



Pediatric Advanced Life Support (PALS) Study Assistance

A guide for employees of
Lake EMS



Situation



- Much of the great care we perform relies on our protocols
- Our protocols are primarily based on the guidelines of the American Heart Association:
 - The challenge is that we have learned to apply a higher level of care since the 2010 guideline release



Florida Bureau of EMS



- Lake EMS provides biannual PALS training:
 - Lake EMS holds a Training Center contract with the National office in Dallas to meet this need
 - And we offer it **free** to any EMS provider that lives or works in Lake County
 - And because it is a live class, studies demonstrate that knowledge and skill retention are substantially higher than other forms of training



The issue



- The issue at hand is that we infrequently run pediatric cardiac arrest calls
- That said, this guide is designed to guide you to review salient educational points within the PALS Provider Manual:
 - Prior to class training



To start



- So open up the textbook and follow along with the slides:
 - Of course that is after you remove the plastic from the textbook



Sections of the textbook



- Part 1: Course overview
- Part 2: Systemic Approach to the Seriously Ill or Injured Child
- Part 3: Effective Resuscitation Team Dynamics
- Part 4: Recognition of Respiratory Distress and Failure



Sections of the textbook



- Part 5: Management of Respiratory Distress and Failure
- Part 6: Recognition of Shock
- Part 7: Management of Shock
- Part 8: Recognition and Management of Bradycardia



Sections of the textbook



- Part 9: Recognition and Management of Tachycardia
- Part 10: Recognition and Management of Cardiac Arrest
- Part 11: Postresuscitation Management
- Part 12: Pharmacology



Part 1, pages 1-5

Course overview



Course overview, p.1



- Course objectives:
 - Meaning what you should be able to recognize/demonstrate/perform after successful completion
 - These are based on Bloom's taxonomy:
 - Bloom's taxonomy is a component of training that Jamie Lowery and I present to the FTOs



Course overview, p.1



- Systematic approach to assessment:
 - Is emphasized at numerous aspects throughout the textbook and is a major component of the final test out Megacode



Course overview, p.2



- Lists the required knowledge and skills needed for successful course completion:
 - With an emphasis on good quality CPR
 - The American Heart Association is known for asking sequenced based questions, know the order of treatments/assessments



Course overview, p.3



- Which EKG rhythms we need to be able to identify:
 - It is important to understand that the AHA wants us to understand the rhythms and pharmacology **and** to be able to apply them correctly in a scenario or real life incident



Course overview, p.3



- Precourse self assessment:
 - www.heart.org/eccstudent
 - Access code: palsprovider
- This is a great tool to assess your understanding and progress



Course overview, p.5



- Reminds us of the importance of the **red** Critical Concept boxes:
 - They are good reminders
 - Like they might show up as a test question or two



Course overview, p.5



- The base requirements to successfully complete PALS:
 - This is in addition to being able to demonstrate a clear understanding of:
 1. EKGs
 2. Pharmacology
 3. When to use appropriate therapies and treatments



Part 2, pages 7-29

Systemic Approach to the Seriously Ill or Injured Child



Rapid Intervention to Prevent Cardiac Arrest, p.7



- Most cardiac arrests result from progressive:
 - Respiratory failure
 - Shock
 - Or both
- Out-of-hospital survival to discharge is only 4-13%



PALS Systematic Approach, p.9



- Have a clear understanding of the algorithm when caring for a critically ill or injured child:
 - The core of the algorithm are 4 critical steps:
 1. Initial impression, p.10
 2. Evaluate, p.10-11
 3. Identify, p.11
 4. Intervene, p.11



Do you understand the following (As defined by the AHA)?



1. Tachypnea, p.14
2. Bradypnea, p.14
3. Apnea, p.14
4. Nasal flaring/retractions, p.15
5. Head bobbing and it's significance, p.15
6. Lung and airway sounds, p.16-17
7. Hypotension, p.22



Part 3, pages 31-35

Effective Resuscitation Team Dynamics



Roles of resuscