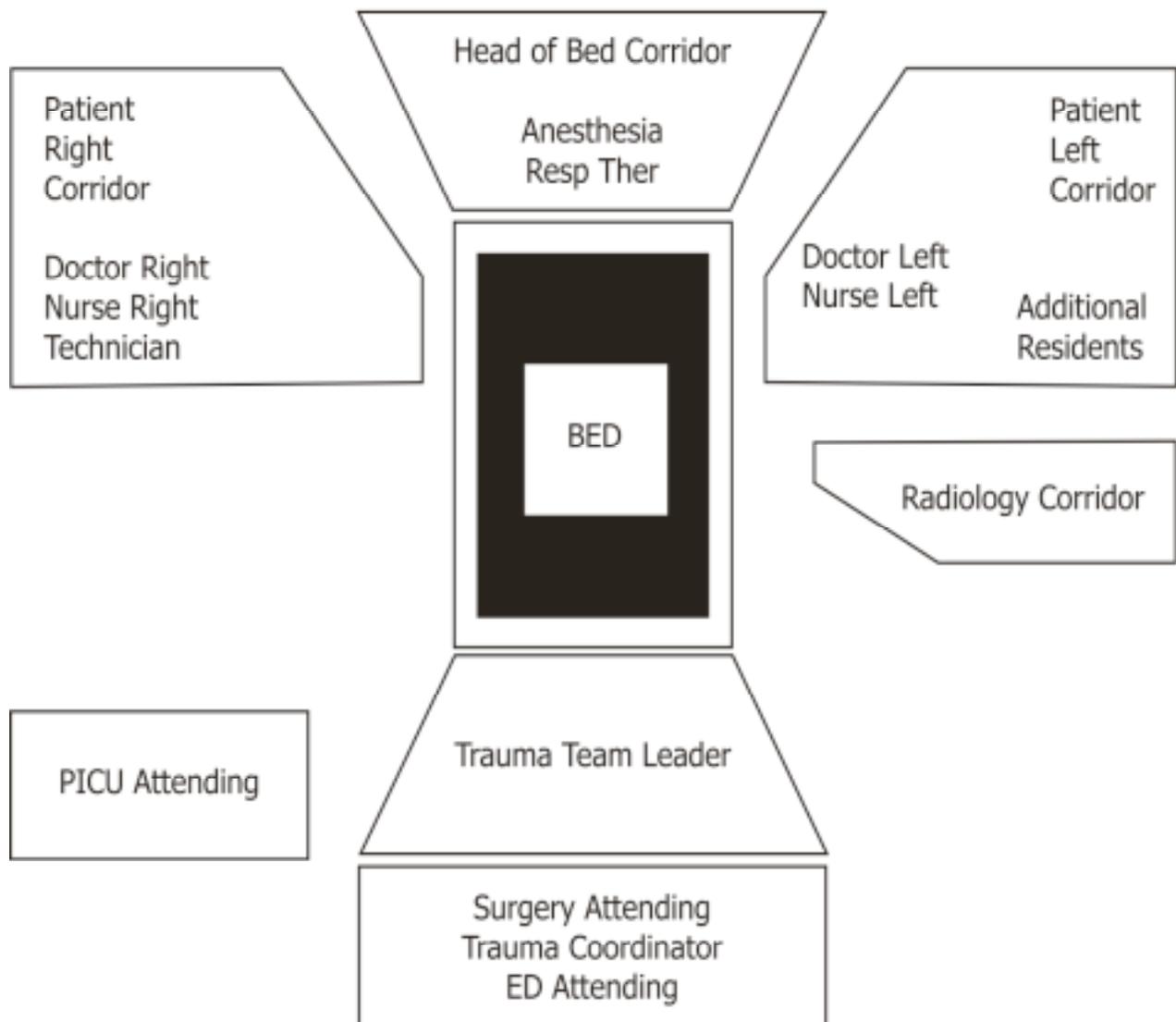
Patient Left Corridor: Surgery Resident (PGY 2 or 1), ED resident, ED nurse

- Doctor Left performs primary and secondary survey assists with procedures, patient movement as directed by the TTL
- Responsible for recording of history and physical (may delegate to another physician)
- Nurse Left regulates the administration of fluids, medications not given by anesthesia, performs initial and ongoing assessment of patient (neuro, respiratory, extremity when applicable). Obtains needed equipment
- Additional physicians occupy this position along with DL and assist with record keeping (H & P), procedures, as directed by the TTL.

PICU Attending:

Assist with initiation of mechanical ventilator; begin management of ICP by protocol; oversee medical resuscitation if needed; assist with procedures

Pediatric Trauma Resuscitation Room Positions



2. **Trauma Consultation**

Sometimes apparently less seriously injured patients are admitted to the Emergency Department, and a trauma consult is requested. These must be responded to immediately. There must be an emphasis on documentation of the recommendations and ongoing care of these patients in the Emergency Department. **Be sure to document time consulted, time arrived and time span of the encounter. Document discussion with attending physician.**

3. **Triage and Initial Management**

Initial triage decisions are usually made by the ED physician giving medical command. There is a delicate balance between under and over triage, and such decisions are difficult to make. When in doubt, a Trauma Response should be called. When a Trauma response has been initiated, it is acceptable for the TTL to modify the resuscitation to the individual patient's needs. It is often appropriate to forgo femoral blood sampling, rectal examination and placement of a urethral catheter based on injury type, severity and initial assessment. Management of pain and discomfort in conjunction with anesthesia should be considered in every patient. Keep the family updated.

Refer to Pediatric Emergency Department Triage Criteria.

D. Role in the Pediatric Intensive Care Unit

Trauma patients in the Pediatric Intensive Care Unit are either on the Pediatric Surgery Service if multiply injured or on the Pediatric Neurosurgery Service if they have an isolated head injury. The attending of record is either a pediatric surgeon or a neurosurgeon. They are concurrently cared for by the Pediatric Critical Care Medicine service. This arrangement provides optimal care for the pediatric trauma patient as outlined in the Standards of the Pennsylvania Trauma Systems Foundation and at the same time provides the benefits of onsite care by a specialist in Pediatric Critical Care Medicine. The complexity of the environment of the modern Pediatric Intensive Care Unit and the ability to provide state-of-the-art care for the injured child necessitates this cooperative relationship between the surgical services and the PCCM service. The ability to provide onsite care uninterrupted by operative responsibilities and duties outside of the environment of the PICU are the hallmarks of modern PICU care allowing the delivery of care with the fewest complications and the best outcomes.

The Pediatric Surgery Trauma Service, described previously, consists of the attending pediatric surgeon, a PGY 4 chief resident, and two or three junior residents at the PGY 2 or 1 level. The junior residents alternate call on an every third night basis. They have responsibilities to cover all pediatric surgery patients including both trauma and non-trauma patients. They respond to Emergency Department consults to pediatric surgery. They admit patients to the Pediatric Surgery Service. The PGY 4 is in-house on a rotating schedule with the other PGY 4 residents as the Trauma Team leader for both adult and pediatric trauma as well as the primary responder for General Surgery emergency after hours consults.

The Neurosurgery Service consists of the neurosurgery attending and residents. The Neurosurgery Service has a rotating call schedule that has one PGY 2, PGY 3 or PGY 4 in-house with no operative responsibilities. This resident covers all neurosurgery patients and, therefore, has responsibilities outside the PICU including adult and pediatric trauma responses. This resident responds to problems in the Pediatric Intensive Care Unit for patients on the Neurosurgery service. Back up is provided by the neurosurgery resident (PGY 5/6) on call.

The Pediatric Critical Care Medicine Service has four attendings that cover the PICU on a rotating basis. They take call from home only when the Pediatric Intensive Care Unit is quiet and frequently are present throughout any given 24 hour period. There are three residents, PGY 2 or greater assigned to the PICU including pediatric, anesthesia and emergency medicine residents from the Hershey Medical Center Residency Programs. Each is PALS certified and remains onsite in the Pediatric ICU or in the adjacent Pediatric ICU call room. They are notified of all patient problems in the PICU and provide immediate on-site first response for any problems requiring immediate attention (airway, shock, arrhythmia, acute neurologic deterioration).

Communication among the services is facilitated by the Pediatric ICU resident accompanying the Pediatric Surgery residents and Neurosurgery residents on their morning rounds. The Pediatric Surgery resident accompanies the PCCM service on their daily rounds as well. The attendings of each service communicate daily, customarily in the afternoon. Thus, at least three times each day, there is a formal opportunity for inter-service communication.

Orders may be written by any of the managing services, as the designee of the attending surgeon of record. The entire plan of care is reviewed each day by the attending surgeon of record. Ventilator management and sedation requirements associated with the use of mechanical ventilation are under the direct supervision of the PCCM service. Management of intra-cranial pressure is done by protocol under the guidance of Neurosurgery and PCCM. Subspecialty service-specific orders (for example orthopedic orders) are written by the subspecialty service.

On-site personnel in the PICU (nurses, residents, attendings), notify the surgical service of record of both emergent problems that require immediate attention (loss of airway, shock, arrhythmia, acute neurologic deterioration) and non-emergent problems (temperature elevation, test results, abnormal laboratory value reporting). The first responder for emergencies that require immediate attention (loss of airway, shock, arrhythmia, acute neurologic deterioration) is the on-call resident in the PICU who does not leave the immediate area of the PICU or the PICU attending when present. As noted, the surgical service of record is simultaneously notified for all such problems as well. Problems are addressed through the appropriate hierarchy with the Pediatric Critical Care Medicine attending and the Surgery attending providing the final level of oversight.

E. **Trauma Conferences**

Multidisciplinary Pediatric Trauma Morbidity and Mortality Conference is held monthly. It is attended by attending surgeons and residents from Trauma Surgery, Pediatric Surgery, Orthopedic Surgery, Neurosurgery, Anesthesia, Radiology and Emergency Medicine, as well as the Trauma Program Manager, Pediatric Trauma Care Coordinator, and Nursing Unit Managers. Trauma cases that have generated a Performance Improvement concern are reviewed and plans are generated to address each issue.

Trauma Grand Rounds are held the fourth Thursday of the month from 7 to 8 a.m. and addresses adult and pediatric trauma care and system issues in an educational venue.

Pediatric Surgery Trauma Resident Teaching Conference - This conference is held weekly with the residents rotating on the Pediatric Surgery Service. Trauma care and system issues are discussed along with other Pediatric Surgery Topics.

F. **Role of the Pediatrician in Pediatric Trauma Care**

(This information is extracted from the Hospital Administrative Policy Manual)

The ultimate responsibility for the pediatric trauma patient lies with the attending surgeon to whom the child is admitted. This will under most circumstances be the pediatric surgeon on call when the child is admitted or, in the case of certain isolated head injury patients, the neurosurgeon on call for neurosurgery at the time of the injury. The injured child will be admitted to one of the in-patient units of the Penn State Children's Hospital at the Milton S. Hershey Medical Center.

The Department of Pediatrics has an approved residency training program in general pediatrics and includes specialists in all of the major disciplines of pediatrics. Pediatricians and pediatric residents become involved in the care of injured children under a number of circumstances as described below.

The role of the pediatrician in pediatric trauma resuscitation: The trauma team leader, under the supervision of the attending pediatric surgeon, directs the activities in the pediatric trauma resuscitation room. The Pediatric Critical Care Medicine attending and a pediatric resident on call in the PICU are included in the pediatric trauma response. The PCCM service provides consultative care as requested during resuscitation. This may include but is not limited to assistance with the institution of mechanical ventilation and the choice of ventilator settings as well as the initiation of care for intracranial pressure. Under circumstances such as a "trauma code" which requires simultaneous medical and surgical resuscitation, the PCCM service will supervise the administration of resuscitative medications while the trauma team attends to issues such as airway, intravascular access, and the treatment of life-threatening injuries. The pediatric resident assigned to the PICU is ATLS certified and may provide assistance in the resuscitation as requested by the Trauma Team Leader.

The role of the pediatrician in the Pediatric Intensive Care Unit: Multiply injured patients are admitted to the Pediatric Surgery Service with concurrent care provided by the Pediatric Critical Care Medicine Service. Concurrent care includes the use of mechanical ventilation, sedation and paralysis, the management of intracranial pressure, and the immediate oversight of all aspects of patient care in the PICU. Invasive procedures may include jugular venous pressure monitoring for ICP and CPP management. Immediate life-saving procedures required for airway management and the treatment of hypotension or pneumothorax may likewise be performed. A pediatric resident at the PGY 2 level or above is in attendance and immediately available in the

Pediatric Intensive Care Unit 24 hours a day as the first-responder for life-threatening emergencies and works under the supervision of the Pediatric Critical Care Medicine Service. The residents are ATLS and PALS certified. Concurrent care provided by the Pediatric Critical Care Medicine Service involves the minute-to-minute oversight of all activities within the Pediatric Intensive Care Unit. Cooperative relationships have been established that provide the optimal care for the injured child under the direction of the attending surgeon. Communication between the Pediatric Trauma Service and the PCCM service occurs formally and informally throughout the day. The on-call PCCM resident accompanies the Pediatric Surgery Service on morning rounds; the Attending Physicians review the plan of care daily, and residents on each service review the plan of care.

There are instances when a child is admitted to the General Pediatrics Service and as the history and evaluation proceeds a suspicion of abuse becomes evident. The hospital policy, **“Trauma/Non-Surgical Admissions of Pediatric Patients with Suspected Child Abuse”** is followed when a diagnosis of child abuse is entertained.

The role of the pediatrician as a consultant for the pediatric trauma patient: Because the pediatric trauma patient is admitted to the Children’s Hospital, the expertise of the full range of the pediatric specialists is immediately available. Children with concurrent lung disease may benefit from consultative services with a pediatric pulmonologist. Children with intrathoracic injuries benefit from the availability of our pediatric cardiologists’ evaluation including the use of echocardiography. Some children with head injuries benefit from the early input of the pediatric neurologists.

The role of the pediatrician in rehabilitative care of the pediatric patient: Pediatric rehabilitation specialists at the University Hospital Rehabilitation Center supervise the rehabilitative care of injured children during their in-patient stay at the acute care facility.

III PEDIATRIC TRAUMA PROGRAM: QUESTIONS AND ANSWERS

A. What is the Pennsylvania Trauma System Foundation (PTSF) ?

The PTSF is the agency that was established in 1985 by the PA legislature to accredit trauma centers. The foundation is comprised of an administrative staff and a board of directors. On the board are physicians, nurses, and others that are charged with evaluating institutions for designation as accredited trauma centers and determining standards for trauma care in Pennsylvania. The offices of the foundation are in Mechanicsburg.

There are 27 trauma centers in PA. There are 10 Regional Resource Trauma Centers (Level I), which is our designation. We are one of 4 centers with Additional Qualifications in Pediatric Trauma. Children's Hospitals in Pittsburgh and Philadelphia, and St. Christopher's Children's are the 3 Pediatric Regional Resource Centers. There are 10 Regional Trauma Centers also named Level II Trauma Centers with York Hospital and Lancaster General Hospital as the closest to HMC.

B. What is the trauma service?

The trauma service consists of all Children's Hospital surgical staff who admit and treat patients with significant trauma. The key word is "surgical" - pediatric surgery, neurosurgery, orthopedic surgery, plastic surgery, urology, and otolaryngology. When the child is admitted to the trauma service, he or she remains under the care of the admitting surgeon. **The primary attending physician must be a surgeon.**

Children admitted to the PICU after a trauma must be admitted to Pediatric Surgery or Neurosurgery with concurrent care by the Pediatric Critical Care Service.

In the acute care of the trauma patient, nursing care must be given by an RN who has been credentialed as a trauma nurse which means he or she has completed the trauma nurse course, has obtained 8 hours of continuing education per year, and has re-credentialed by completing the unit's skill proficiency list.

In the broadest sense, the trauma service includes nurses, doctors, laboratory techs, therapists, radiology techs, and administrative staff as an organized system of care for the injured child, which is coordinated by the surgical services.

The Trauma Service reports administratively through the Department of Surgery.

C. If there is a problem during the management of an injured child throughout the institution, whom do you notify?

Dr. Robert Cilley, Pediatric Trauma Program Medical Director, at extension 8342 pager 1209

Susan E. Rzucidlo, MSN, RN, Pediatric Trauma Program Manager, at extension 7161 or pager 2137.

You should also inform your unit manager \department head.

D. What is significant trauma?

Significant trauma that is reported to the PTSF database and are patients that may be reviewed at the time of survey are injured children under 18 years that meet the following criteria:

- All deaths
- Burns that were admitted or transferred to another facility
- Transferred to our institution
- Transferred from our institution to another institution
- Admitted to a monitored bed (PICU, PIMC)
- Length of stay is greater than 2 days

E. How is the system activated?

The system is activated by the Emergency Department attending serving as the Medical Command physician. The dispatchers at the command center (located in the Emergency Department) contact the hospital operator to activate the Pediatric Trauma Paging System. All members of the trauma team are simultaneously contacted by the pediatric trauma paging system for any child under 18 years of age. Prehospital report on the child is on a repeater accessed by dialing 7077.

F. What are the levels of the pediatric trauma response systems?

The ED attending will determine what level of activation to engage based upon the patient condition, injury pattern. Patients are triaged into the following levels:

Level I – Trauma Attending Request

Level II – Trauma Response

The two stages of the activation are:

Pediatric Trauma Standby is broadcast for an injured child who is under 18 years of age. Estimated arrival time is 10 to 20 minutes.

Pediatric Trauma Response Stat is broadcast for an injured child and arrival is estimated within 5 minutes. It is possible that there will only be a Response Stat if there is a short ETA.

G. When is a Pediatric Trauma Attending Request Called?

This will accompany the trauma stand-by or response stat page when the incoming patient is hemodynamically unstable, there is **respiratory distress**, or there are **multiple patients** needing extra manpower, prioritization, or triage for studies or therapy. This requires an immediate response by the on-call pediatric trauma attending.

In the absence of the “attending required” page, i.e. for “stable patients” or for trauma consults, the on-call trauma attending must be contacted for a report and case discussion within **30 minutes** of the patient’s arrival.

H. Who decides which patients are transferred here from another institution and how they are transported?

The trauma surgeon on call in conjunction with the attending emergency department physician. They will also determine if the pediatric trauma response system should be activated. The mode of transport will depend on the distance and severity of injury.

I. What are the criteria for a direct admission of a pediatric trauma patient?

The criteria for bypassing the ED phase of care are:

- 1) Post-injury greater than 24 hours
- 2) Single system injury
- 3) Hemodynamically and neurologically stable
- 4) Already an inpatient at another facility

The injured child must be admitted to the care of a surgeon. If the child is being transferred for definitive care of injuries (i.e. orthopedic or neurosurgical injuries), a consult to Pediatric Surgery should be made.

J. If the Children’s Hospital Pediatric Nursing Unit is full and a trauma patient requires admission, what do you do?

A policy exists to cover such instances for adolescents where they can be transferred to an adult trauma unit (SICU, 3rd or 5th floor). If the child is less than 15 years of age, a non-injured patient must be triaged to open a bed space for the injured child. Triage is done by the Pediatric Critical Care Medicine faculty as the Children’s Hospital Triage Officer.

K. Who is the trauma team leader?

The team leader per the Trauma Foundation standards **MUST** be a 4th or 5th year surgical resident, an attending surgeon, or an Emergency Department attending. The team leader directs the resuscitation and is responsible for all decisions regarding the injured child’s care.

L. What are the roles of the trauma nurses in the ED?

To provide care for the injured child and family and to document care according to the standards of the Pennsylvania Trauma Systems Foundation. There are to be 2 trauma credentialed nurses per shift for the care of the injured child. It is imperative that assessment findings and the plan are communicated to the nurses.

M. What happens if more than one injured patient arrives at the same time?

If two patients with significant injuries arrive simultaneously, the senior surgical resident acts as the team leader for one patient and the emergency department attending or the surgery attending acts as the team leader for the other patient. If there are multiple casualties, the disaster plan may be activated.

N. What IV fluids is the injured child to receive?

Initially, normal saline at a rate of 20 ml/kg, which is then adjusted as clinical condition dictates. Warmed fluid is used whenever possible. To calculate the child's weight, use the Broselow tape or as a quick rule use $8 \text{ kg} + 2 (\text{Age in years}) = \text{weight estimate in kg}$. (This mirrors the Ross growth chart 50%). In all cases, constantly MONITOR FLUIDS RECEIVED. Once the child is stabilized, fluids may be adjusted to maintenance rate, which is calculated using the following formula:

Infants less than 10 kg: 4 ml/kg/hr

Child wt 10 – 20 kg: 40 ml/hr plus 2 ml/kg above 10 kg

Child wt greater than 20 kg: 60 ml/hr plus 1 ml/kg above 20 kg

O. What equipment and resources are available for the care of the injured child?

In each of the 3 primary rooms for trauma patient triage (Trauma Rooms A and B and ED Room 21-22), there is the Broselow system which has IV, NG, monitoring, foley catheter, and airway equipment for the injured child by size for newborns to adults. The Pediatric crash cart is in Trauma Room B, which can be moved to either Trauma Room A and Room 21-22 as needed.

P. Is there an OR available at all times for a trauma patient?

Yes, there is always an OR available for the trauma patient. If there are multiple trauma patients, a room is always to be made available. With the activation of the pediatric trauma paging system, a nurse or surgical tech from the operating room responds and coordinates the operative needs for the child's care.

It is imperative that the Team leader \ trauma team assures that the operating room is aware of the exact operative plans so that equipment and staff are ready.

IV SCREENING REQUIREMENTS FOR ALL PEDIATRIC TRAUMA PATIENTS

All trauma patients must have a Nutrition evaluation, a Social Services evaluation and a Rehabilitation evaluation documented on the chart within the first 24 hours of admission. **In the event that such an evaluation is not needed, it must be documented as such in the day of discharge note and discharge summary.**

SOCIAL SERVICES AND SCREENING FOR CHILD ABUSE

All pediatric trauma patients must be evaluated by Social services. During the week this happens routinely. On weekends, the Social Service on-call person should be notified of their admission, and if necessary under extraordinary circumstances, must evaluate the patient in the hospital.

EVERY pediatric trauma patient with a suspicion of abuse or neglect must be evaluated by a social worker as soon as possible after admission. All staff have the responsibility to report suspected abuse or neglect as mandated reporters per PA law.

There is a child protection team that is comprised of physicians, nurses, social workers, and others that care for children. The team evaluates the case and a plan of action is coordinated with the county Child Protective Services (formerly Children and Youth) where the child resides.

NUTRITIONAL ASSESSMENT

On admission, the nursing staff completes the Pediatric Patient Health Care Profile. The nutritional needs and habits are assessed. In addition, a pediatric nutritionist screens all admissions to the Children's Hospital. The nutritional needs of the trauma patient are also assessed daily by the attending service. **Weekend admissions and discharges require a note that there were no nutritional issues noted.**

REHABILITATION PLAN

The process begins on admission with the completion by the Pediatric Trauma Case Manager/Coordinator of the Trauma Rehabilitation Assessment Screen that evaluates the need for therapy consults and rehabilitation services. The Rehabilitation Coordinator and the Pediatric Trauma Coordinator review all trauma admissions for potential rehab needs. If the child requires rehab, the services are available through inpatient acute rehab, outpatient or clinic services. The plan is directed by the attending physician and the rehabilitation physician to assure that the child receives the most appropriate and efficient services.

If the child is a weekend admission and discharged, it should be noted that there were no known rehabilitation needs. **On the admission orders, complete the section for "therapy, rehabilitation medicine or none required".**

The "Rancho Scale" is used to describe the level of functioning after head injury.

Rancho Los Amigos Scale, Levels of Functioning:

- Level I: No response to stimuli. Appear in deep sleep
- Level II: Generalized Response. First reaction may be to deep pain. Has delayed, inconsistent responses.
- Level III: Localized Response. Inconsistent responses, but reacts in a more specific manner to stimulus. Might follow simple command "squeeze my hand"
- Level IV: Confused, agitated. Reacts to own inner confusion, fear, disorientation. Excitable behavior, may be abusive.
- Level V: Non-agitated, confused, inappropriate. Usually disoriented. Follows tasks for 2-3 minutes, but easily distracted by environment, frustrated.
- Level VI: Confused appropriate. Follows simple directions consistently. Memory and attention increasing. Self care tasks performed without help.
- Level VII: Automatic Appropriate. If physically able, can carry out routine activities. Appears normal. Needs supervision for safety.
- Level VIII: Purposeful, alert, oriented. May have decreased abilities relative to premorbid state.

All patients are evaluated on this scale for rehabilitation placement and progress - patients must be at Rancho Level III to be a candidate for in-patient rehabilitation.

DAY OF DISCHARGE FORM FUNCTIONAL STATUS (FIMS)

The Functional Independence Measure Score (FIMS) is an abbreviated tool to evaluate feeding, transfer mobility, locomotion, expression and social interaction at the time of discharge for injured children over 2 years of age and adults

The information is to be completed on the day of discharge instruction form for injured children and adults. This includes those patients admitted to the trauma service as well as surgical (orthopedics, neurosurgery, plastics, ophthalmology, ENT, etc.) and medical services (pediatrics, pulmonary, etc.)

SCORING:

1. FEEDING:

- 5 = Not applicable if under 2 years of age.
- 4 = Complete Independence: Eats from dish and drinks from a cup presented in customary manner on table or tray, opens cartons pours liquids, cuts meat, and butters bread
- 3 = Independent with Devices. Requires assistance in preparation, e.g., opening cartons, pouring liquids, cutting meat, OR requires an adaptive or assistive device, e.g., straw, spork, rocking knife, BUT is able to manage meal without assistance, e.g., brings food to mouth, chews, and swallows.
- 2 = Modified Dependence: Is able to take food and drink by mouth but requires supervision or minimal to moderate physical assistance during drinking or eating. Patient does not rely on other means of alimentation, such as parenteral or gastronomy feedings.
- 1 = Complete Dependence: Requires maximal or total assistance to take meals by mouth; or does not take food bu mouth and must rely on other means of alimentation, such as parenteral or gastrostomy feedings.

2. LOCOMOTION:

- 5 = Not applicable if under 2 years of age.
- 4 = Complete Independence: Walks a minimum of 150 feet without assistive devices. Does not use wheelchair.
- 3 = Independence with Devices: Walks a minimum of 150 feet, but with brace (orthosis) of prosthesis on leg, adaptive shoes, crutches, or walker. *If not walking* operates a manual or electric wheelchair independently for a minimum of 150 feet turns around: maneuvers the chair to table, bed, or toilet, maneuvers on rugs and over doorsills.
- 2= Modified Dependence: If walking requires supervision or minimum to moderate physical assistance to go 150 feet; or walks independently only a short distance (minimum of 50 feet). *If not walking* operates a manual or electric wheelchair independently for short distances (a minimum of 50 feet).
- 1= Complete Dependence: requires maximal or total assistance to walk 150 feet OR does not walk or operate a manual or electric wheelchair independently for 50 feet. Includes patients restricted to bed with no locomotive abilities.

3. EXPRESSION:

- ❑ 5 = Not applicable if under 2 years of age.
- ❑ 4 = Complete Independence: Expresses complex ideas intelligibly and fluently, verbally or non-verbally, including signing or writing.
- ❑ 3 = Independence with Device: Expresses complex ideas with minor difficulty, but communicates basic needs and wants without difficulty; may require an augmentative communication device or system.
- ❑ 2 = Modified Dependence: Expresses thoughts in a telegraphic or confused pattern, or requires prompts, cues, or assistance of another person.
- ❑ 1 = Complete Dependence: Does not express basic needs and wants consistently, even with an augmentative communication device or system, despite prompting.

4. TRANSFER MOBILITY:

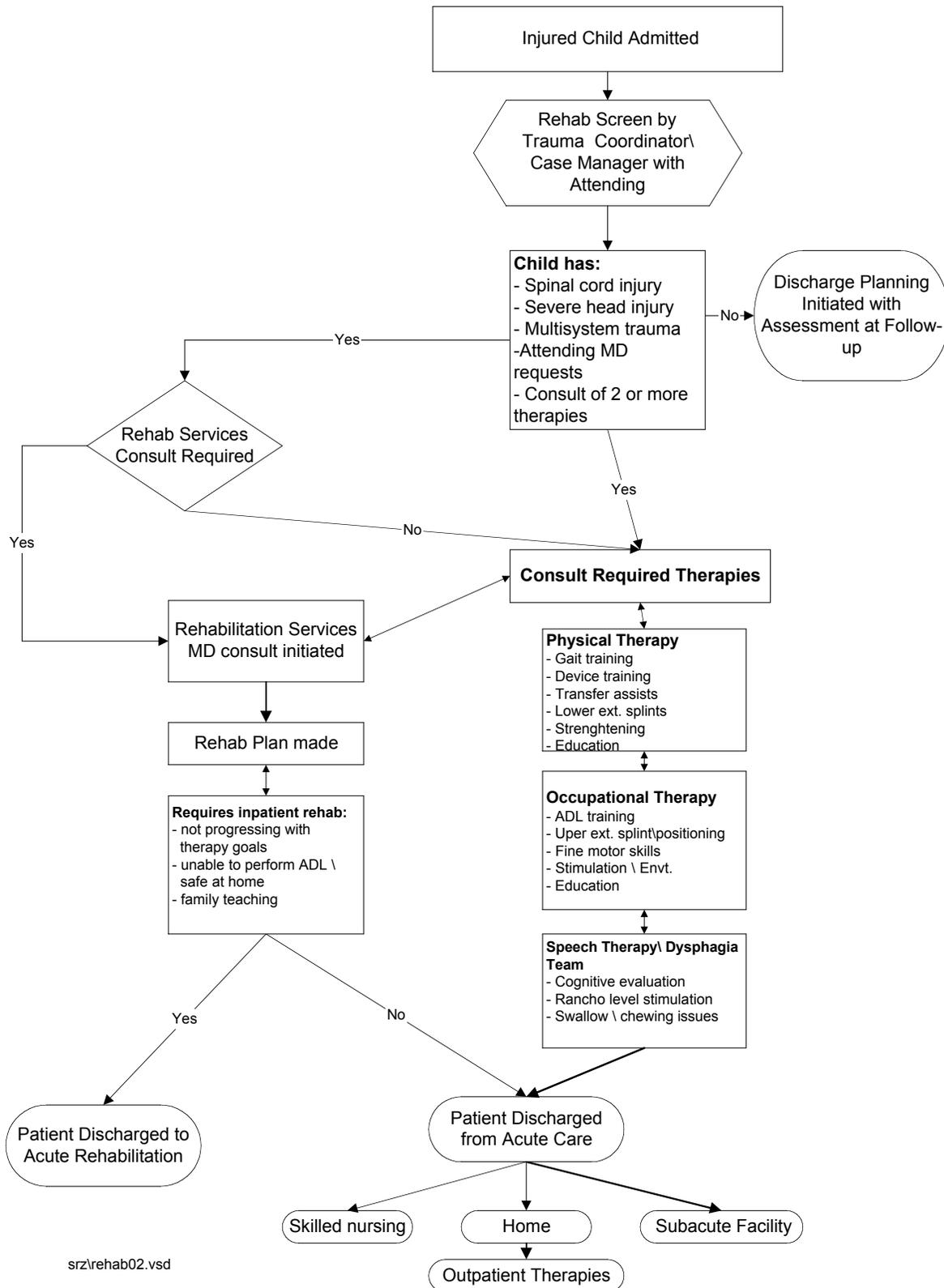
- ❑ 5 = Not applicable if under 2 years of age.
- ❑ 4 = Complete Independence: If walking, approaches, sits, and gets up to a standing position from a chair or bed. Performs transfer safely. If in a wheelchair, approaches a bed or chair, locks brakes, lifts foot rests, and performs either a standing pivot or sliding transfer and returns. Performs transfer safely.
- ❑ 3 = Independence with Devices: Uses adaptive or assistive device such as a slinging board, a lift, grab bars, special seat, brace, or crutch. Performs transfer safely.
- ❑ 2 = Modified Dependence: requires assistance in set up, or adaptive or assistive device: OR requires supervision or minimal moderate physical assistance to perform transfer safely.
- ❑ 1 = Complete Dependence: Requires maximal to total assistance to perform transfer.

5. SOCIAL INTERACTION:

Includes skills related to participation with others in therapeutic and social situations. Represents how one deals with one's own needs together with the needs of others.

- ❑ 5 = Not applicable if under 2 years of age.
- ❑ 4 = Complete Independence: Interacts appropriately with staff other patients, and family members: e.g., controls temper and is aware that words and actions have an impact on others.
- ❑ 3 = Independence with Device: Interacts appropriately with staff other patients, and family members in structured situations and environments; may take more than a reasonable time to adjust in a social situation.
- ❑ 2 = Modified Dependence: Requires some supervision (monitoring, cuing, coaxing) under stressful or unfamiliar situations.
- ❑ 1 = Complete Dependence: Interacts appropriately less than 25% of the time or not at all; may need restraint.

Penn State Children's Hospital The Milton S. Hershey Medical Center
Guidelines for Rehabilitation Planning



srzrehab02.vsd

V SPECIAL TOPICS

DOCUMENTATION

THERE SHOULD NEVER BE A PATIENT ENCOUNTER WITHOUT A NOTE.

Documentation includes the nature of the encounter, the date and the time spent (start and stop) with the patient and/or family, e.g. "12/24/98 9:30-9:50am Discussed discharge planning with family." The note can be as descriptive as you want and should document any objective findings that are relevant, but need not read like a narrative description of the encounter. This is important for all documentation, not only for trauma patients.

A. Documentation in the ED

1. **Trauma H&P**
 - complete all areas including weight and your signature
 - complete an injury list and make sure attending reviews and signs it
2. **Resuscitation order sheet**
 - complete orders including a signature.
3. **Sign your name and time of arrival on the sign-in-sheet.** If not a trauma response and you see an injured child as a consult, make sure you date and time your arrival. Document diagnostic test results as well as head to toe evaluation
4. **Admitting orders** are completed using the Trauma Admission Order set.

They are to be reviewed by the Trauma Team Leader/attending and include a time and date and signature.

B. Documentation in the PICU/PIMC/7th Floor

1. Daily note with the plan of care outlined
2. When cervical spine is cleared, a timed note including criteria for collar removal and who cleared the spine and what criteria were used. Similar documentation for removal of precautions when TLS spine injury is suspected and the spine is then "cleared".
3. If patient requires a procedure such as a line or chest tube, make sure a time, date, what was done, review of follow-up films as well as attending supervision is documented.

C. Documentation Prior to Discharge

1. Prior to discharge, complete the functional status –it is on the back of the white copy of the Day of Discharge form.
2. Document follow-up appointments.
3. Make sure a phone number for questions is included.
4. Provide prescriptions for medications, equipment, school release.
5. If it is a weekend admission/discharge, make notation regarding nutrition, rehabilitation not needed and lack of apparent social service issues.
6. Patients being discharged to rehabilitation require a Day of Discharge form and dictation.

PEDIATRIC TRAUMA PATIENT DEATH

- A. All trauma deaths are coroner's cases and the coroner must be contacted. The family should understand that they do not have any say in the coroner's decision about an autopsy. That is, if the coroner wants an autopsy, it will be performed.
- B. If the coroner does not want to perform one, with the permission of the family, our pathologists will do it. Contact the pathologist via extension 7463.
- C. Contact Mortuary Services who will assist with contacting the coroner, death paperwork and funeral home arrangements.
- D. **All deaths require a discharge summary at the time of death.** Do not let a death chart get out of your sight without a completed dictation.
- E. According to Pennsylvania law, organ donation referrals must be made on all deaths.

VI PEDIATRIC PEARLS

- A. PREVENT HYPOTHERMIA
- B. MONITOR NEURO STATUS CLOSELY
- C. TELL THE CHILD WHAT YOU ARE GOING TO DO AND DO IT. NO DELAYS!
- D. REMEMBER TO MEDICATE FOR PAIN
- E. MONITOR FLUID VOLUMES
- F. UPDATE THE FAMILY ON THE CHILD'S CONDITION

REMEMBER THAT RAPID CHANGE IS THE NORM!!!!!!

NOW MORE DETAIL!!!!!!

- A. **Prevention of Hypothermia**
Warm the room, warm the ventilator, warm blankets, use heat lamps, intracavitary warming (via chest tubes or intraperitoneal catheter), and extracorporeal circulation, as necessary.
- B. **Weight Estimates**
Use the Broselow tape, or calculate an estimate using the formula:
$$8\text{kg} + 2(\text{age in years}) = \text{estimate weight in kg}$$
- C. **Airway**
 - 1. Endotracheal tube size:
$$16 + \text{age in years} / \text{divided by } 4$$

the circumference of the CHILD'S little finger
 - 2. Endotracheal tube placement to the tip of the carina
$$3 \text{ times tube size} = \text{cm mark to gum line. Mark and anchor tube securely.}$$
- D. **Breathing**
 - 1. Ventilation
Infant: delivered Tidal Volume of 8-10 ml/kg with a rate of 25 to 30 breaths per minute. (Delivered Tidal Volume is after correcting for circuit loss.)
Child: delivered Tidal Volume of 8-10 ml per kg with a rate of 15 to 20 breaths per minute.
 - 2. Assessment
 - a. Monitor CO₂ level especially with head trauma.
 - b. Evaluate the work of breathing.
 - c. Monitor chest excursion as one of the best indicators of effective ventilation.
 - d. Prevent gastric distention.
- E. **Circulation**
 - 1. IV Access Algorithm (see Protocol B)
 - 2. Blood Volume Estimates
 - a. Premie 100 ml/kg
 - b. Term infant 80 to 85 ml/kg
 - c. Child 80 ml/kg
 - d. Adults 70 to 75 ml/kg

3. Fluids for Acute Replacement
Initially, lactated ringers or normal saline. This provides an easy system for accurately monitoring delivered fluids. Use warm IV solution. Remember to calculate the child's weight and give 10 to 20 ml/kg crystalloids (usually NSS) times 2, then 10 ml/kg packed cells
4. Maintenance Fluid Calculations
4 ml/kg /hour for the first 10 kg
2 ml/kg/hour for the second 10 kg
1 ml/kg/hr for each kg of body weight over 20 kg

F. Disability

- Neurosurgery residents will assess the injured child **BEFORE** sedation or paralytics if feasible.
- Frequently assess pupils
- If GCS <8 refer to Pediatric Severe Brain Injury Protocol

PEDIATRIC GLASGOW COMA SCALE (score 3 to 15)

EYE OPENING

INFANT	CHILD		
4 Spontaneously	Spontaneously	4	
3 To Speech	To Command	3	
2 To Pain	To Pain		2
1 No Response	No Response	1	

BEST VERBAL RESPONSE

5 Coos, Babbles, Smiles	Oriented	5	
4 Irritable, Crying	Confused	4	
3 Cries, Screams to Pain	Inappropriate Words	3	
2 Moans, Grunts	Incomprehensible	2	
1 No Response	No Response	1	

BEST MOTOR RESPONSE

6 Spontaneous	Obeys Command		6
5 Withdraws from Touch	Localizes Pain	5	
4 Withdraws from Pain	Withdraws from Pain	4	
3 Flexion (decorticate)	Flexion (decorticate)		3
2 Extension (decerebrate)	Extension (decerebrate)		2
1 No Response	No Response	1	

TOTAL

TOTAL

“SPIKES” for Family Interactions

The following are suggestions for when you talk to families

- S - Setting** - make it private and comfortable
- P - Perception**- find out what they know
- I - Invitation** - are they willing to listen to you and accept the information
- K - Knowledge**- be honest
 - share major points
 - find out what others have shared
 - avoid technical language
- E - Empathy** - acknowledge their reactions
 - there are many reactions and each person and culture is different
- S - Summary** - tie it all together when you are done
 - tell other providers what you shared and the family’s reaction

VII PEDIATRIC TRAUMA TRIAGE ACTIVATION CRITERIA

**PENN STATE SHOCK TRAUMA CENTER
Pediatric Trauma Triage Activation Criteria**

Department of Emergency Medicine

February 2004

LEVEL I TRAUMA ATTENDING REQUESTED		LEVEL II TRAUMA RESPONSE	
POSSIBLE MECHANISM OF INJURY 1. Fall from height of 20 feet or 3 stories 2. Massive crush injury 3. Runover 4. Penetrating injury to head/chest/major vascular		POSSIBLE MECHANISM OF INJURY 1. Crush injury of extremity 2. Falls from height 10 to 20 feet 3. Pedestrian, bicycle or motor vehicle trauma 4. Penetrating injury to extremity 5. Any vehicle mechanism such as ATV, dirt bike 6. Ejection or thrown from any motorized vehicle 7. Rollover 8. Death of same vehicle occupant	
Mechanism for injury AND one or more of the following			
V I T A L	*Respiratory Compromise *SHOCK (Systolic BP <80 despite fluid boluses, sustained tachycardia or bradycardia for age) *CPR at scene or during transport *GCS ≤8	V I T A L S	*CHI with reported LOC > 5 minutes, GCS <14 *Vitals stable - intermittent tachycardia and/or hypotension *Airway maintainable with respiratory changes for age *Intubated but adequate ventilation
I N J U R I E S	*Severe head injury: deteriorating LOC, seizures *Abdominal trauma with shock *Known Pneumothorax *Amputation and/or degloving injury (proximal to wrist/ankle) *Neurovascular compromise *Acute paraplegia/SCI *Burns >20% TBSA - 2nd or 3rd/inhalation injury *Gunshot/stab wounds to torso, head *Fractures - open, multiple	I N J U R I E S	*Mild to moderate CHI GCS >8, +LOC, agitated, confused *Proximal long bone fractures *Facial fractures with respiratory changes *Neck lacerations - Zone 2 *Abdomen tender/seatbelt sign but no shock *Femur fracture
L O G I S T I C S	*Anticipated need for immediate operative care *Multiple pediatric patients *Patient deterioration *ED Medical Command Judgment	L O G I S T I C S	*Transfer from another institution *Acute ED patient deteriorates *Presence of alcohol/substances *Pregnant *ED Medical Command Judgment

VIII PEDIATRIC TRAUMA GUIDELINES

GUIDELINE A

Pediatric Abdominal CT Protocol

1. Oral Contrast

A. Preparation of the solution

- 1) E-Z CAT - bottle of powder dilutes to 600 cc with juice
- 2) Gastrografin
 - 1.5% Dilution with juice or water
 - 10 cc Gastrografin in 240 cc water equals 250 cc solution

B. Dosages (smaller doses will often suffice)

NB - infancy	200 cc
1 - 2 years	250-300 cc
2 - 6 years	300-500 cc
6 - 8 years	600-800 cc
Over 10 years	1000-1200 cc

C. Administration

- 1) If child awake, must drink in 30-45 minutes. Do not tell the child it tastes like Koolaid!
- 2) If via nasogastric tube
 - Insert tube, verify placement
 - Connect NG to low suction to empty stomach
 - Install Gastrografin by gravity via 60 cc catheter tip syringe
 - Determine log rolling technique in the event of vomiting have suction available to prevent aspiration

2. Oral contrast is rarely used and will be decided on a case by case basis between the Team Leader/Trauma Surgeon and the radiologist. In some cases, there may not be a diagnostic advantage in using oral contrast. There may also be risks of aspiration.

3. IV Contrast for Chest and Abdominal CT Scans

2 cc per kg into IV by the radiologist. Assess IV patency carefully.

Start January 1996, implemented May 1996.

GUIDELINE B

Pediatric Intravenous Access

After utilizing the Broselow tape to determine the “child’s bag” color, there is an “IV” insertion bag that contains:

- 2 size IV catheters for age
- T-connector
- alcohol prep
- tourniquet
- arm boards for smaller children

Catheter Selection

Small infant	#20 or #22 IV Catheter
Toddler	#18 or #20 IV Catheter
School Age Child	#18 IV Catheter
Adolescent	#14, #16, #18 IV Catheter
Intraosseous	#16-18 “ Bone Marrow Aspiration/Transfusion Needle Catheters in bottom drawer of pediatric crash cart

Insertion Sites

- First choice is percutaneous access
- Consider intraosseous access after 2 failed percutaneous attempts
- A cutdown saphenous or antecubital vein is required if no percutaneous site is found after intraosseous placement
- Percutaneous femoral vein or subclavian access is performed by an attending or PGY4/5

Intraosseous Infusion

- May be appropriate for those patients 6 years of age or younger.
- Preferred site is 2 to 3 cm below tibial tuberosity.
- Circulation time to heart from marrow cavity is approximately 20 seconds or less.
- Able to administer resuscitation drugs, crystalloids and blood products. Must use an infusion pump.
- Not to be used if there are long bone fractures.
- Flush with 5-10cc NSS after administering medications.

Start January 1996, implemented May 1996.

GUIDELINE C

Screening for Drug and Alcohol Abuse in Adolescents

Medical resources are increasingly directed toward the appropriate treatment and support of alcohol and drug abusing patients. This issue is particularly important among adolescents, who may be more secretive about drug use because of legal and social pressures. The hospital setting provides a singular opportunity to recognize and address these problems in the context of an alcohol related event.

The Children's Hospital will screen for the use of drugs and alcohol in patients over the age of 14 years or who exhibit any of the following:

1. Mental status change not consistent with the severity of the trauma.
2. Physiologic symptoms of intoxication or withdrawal not related to the trauma (i.e. changes in vital signs, nystagmus).
3. High suspicion by the physician of drug and alcohol use based on the smell and/or appearance of the patient.
4. Evidence of drug and alcohol on the patient or at the scene of the trauma.
5. Trauma occurring during a criminal act (i.e. car theft, physical assault).
6. Trauma that resulted from a single vehicle accident in which the patient was either driving or was a passenger with an individual suspected of intoxication (automobile, Land Rover, Snowmobile, etc.).
7. Trauma occurring during self-abusive, self-destructive, homicidal or otherwise violent behavior.
8. The patient has a history of drug and alcohol abuse as reported by the patient or the family.
9. The patient is engaged in "drug seeking behavior", fabricating a complaint to obtain drugs.

DRUG SCREEN - The adolescent trauma panel including urine screening for amphetamine/Methamphetamine, barbiturates, benzodiazepines, cocaine metabolite, opiates, and marijuana. The results of the urine screen are reported as either negative or presumptive positive. If positive, the sample is sent to an outside lab for further evaluation. **Confirm that the ETOH testing and urine drug screen have been completed as ordered.**

RESULTS - Positive findings are revealed to the patient and family by members of the social work and medical staff and recommendations are made for psychosocial intervention prior to the patient's discharge. Adolescents admitted with a positive drug and alcohol screen receive evaluation by Psychiatry and social work during their hospital stay to assess the extent and history of use and to make necessary recommendations for referrals for treatment.

REPORTING – If the adolescent is a driver, the alcohol or drug use is to be reported to the Department of Transportation

Start January 1996, implemented November 2004.

GUIDELINE D

Pediatric Intensive/Intermediate Care Unit

Levels of Sedation for Ventilated Patients

Refer to MCH Policy 709 – Levels of Sedation for Ventilated Children

Level 1: **Goal:** Awake and **interactive** with environment, watches TV, communicates (generally for more mature children with neuromuscular cause for ventilation)

Action: PRN anxiolytics/analgesics

Level 2: **Goal:** Sleepy, **arouses to light stimulation**, becomes excited with nursing care/suctioning, moves spontaneously, turns head, **consistently breathes above ventilator**

Action: PRN anxiolytics/analgesics, paralysis only if PRN sedatives fail

Level 3: **Goal:** Asleep most of time, **arouses to pain**, coughs with suctioning, breathes above ventilator, **little spontaneous movement or head turning**

Action : PRN anxiolytics/analgesics with or without continuous anxiolytics/analgesics, paralytics only if PRN sedatives fail

Level 4: **Goal** :Asleep, arouses to pain, coughs with suctioning, **returns to sleep immediately**, does **not consistently breathe above ventilator**, little spontaneous movement, **no head turning**

Action: Continuous anxiolytics/analgesics, PRN as needed, paralytics only if sedatives fail

Level 5: **Goal:** Asleep, minimal response to pain or suctioning, **no respiratory effort, no sustained spontaneous movements**

Action: Continuous anxiolytics/analgesics, PRN as needed, liberal use of paralytics if PRN sedatives fail.

Level 6: **Goal:** Asleep, **continuous paralysis**, level of paralysis assessed by nerve stimulator or by observing minor motor movements between supplemental doses

Action: Continuous anxiolytics/analgesics, continuous paralytics, PRN sedatives to vital signs.

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GUIDELINE E

Spine Immobilization

All children sustaining actual or suspected injury to the spine should be fully and correctly immobilized on arrival to the ED. These include the following patients:

1. All patients with altered mental status.
2. All patients with signs and symptoms consistent with spinal cord injury:
 - a. History of transient paresthesia, dyesthesias, shooting pains or subjective extremity paralysis.
 - b. Complaints of neck pain or discomfort, or presence of muscle spasm, limited range of motion or tenderness over the spine.
 - c. Presence of sensory-motor deficits.
3. Cervical spine immobilization must be considered in all patients in whom mechanism of injury is likely to have resulted in significant trauma to the spine:
 - a. Pedestrian/MVA
 - b. Driver/passenger involved in MVA
 - c. All motorcycle or All Terrain Vehicle accidents
 - d. All falls greater than 10 feet
 - e. All vehicle accidents (sled, bike, skateboard) where patient thrown (not fell) from vehicle.
 - f. Diving injuries
 - g. Other mechanisms yielding high index of suspicion

BACKBOARD

There is a common misconception that patients must remain on the backboard until the entire spine has been evaluated and/or cleared. Backboards are uncomfortable and can result in significant tissue breakdown within two hours of application. All patients should be removed from the backboard as soon as possible.

AXIAL ALIGNMENT

Axial alignment should be maintained once the child is off the backboard. This means that the head of the bed cannot be elevated and the child must be log rolled. Remember some mechanisms of injury such as lap belt complex may increase concern for thoracic, lumbar or sacral injuries.

CERVICAL COLLARS

- The field or extrication collar is to be changed in the trauma room unless the plan is to clear the C-spine in the ED.
- The Aspen collars are available for infants to adults. There is a sizing chart in the ED and on the units.
- The colors of the Aspen collars DO NOT correspond to the Broselow tape collars.
- The collars are available in the ED in the trauma rooms. On the inpatient care units they are ordered through Central Stores.

Start January 1996, implemented May 1996.

GUIDELINE F

A Clinical Practice Guideline for the Clearance of the Axial Skeleton in the Pediatric Trauma Patient

Background: Trauma victims are at risk for injury to the axial skeleton. The cervical spine is maintained in a neutral rest position by means of a properly fitting cervical collar at the injury scene and maintained during transport. Similarly, the remainder of the axial skeleton is stabilized by maintaining in-line positioning and log-rolling the patient. At the trauma center, injuries to the axial skeleton must be diagnosed and treated, while uninjured patients must be cleared of injury. All guidelines for the clearance of the axial skeleton represent an attempt to balance safety and practicality.

The most practical approach to clearing the axial skeleton in children is to ignore the problem unless there is a clinical indication of injury such as paralysis. The rationale is that such injuries are very rare and injury without clinical signs is even more rare. Few injuries will be missed if precautionary stabilization of the axial skeleton is omitted in the absence of clinical signs of injury. Most would agree that this is unsafe and inadvisable. On the other hand, *the safest approach* with regard to injury to the axial skeleton would be to leave every child in a collar and on log-roll precautions until they are fully awake and cooperative for an examination. This approach has distinct disadvantages in a child. Secondary injury in the form of skin breakdown due to the cervical collar will occur in up to ten percent of children. For this reason, early removal of the collar and elimination of spinal precautions is advantageous.

Purpose: This clinical practice guideline provides a framework for the clearance of the axial skeleton in children in a safe and practical way.

Cervical Spine Clearance Guidelines: Pediatric trauma patients will have cervical spine protection provided by the application of a properly fitting cervical collar. If the child arrives with proper stabilization and is likely to be cleared in the trauma room, a new collar will not be applied immediately. This will decrease the number of “wasted” Aspen collars. The collar will be removed when an attending radiologist documents radiographic normality and there is minimal clinical suspicion of injury (no pain or neurologic findings). The collar is removed with confirmation of negative exam (no pain on flexion, extension, rotation or axial loading).

Progress Note and order are written in the chart.

The concept of "radiographic normality" means under most circumstances: normal AP, lateral through top of T-1, open mouth views. If any portion is unobtainable by these techniques, CT scanning (usually C1, C2 in the intubated patient or C7, T1) is used to complete the evaluation for bony injuries. When there is a high suspicion of injury (neck pain, tenderness, physical findings, highly suspicious mechanism) or the patient remains unevaluable (comatose, distracting injury) collar remains on. Further evaluation by appropriate service covering spinal injury (Neurosurgery or Orthopedics) may be needed. Flexion and extension views or MRI may be required to complete the evaluation.

Exceptions to these guidelines that occur with some regularity:

1. Fully evaluable patient with low suspicion of injury and negative exam: no radiographs needed, collar may be removed.
2. Infant or young child with low suspicion of injury, normal AP and lateral and unobtainable open mouth odontoid views: CT not usually required after review of radiographs with pediatric radiologist.
3. Risks of maintaining the collar outweigh the benefits (e.g. low suspicion and need for sedation to keep collar in place in a small child who is uncontrollable in the collar, films

reviewed by the pediatric trauma service and radiology resident): collar will be removed without an attending radiologist's reading at the discretion of the pediatric surgery attending.

4. Older child or teenager who can give an accurate exam and has no pain or tenderness and has normal c-spine x-rays (as read by pediatric trauma service and radiology resident, i.e. no attending reading) may have the collar removed. Collar is removed with confirmation of negative exam. Note and order are written in the chart.
5. Attending orthopedic surgeon or attending neurosurgeon clears the c-spine. With a written note on the chart by the attending, collar may be removed.
6. Patients on NS or Ortho service: collar removed at the discretion of the service. Must note that c-spine is cleared in the progress notes and write an order.
7. Unevaluable patient (intubated, distracting injury, depressed LOC, etc.): evaluate for bony injuries as always (Lat, AP, odontoid or CT of C1,2). Patient remains in Aspen collar. Examine later when better evaluation can be performed (i.e. more awake, extubated, calmer, etc) for clinical clearance.
8. Unevaluable patients who remain that way due to their injuries: evaluate for bony injury as always (Lat, AP, odontoid or CT of C1,2). Patient remains in Aspen collar. MRI of cervical spine if patient remains unevaluable to r/o ligamentous injury or SCIWORA. Collar removed if all studies normal. Customarily there is input on these patients from Neurosurgery. These patients also require T and L spine films.
9. Patients with pain: remain in collars until F/E can be performed either as inpatient or go home in collar and perform as outpatient. Injuries are referred to ortho/neurosurg.
10. Collar is off of a patient and there is disagreement regarding its removal: communicate first and act second. We have had several "dramatic" replacements of collars in front of families. This is unnecessary and clearly undermines the appearance that we function as a coordinated multidisciplinary team.

Thoracic and lumbar spine clearance guidelines: awake, conscious patients that can be examined may be cleared by a physical examination.

Symptomatic, unconscious or unevaluable patients will undergo AP and lateral thoracic and lumbar radiographs for clearance of the T and L spine. Log-roll precautions will be used until radiographs are formally read by an attending radiologist. The spine will be considered cleared with radiographic normality. **Note on chart and order will be written to indicate this.** Injury will be referred to the appropriate service. In these patients, "log-roll" precautions will be maintained until directed otherwise by the spine injury service.

Future development: These clinical practice guidelines were developed cooperatively by the Division of Pediatric Surgery/Pediatric Trauma Program, the Division of Neurosurgery, the Department of Orthopedics, the Department of Radiology, and Pediatric Critical Care Medicine. Suggestions for revision and improvement are welcome and should be directed to the Pediatric Trauma Program Director.

July 2001, implemented January 2002, reviewed November 2004.

GUIDELINE G

Tetanus Prophylaxis in Wound Management

DO NOT AUTOMATICALLY ASSUME THE INJURED CHILD NEEDS TETANUS PROPHYLAXIS! Ask the parents or call the child's PCP

SUMMARY OF TETANUS PROPHYLAXIS FOR THE INJURED PATIENT

History of Absorbed Tetanus Doses	Non Tetanus Prone		Tetanus Prone	
	Td (1)	TIG	Td	TIG
Unknown or < 3	Yes	No	Yes*	Yes*
≥ 3 doses (2)	No (3)	No	No (4)	No

Clinical Features	Non Tetanus Prone Wounds	Tetanus Prone Wounds
Age of Wound	< = 6 hours	> 6 hours
Configuration	Linear wound	Stellate wound, avulsion
Depth	< = 1 cm	> 1 cm
Mechanism of injury	Sharp surface	Missile, crush, burn, frostbite
Signs of infection	Absent	Present
Devitalized Tissue	Absent	Present
Contaminants	Absent	Present
Denervated tissue	Absent	Present

- (1) For children younger than 7 years: DTP is preferred to tetanus toxoid alone. (DT if pertussis vaccine is contraindicated)
For children 7 years and older: Td is preferred to tetanus toxoid alone.
- (2) If only three doses have been received, a 4th toxoid, preferably an absorbed toxoid should be given.
- (3) Yes, if more than 10 years since last dose.
- (4) Yes, if more than 5 years since the last dose. More frequent boosters are not needed and can accentuate side effects.

Td is Tetanus and diphtheria toxoids adsorbed, for adult use and children over 7 years - 0.5 cc tetanus toxoid.

TIG is Tetanus immunoglobulin, human, 250 units tetanus antitoxin.

*Use different needles, syringes and injection sites if given both preparations.

Reference: Advanced Trauma Life Support, Core Course, American College of Surgeons, 1993

GUIDELINE H

Management of Children with Mild Closed Head Injury/Concussion

Introduction

Each year in the United States alone, approximately 100,000 children suffer head injuries, 90% of whom are classified as 'minor' (Glasgow Coma Score (GCS) of 13-15).¹ Although guidelines for the management of children with minimal head injuries (a loss of consciousness (LOC) < 1 minute, normal mental status and no abnormal neurological findings at the initial examination, and no physical evidence of skull fracture) have recently been published², there is currently no consensus regarding the management of more seriously injured children with 'minor' head injuries.

Table 1: Management Algorithm for Pediatric Accidental Minor Head Injuries

- 1) Child is evaluated by ED personnel and meets clinical entry criteria (Table 2)
- 2) Child undergoes urgent CT scan and meets radiographic criteria (Table 3)
- 3) Neurosurgery per Pediatric Trauma Program Guidelines and consulted for evaluation of:
 - ≥ 2 minute LOC
 - Any skull fracture
 - Persistent GCS < 15 or any sustained deterioration in GCS or clinical status
 - Significant neck or back pain/tenderness
 - Intracranial abnormality (eliminates patient from algorithm)
- 4) Child is observed for at least 2 hours in ED/ admitted for observation to the Pediatric Surgery service
- 5) Child meets discharge criteria (Table 4)
- 6) Child is discharged to home under the care of a reliable caretaker with review of Care after Mild Head Injury Booklet and information in (Table 5).
- 7) Follow up either with pediatric surgery or PCP in 2 to 3 weeks

Table 2: Clinical Parameters

- Age ≥ 24 months
- One or more of the following:
 - More than a brief (seconds) loss of consciousness
 - Significant amnesia
 - More than 1 episode of vomiting
 - Lethargy/decline in mental status
- Lowest recorded in-hospital GCS 13-15
- No focal neurological deficits referable to head injury
- No post-traumatic seizure
- No spinal fluid otorrhea or rhinorrhea
- No shock or other major organ system injury that would preclude discharge
- No anticoagulant or chronic anti-inflammatory drug use or bleeding diathesis
- No suspicion of child abuse
- No prior cranial neurosurgical procedure

Table 3: Radiographic Parameters

- No intracranial abnormalities related to the head injury
- Skull fractures allowed *except*
 - Those that cross the middle meningeal artery (present on first three cuts of the middle fossa between the sphenoid wing and petrous ridge)
 - Those that cross the dural venous sinuses (sagittal, transverse, sigmoid)
 - Those that are depressed > thickness of the adjacent skull

Table 4: Discharge Criteria

- No hemodynamic or respiratory changes
- GCS 15 at time of discharge
- No neurological deterioration over preceding 2 hours
- No focal deficits referable to head injury
- Able to hold down liquids for at least the preceding 30 minutes
- Reliable caretaker who is comfortable with discharge and understands discharge instructions

Return to Activity/Followup

- Athletes or those who have been diagnosed with a concussion from other causes should not drive nor participate in “impact –prone” activities like: do physical education class, bike riding, recess/playground or organized sports for usually 2 to 4 weeks.
- No return to activities or school until completely asymptomatic
- Evaluation for signs of ongoing cognitive impairment (such as changes in memory, reasoning, concentration, vision, pain) can be facilitated by a consult to Dr. Ramer, Rehabilitation Medicine, pager 0928.
- Clearance from restrictions will be determined by the parent with the child, trauma team and school personnel.

This material was excerpted from a manuscript - The Management of Accidental Minor Head Injuries in Children: A Prospective Outcomes Study, Dias, Mark et al.

References:

1. Roddy SP, Cohn SM, Moller BA, et al. Minimal head trauma in children revisited: is routine hospitalization required? *Pediatrics*. 1998;101:575-577.
2. Committee on Quality Improvement AAP, Commission on Clinical Policies and Research AAP. The management of minor closed head injury in children. *Pediatrics* 1999; 104:1407-1415.

August 2003, implemented January 2004, reviewed November 2004.

Penn State Children's Hospital
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Guidelines for the Management of Severe Head Injury in Children (< 18 years)

- 1.0 Definition of Severe Head Injury - Severe traumatic injury to the brain is assumed to exist when a patient arrives in the emergency room with injuries resulting in a post-resuscitation Glasgow coma score ≤ 8 , or in a previously intubated patient, a Best Motor Response ≤ 3 . Dead on arrival and brain death criteria will be addressed separately.

Severe brain injury can only be assessed in the absence of **hypotension** (SBP < 60 mm Hg), **hypoxemia** (Pa O₂ < 60 mm Hg), **hypothermia** (core body temperature $< 95^{\circ}\text{F}$ or $< 35^{\circ}\text{F}$), and in the absence of a drug altered consciousness. When it is not possible to assess a patient in the absence of above limiting conditions, a severe head injury must be presumed and at least the initial portion of the protocol (stabilization and CT scanning of the brain) should be carried out while the underlying difficulties and assessment are corrected.

- 1.01 Aims of Therapy - The aims of treatment for severe head injury are:
1. To protect, prevent, and limit those processes leading to secondary brain damage.
 2. To provide optimal oxygenation and perfusion for the injured brain.
- 1.1 Emergency Department Management - Outpatients with a Glasgow Best Motor Response ≤ 3 or a Glasgow coma scale score of ≤ 8 in the Emergency Department undergo endotracheal intubation upon arrival if this has not been done at the transferring hospital or at the scene of the trauma. Neurological assessment and general physical examinations are performed from the moment of the patient's arrival, prior to intubation. This allows the use of pharmacological paralysis and fully controlled ventilation from the earliest minutes of the patient's hospital care. Rapid examination is performed to diagnose concomitant injuries while adequate intravenous access is established. Blood samples are obtained for appropriate counts and chemistries as well as toxicology screen (depending on patient's age) for commonly abused drugs. Expedient radiologic examination is carried out including x-rays of the cervical spine, chest, and pelvis. Patients with suspicion of intraabdominal injury undergo abdominal CT scanning with IV contrast. Occasionally, diagnostic peritoneal lavage or FAST ultrasonic exam may be performed in unstable patients. Fluid resuscitation is initiated with correction of any abnormal blood values, and cranial CT scan is performed. CT images of the cervical spine may also be obtained at this time. During the prehospital phase of care and in the Emergency Department, Pa CO₂ is maintained at 35 to 40 mmHg.
- 1.2 Surgical Management - If CT findings demonstrate a surgical lesion, the patient is taken to the operating room for definitive treatment. This procedure may be simultaneous with surgical repair of other injuries. Decompressive frontal or temporal lobectomy is not routinely done. Placement of a ventriculostomy is usually done in the operating room at the conclusion of the craniotomy for these patients. Postoperatively, the patients are taken directly to the Pediatric Intensive Care Unit (PICU) and entered into a protocol for head injury management.

- 1.3 Nonoperative Patient Management - Patients with severe head injuries who do not have surgical lesions on CT and do not have any other surgical emergency requiring an operation are transported from the CT scanner directly to the PICU. They are then entered into the head injury protocol. Any specialty consultations take place in the Emergency Department at the time of the Trauma Response. The decision to address other operative needs (e.g. orthopedic, plastic) is made jointly by the trauma surgeon, neurosurgeon, pediatric intensivist and the subspecialty surgeon.
- 2.0 Protocol for Monitoring and Management of Severely Brain Injured Patients in the Pediatric Intensive Care Unit - Upon arrival to the PICU, patients are connected to non-invasive monitoring devices which include cardiac rhythm, respiratory pattern, end tidal CO₂, and pulse oximetry. Head of bed will be maintained at 30°. (This does not require formal clearance of the thoracic and lumbar spine. Log roll precautions and maintenance of axial in-line stability is continued until the spine is cleared). Laboratory studies including blood gases, chemistries, and blood counts are repeated as the non-invasive devices are installed. Placement of the invasive monitors is carried out at the bedside. These include ventriculostomy or fiberoptic ICP monitor, arterial catheter, central venous catheter, and reverse internal jugular catheter, as indicated. Further x-ray studies are then completed, including a complete spine series, extremity films, repeat chest, and others as indicated. The patient's treatment in the PICU is individualized, but the following details generally apply to most cases. Initially, all patients with severe head injury will have serum sodium levels checked every 6 hours. Initial fluid management will consist of 0.9% normal saline for resuscitation and 5% dextrose in 0.9% normal saline for maintenance, and will be altered pending the results of serial serum sodium and glucose levels. Goals will be normal sodium and glucose levels for age.
- 2.1 Intracranial Pressure (ICP) - The decision as to whether or when to monitor intracranial pressure, as well as which type of intracranial pressure monitor to place will be the ultimate decision of the attending neurosurgeon. A ventriculostomy will be the monitor of choice whenever technically feasible. This will not only enable intracranial pressure monitoring, but will also allow CSF drainage as a front-line therapy to control ICP. However, it is recognized that there may be some circumstances (such as the patient with a mild coagulopathy, in whom a more invasive procedure might be inherently more risky; the patient with a normal CT scan and a low likelihood for sustained elevations in intracranial pressure; or the patient who requires only a short period of intracranial pressure monitoring during a non-neurosurgical operation) in which a fiber-optic intracranial monitor might be preferable. ICP is continuously monitored until 20 mm Hg for a period of 48 hours, or there is a sustained improvement in the clinical exam (at the discretion of the attending neurosurgeon). Patients requiring therapy at greater than Level 4 for control of increased ICP will be considered for placement of a reverse internal jugular vein catheter for continuous monitoring of jugular venous oxygen saturation (SjvO₂) and intermittent sampling of arterio-jugular lactate difference.
- 2.11 ICP Therapy - **Treatment objective is to minimize time above 20 mm Hg while, in patients requiring some degree of level 1 and level 2 therapy outlined below, maintaining CPP > age guideline level (below), and, if applicable, maintaining SjvO₂ > 50%.** Decisions regarding ICP protocol management should be made cooperatively between Neurosurgery and PCCM services. Neurosurgery residents should be informed of deterioration requiring advancement of level of care

FIRST TIER THERAPY

Level 1 – The first therapy for a rise in ICP should be to ensure adequate sedation. Fentanyl (2 mcg/kg/hour continuously, and 1-2 mcg/kg hourly as needed), Midazolam or Lorazepam (0.1 mg/kg every two to four hours as needed), and Vecuronium or Pancuronium (0.1 mg/kg dosed hourly) are titrated to tolerance. In accordance with FDA guideline, propofol infusions will be avoided in pediatric patients. The PCO₂ is maintained at 35-40 mm Hg, with the avoidance of acidosis. Normothermia (goal temperature between 36.5 and 37.5 °C) **and normotension** for age should be maintained.

Level 2 - In patients with a ventriculostomy, the catheter will be set up to monitor continuously with intermittent drainage. The height of the drainage system will be kept at 10 mm Hg. If the ICP exceeds 20 mm Hg for five minutes, drain CSF until the ICP is <15 mm Hg or CSF is no longer draining. Drainage should not be continued for more than 5 minutes. Continue management of ICP with drainage so long as this is effective. If drainage is poor, the pediatric neurosurgery service will be notified. In patients with intraventricular blood continuous drainage of CSF will be used at the discretion of the attending neurosurgery service. With continuous drainage, the bedside nurse will be required to turn the ventriculostomy to monitor every 15 minutes, and more often if necessary. Again, if drainage is poor, the pediatric neurosurgery service will be notified

Level 3 – If ICP is elevated and is not responsive to sedation or ventricular drainage, CPP management should be instituted. CPP will be maintained at age specific goals. For patients less than 5 years of age, minimum acceptable CPP is 45 mm Hg. For children 5-8 years old, minimum accepted CPP is 55 mm Hg. For children over 9 years old, minimum accepted CPP is 60 mm Hg. CPP goals will be maintained by the use of intravenous fluids if the patient is hypovolemic and the addition of inotropes or vasopressors for euvoletic patients.

Level 4 - If the ICP exceeds 20 mm Hg for five minutes and cannot be controlled with drainage and the serum osmolarity is <320 mOsm/L, give Mannitol .25 to 1 gram/kg IV as needed. Alternatively, 3% normal saline infusions may be utilized to an upper limit serum sodium not to exceed 160 mEq/L and an upper limit serum osmolarity goal not to exceed 360 mOsm/L.

Level 5 - If the ICP cannot be managed with the above measures, or if the CPP falls below the goal CPP for age, then moderate hyperventilation to a goal PCO₂ of 30-35 mm Hg may be attempted.

SECOND TIER THERAPY

The evidence for the selection of second tier therapies is not as strong as for first tier therapies and individual variation may exist both in terms of whether a particular therapy is employed and in what order various escalating therapies are used. Second tier therapies should be instituted after discussion between the attending neurosurgeon, trauma surgeon, and intensivist although the decision of which therapy to employ will ultimately remain the purview of the neurosurgeon. Note that the order in which these therapies are initiated is not specified as the evidence for their use is not of sufficient magnitude to force consideration of a particular therapy or order of therapies, and circumstances will be tailored to the individual patient's needs. At any point during therapy in which ICP cannot be controlled, consideration should be given to obtaining a repeat CT scan.

Lumbar Drainage

A trial of lumbar drainage may be initiated if the following circumstances warrant:

- 1) a functioning ventriculostomy catheter is in place and is opened whenever the lumbar catheter is opened
- 2) there is no significant intracranial mass effect or shift present on imaging studies
- 3) the basilar cisterns are open on a CT scan performed before the lumbar drain is placed.

A lumbar drain is placed and the buretrol is placed at the same level as the ventricular drain. Both drains are opened and closed simultaneously using the same parameters as established for opening ventriculostomy catheters (Level 2). If any evidence of pupillary dilation should occur, the lumbar drain should be closed (leaving the ventriculostomy drain open) and the neurosurgery service called immediately.

Jugular Venous Saturation Monitor

A jugular venous saturation monitor is placed in order to establish the effects of therapy for ICP control (particularly hyperventilation) on global cerebral blood flow. The jugular venous saturation monitor allows for assessment of the venous extraction of oxygen by the brain and therefore is an indirect measure of the adequacy of cerebral blood flow with respect to cerebral metabolic demands. If placed, the following apply:

- A. If no improvement and S_{ijv}O₂ is not < 50%, proceed with hyperventilation to a PCO₂ of 26-30 mm Hg. This applies only to patients with intact autoregulation and no ischemia by CT. If S_{ijv}O₂ falls by 10% or if absolute level is < 50%, measure arterio-jugular lactate difference (AVDL). If AVDL > 0.5 proceed to level 6.
- B. If ICP exceeds 25 mm Hg for five minutes and cannot be managed with PCO₂ of 26-30 mm Hg and S_{ijv}O₂ is not < 50%, proceed with aggressive hyperventilation to lower the PCO₂ as required to reduce the ICP. If S_{ijv}O₂ falls by 10% or if absolute level is < 50%, measure arterio-jugular lactate difference (AVDL). If AVDL > 0.5 proceed to level 6

Hypothermia

Begin controlled hypothermia to maintain a mean core temperature at 34-36° C. With resistant intracranial hypertension, the goal temperature may be down to 32° C if clinically tolerated. This will be utilized for up to 48 hours, if necessary, at which point passive rewarming will be undertaken, with a goal of normothermia, as long as the ICP goals are achieved with rewarming.

Pentobarbital Coma

Begin pentobarbital (or substituted barbiturate) boluses to effect or begin pentobarbital infusion titrated to burst-suppression demonstrated on hourly monitored EEG. Continuous EEG monitoring may be required for patients at this level. Particular attention should be directed toward ensuring adequate intravascular volume and cardiac output before, and monitoring same during treatment with pentobarbital.

Decompressive Craniectomy

Under certain circumstances it may be desirable to remove a large portion of the calvarium (unilaterally or bilaterally) in an attempt to reduce ICP. This may be useful particularly in unilateral cerebral injury.

- 2.2 Prophylactic Anticonvulsant Therapy – Prophylactic anticonvulsants may be administered to the child with severe closed at injury at the discretion of the attending neurosurgeon. Anticonvulsant therapy to prevent the occurrence of early post-traumatic seizures in high-risk children during the first week following severe traumatic brain injury (or during the period of intracranial pressure monitoring, whichever is greater) is recommended as a treatment option. Long-term use of prophylactic anticonvulsants (for more than seven days post-injury) is not recommended.
- 2.3 Repeat CT scan - A CT scan may be repeated within 24 hours of admission and at three days post-injury. A CT may also be repeated in the event of any neurological deterioration and for a new sustained elevation of ICP or in the event of a loss of responsiveness to therapy. As a general rule, no contrast is given.
- 2.4 Nutrition - Objective: To establish adequate nutrition within 48-72 hours of injury. Enteral feeding takes preference over parenteral nutrition.
- 3.0 Physical Therapy/Occupational Therapy consultation is initiated on the first regular business day following admission. During the first week, rehabilitation medicine will be consulted for rehab planning. Early consultation allows maximal input and accelerates the rehabilitation process.

GUIDELINE J

Nonoperative Care of the Child with Splenic and/or Hepatic Injuries

A. Overview

Management of hepatic and splenic injuries has evolved over the past two and a half decades. Prior to that time a diagnostic peritoneal lavage positive for blood was an indication for exploratory celiotomy because of concern about ongoing hemorrhage and/or missed intra-abdominal injuries needing repair. Stimulated by the success of nonoperative management of splenic and hepatic injuries in children who are hemodynamically stable, there has been a trend towards nonoperative management in hemodynamically stable adults with similar injuries.

Nonoperative management in children with splenic injuries rapidly gained currency because of the significant incidence and seriousness of post-splenectomy sepsis as well as the frequency of and complications associated with non-therapeutic laparotomies. More recently, nonoperative management has been extended to blunt hepatic injuries in children with similar success. Advantages of nonoperative management include avoidance of non-therapeutic celiotomies and the associated cost and morbidity; fewer intra-abdominal complications compared to operative repair; and reduced transfusion risks. Currently, nonoperative management of isolated blunt hepatic and splenic injuries is considered the standard of care for hemodynamically stable children.

The past five years have witnessed a proliferation of reports of nonoperative management in adults with injuries to the liver and spleen. However, it is unclear whether the pediatric experience is generalizable to adults. The proposed protocols for nonoperative management of abdominal solid organ injuries are based on published data, surgical texts, available institutional protocols, as well as our current practices at The Milton S. Hershey Medical Center.

Adapted from Practice Management Guidelines for the Nonoperative Management of Blunt Injury to the Liver and Spleen, 2000, Eastern Association for the Surgery of Trauma

B. Admission

1. Admit to PICU, consider IMC or medical- surgical unit for lower grade injuries
2. Remains in PICU or PIMC until hemodynamically normal and Hct stable; for 2 shifts
3. Large bore IV's
4. Gastric decompression and NPO (may not be needed for lower grade injuries)
5. Type and screen 1-2 units
6. Serial Hcts every 6 hours for 24 hr (fewer needed for lower grade injuries without bleeding)
7. Arterial line or central venous catheter as indicated
8. Follow amylase, ALT's daily until improving (no need to repeat if initially normal)

Operation indicated for: Persistent hemodynamic instability despite aggressive resuscitation, falling Hct, unresponsive to transfusion therapy and total blood transfusion requirement greater than 50% of estimated patient's blood volume at the discretion of the attending pediatric surgeon. Multiple system injuries and if the patient is comatose will lower the threshold for an operation.

C. Ongoing Acute Care

1. Transfer to PIMC or Floor. May be discharged when hemodynamically stable for 24 hours, pain is controlled and any ileus has resolved. Total hospitalization should be 2-5 days unless the injury is very severe.
2. Bedrest with bathroom privileges only while hospitalized. Total bedrest time in acute care and home is 2 weeks depending on the severity of injury.
3. At times, a repeat CT scan within the first week of the injury may be obtained for the evaluation of any evolving injuries (pancreas, cyst, persistent fevers, abdominal distention, etc.)

D. Discharge and Follow up Care

1. Discharge to home on bedrest with bathroom privileges for a total of 2 weeks, then limited activities - i.e., no running, bike riding, trampoline, contact sports.
2. The “2 weeks/2 months” rule: 2 weeks of bedrest with bathroom privilege only. Two months of restriction to walking only for Grade 3 to 5 injuries and one month for Grade 1 to 3 injuries. No contact sports, physical education classes or recess until cleared on trauma team followup visit.
3. CT scan evaluated after discharge will be at the discretion of the attending trauma surgeon.

Start November 2001, implemented March 2002, revisions April 2004, reviewed November 2004.

SPLEEN INJURY SCALE (1994 revision)

Grade	Injury Description
I Hematoma	Subcapsular, <10% surface area
Laceration	Capsular tear, <1cm parenchymal depth
II Hematoma	Subcapsular, 10-15% surface area; intraparenchymal, <5cm in diameter
Laceration	1-3cm parenchymal depth which does not involve a trabecular vessel
III Hematoma	Subcapsular, >50% surface area or expanding; ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma >5cm or expanding
Laceration	>3cm parenchymal depth or involving trabecular vessels
IV Laceration	Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)
V Laceration	Completely shattered spleen
Vascular	Hilar vascular injury that devascularizes spleen

LIVER INJURY SCALE (1994 revision)

Grade	Injury Description
I Hematoma	Subcapsular, <10% surface area
Laceration	Capsular tear, <1cm parenchymal depth
II Hematoma	Subcapsular, 10-50% surface area; intraparenchymal, <10cm in diameter
Laceration	1-3cm parenchymal depth, <10cm in length
III Hematoma	Subcapsular, >50% surface area or expanding; ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma >10cm or expanding
Laceration	>3cm parenchymal depth
IV Laceration	Parenchymal disruption involving 25-75% of hepatic lobe or 1-3 Couinaud's segments within a single lobe
V Laceration	Parenchymal disruption involving >75% of hepatic lobe or >3 Couinaud's segments within a single lobe
Vascular major	Juxtahepatic venous injuries; i.e., retrohepatic vena cava/central hepatic veins
VI Vascular	Hepatic avulsion

RENAL INJURY SCALE

Grade	Injury Description
I Contusion	Microscopic or gross hematuria; urologic studies normal
Hematoma	Subcapsular, nonexpanding without parenchymal laceration
II Hematoma retroperitoneum	Non expanding pari renal hematoma confined to renal
Laceration	<1.0cm parenchymal depth of renal cortex without urinary extravasation
III Laceration	>1,0cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation
IV Laceration and	Parenchymal laceration extending through the renal cortex, medulla and collecting system
Vascular	Main renal artery or vein injury with contained hemorrhage
V Laceration	Completely shattered kidney
Vascular	Avulsion of renal hilum that devascularizes kidney

(1) Moore EE, Cogbill, TH, et al, Organ injury scaling: spleen and liver (1994 revision). J Trauma 38:323, 1995.

- (2) Moore EE, Schackford SP, et al, Organ injury scaling: Spleen, liver and kidney. J Trauma 29:1664, 1989.

GUIDELINE K

PRACTICE GUIDELINES FOR ORTHOPEDIC SURGERY CARE OF THE PEDIATRIC TRAUMA PATIENT

Background:

The clinical care of the pediatric trauma patient by the pediatric orthopedic surgery team is characterized by prompt resident surgeon response to injured children, attending oversight, and excellent operative care directed by the attending staff. The performance of the pediatric orthopedic surgery service continues to be tracked through the Pediatric Trauma Performance Improvement mechanism.

1. Pediatric orthopedic consultation by the pediatric trauma team in the emergency department for the following:
 - Fractures of the appendicular or axial skeleton identified on the trauma survey
 - Any possible fractures or musculoskeletal injury identified on the primary or secondary survey
 - Open wounds that **may** have an intra-articular extension (involve the joint)
 - Potential compartment syndromes of the upper or lower extremities
 - Structural abnormality of the cervical, thoracic, or lumbar spine on radiographs or CT scan, focal spine tenderness and/or neurologic deficit when pediatric orthopaedic surgery is on spine coverage for acute spine injuries
 - Neurovascular deficits of upper or lower extremities
 - Request for evaluation by the Pediatric Trauma service attending
2. The pediatric orthopaedic resident on call will respond to pediatric trauma within thirty (30) minutes of the request according to the guidelines set forth for pediatric orthopedic consultation.
3. After evaluation of the pediatric trauma patient, the pediatric orthopaedic resident will contact the pediatric orthopaedic attending on call to discuss his/her findings and determine a plan of care **from** the emergency department.
4. The pediatric orthopedic resident will document time, date, findings and plan of care in the appropriate section of the medical record (the orthopaedic trauma assessment sheet in the emergency department).
5. The pediatric orthopaedic attending on call will evaluate pediatric trauma patients in the emergency department under the following conditions:
 - Hemodynamically unstable patients with life-threatening hemorrhage from pelvic fractures
 - Spine fractures/spinal cord injuries with progressive neurologic loss and document time, date, findings, and plan of care in the appropriate section of the medical record
 - At the request of the Pediatric Trauma service attending

6. The pediatric orthopaedic attending on call will see and evaluate all pediatric trauma patients consulted by the pediatric trauma service within 24 hours for non-critical/stable musculoskeletal injuries, and document time, date, findings, and plan of care in the appropriate section of the medical record.
7. The pediatric orthopaedic attending on call will see all pediatric trauma patients who require operative intervention within 6 hours of consultation **(or when an operating room becomes available)** for the following conditions:
 - Open fractures
 - Open wounds with intra-articular extension
 - Compartment syndrome of the upper and lower extremities
8. Appropriate documentation of resident supervision on non-operative and operative care of pediatric trauma patients will be recorded in the medical record by the pediatric orthopedic attending
9. All pediatric trauma patients in the Pediatric ICU (PICU) will be under the primary care and supervision of the Pediatric Trauma attending with concurrent care by the Pediatric Critical Care Medicine attending. The pediatric orthopaedic attending/resident will function as a consulting service while the patient is in the PICU. Upon transfer to the Pediatric IMC or the pediatric floor, either the pediatric trauma service or the pediatric orthopaedic service will have primary responsibility of that particular patient, depending on the nature and complexity of traumatic injuries and upon approval of transfer from the pediatric trauma service to the orthopaedic service.
10. The pediatric orthopaedic attending will document supervision and care of the pediatric orthopaedic trauma patient on a daily basis throughout the patient's length of hospital stay reflecting the time, date, and plan of care in the appropriate section of the medical record.
11. When a pediatric orthopaedic patient is transferred for subspecialty care, it will be the responsibility of the pediatric orthopaedic attending to determine whether the patient will be an emergency department trauma activation (in consultation with the pediatric trauma attending), or a direct admit, depending on the nature and complexity of the injuries and established guidelines for the transfer of trauma patients.
12. Spine fractures and spinal cord injuries will initiate routine consultation with the pediatric neurosurgery service (or pediatric orthopaedic service) if not on call for spine injuries to coordinate and optimize care of the pediatric trauma patient with a spine fracture/SCI as well as enhance resident exposure/experience for both services.

July 2001, implemented January 2002, reviewed November 2004.

PROTOCOL L PRACTICE GUIDELINES FOR NEUROSURGERY CARE FOR INJURED CHILDREN

1. The pediatric trauma patient will be evaluated by the pediatric surgery attending and/or team leader using ATLS protocols.
2. The following criteria will be utilized for neurosurgical consultation by the Trauma Team Leader:
 - a. All patients with GCS= \leq 14 (altered level of consciousness).
 - b. GCS = 15 with evidence of head injury and/or post-traumatic seizure including linear and basal skull fracture eq. Battle's sign, hemotympanum, raccoon eyes and/or CSF leakage.
 - c. Focal neurological deficit.
 - d. Findings on CT scan or plain x-rays consistent with acute injury.
 - e. Structural abnormality on spine x-rays or CT, focal spine tenderness and/or neurological deficit when neurosurgery covers spine consistent with acute injury.
 - f. Patient who will need neurosurgical care immediately upon arrival.
3. **The trauma team leader/attending should provide the following information when consulting:**
 - Patient age and sex
 - Mechanism of injury
 - Respiratory and cardiovascular status
 - Neurological status (GCS by segments, pupillary exam, and localizing signs such as weakness)
 - Other injuries
 - Results of diagnostic studies at time of consultation request
4. The neurosurgical service provides 24-hour coverage of trauma through pager number 1001. There is an on-call attending neurosurgeon 365 days a year.
5. The neurosurgical consultant is expected to sign the sign in sheet immediately upon entering the trauma bay and generate a timed documentation of his findings in the chart during that interaction.
6. The neurosurgery resident on call will respond to traumas within thirty (30) minutes according to the guidelines for neurosurgical consultation. The neurosurgical resident will be present in the ED at the time of patient arrival in those circumstances when such immediate consultation is required
7. **The neurosurgery resident will evaluate the neurological condition of the patient according to the ATLS and Neurosurgery's Head Trauma Foundation Management Guidelines.**
8. The attending neurosurgeon will see all trauma patients with a documented head injury that have a GCS $<$ or $=$ 14 within 24 hours of arrival in the ED. All non-

operative cases will **be discussed with the attending neurosurgeon by phone, and if there is no intracranial mass**, lesion or abnormality that would require surgery other than intracranial pressure monitor. Neurosurgery residents are credentialed to perform intracranial pressure monitor insertion without supervision after their third month as PGY2. The neurosurgery attendings presence is not required until the next day.

9. The attending neurosurgeon will see all trauma patients who require operative intervention (eq. Intracranial mass lesion requiring evacuation or surgical repair, depressed skull fracture, open skull fracture or penetrating wounds requiring operative repair) within 1 hour of the time of consultation.
10. All neurosurgery residents and attendings will document time, date, findings and plan of care in the medical record.
11. If there is a delayed response to the page, the trauma service is to call the neurosurgical chief resident or his assigned covered back up, **immediately**. The trauma team leader/attending should document the time and content of discussion as well as to whom he spoke. Problems with resident response or timing of consultation should be addressed between the pediatric surgery and neurosurgery attending for prompt feedback and resolution.

July 2001, implemented January 2002, reviewed November 2004.

GUIDELINE M

Practice Guideline for Fever Management in Pediatric Trauma Patients

Introduction:

Infection following trauma contributes to morbidity and mortality in injured children. Fever frequently occurs after trauma in children. Fever has been associated with both infectious and non-infectious etiologies including spinal cord injury, traumatic brain injury, burns, thromboembolic disease and the systemic inflammatory response syndrome.

Fever within 48 hours of hospitalization is an unreliable predictor of bacterial infection in children after trauma.

A retrospective chart review of children admitted to the PICU at a pediatric trauma center over 3 years was performed to determine if fever (core temperature $\geq 38.5^{\circ}\text{C}$), within 5 days of admission, was a reliable indicator of infection. Bloodstream infections, lower respiratory tract infections (LRTIs) including pneumonias, and urinary tract infections (UTIs) were defined by the CDC definitions for nosocomial infections. It was found that a high incidence of fever occurs within 48h of traumatic injury in children. Fever alone is a poor indicator of bloodstream or UTIs. Fever in the presence of other clinical, radiographic, or laboratory evidence may indicate a LRTI. In the absence of a LRTI, the etiology of fever within 48h is most likely non-infectious.

Reference: Research study - Ceneviva, G.D., et al. Fever as a predictor of infection in childhood trauma, 2001

Guidelines for Care

1. Unless specifically indicated by clinical parameters OTHER than fever, routine “fever” workups (Chest X-ray, blood, sputum, urine and other fluid cultures) will NOT be performed within the first 48 hours of hospitalization.
2. In febrile patients at risk for lower respiratory tract infections (possible aspiration or intubated) antibiotics will be initiated if there are additional signs such as changes in sputum characteristics, radiographic findings of pneumonia or worsening respiratory failure. However, antibiotics should not be initiated solely on the basis of fever. Respiratory cultures are indicated in this group of patients.
3. The plan for the management of “fever” will be discussed by the pediatric trauma team, subspecialists and Pediatric Critical Care Medicine team.

Start November 2000, implemented December 2000, reviewed November 2004.

GUIDELINE N

A Clinical Practice Guideline for the transfer of care from anesthesia to the surgical team in Pediatric Trauma Resuscitations.

Background: Currently we enjoy the tremendous benefits of anesthesia management of the airway during the initial assessment of the pediatric trauma patient. It is customary and appropriate that when there are no longer any airway issues and the patient has been stabilized that the anesthesia service leaves after discussion with the trauma team leader or surgical attending. When patients arrive intubated or are subsequently intubated in the trauma room, the management of their airway continues to be overseen by anesthesia. Often, someone from anesthesia at the attending, resident or CRNA level will stay with the patient during their time in the trauma room, when being transported to and from diagnostic tests, during times that the diagnostic tests occur (particularly CT scans), and subsequently until the patient is transported to either the operating room or the Pediatric Intensive Care Unit. There are times, however, due to constraints related to personnel in anesthesia when the care of the intubated patient will be turned over to the pediatric trauma team.

Purpose: This clinical practice guideline defines the responsibilities for the transfer of care from the anesthesia service to the pediatric trauma team prior to the delivery of the patient to the ICU or operating room. Three issues are addressed at the time of the transfer of care: 1) The personnel involved in the sign out; 2) the use of pharmacological agents; 3) equipment.

Clinical Practice Guidelines:

- 1) *Personnel: The sign out from anesthesia should be made directly to the trauma team leader (senior surgical resident) or trauma attending. The pager number of the anesthesia attending should be left with the senior surgical personnel so that if problems arise they may address them immediately at the highest level.*
- 2) *Pharmacological agents: The sign out should include the doses and availability of medication for sedation, paralysis and potential resuscitation including Epinephrine and Atropine. Information regarding when medications were last administered, appropriate doses and the labeling of any syringes currently being used should be reviewed directly between anesthesia and surgery.*
- 3) *Equipment: The availability of a laryngoscope, ETT, stilette, bag mask device, oxygen, monitoring and portable suction for transport should be reviewed and confirmed.*

Future development: These clinical practice guidelines were developed cooperatively by the Division of Pediatric Surgery/Pediatric Trauma Program and the Department of Anesthesia. Adherence to these guidelines will be monitored as part of Pediatric Trauma Program Performance Improvement. Suggestions for revision and improvement are welcome and should be directed to the Pediatric Trauma Program Director.

Start November 1999, implemented April 27, 2000, reviewed November 2004.

Robert E. Cilley, MD Pediatric Trauma Program Medical Director

Thomas Long, MD, Chief, Pediatric Anesthesia

Pediatric Trauma Administrative Resource Manual

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On the Infonet: Workplace Tools/Resources/Policies/On-line Policies/
then choose individual category, as below

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ED	Emergency Department
HAM	Hospital Administrative
WH	Women's Health
MS	Medical Staff Office
NAM	Nursing Administrative
PSCH	Penn State Children's Hospital
TPM	Trauma Program Manual
CPM	Clinical Practice Manual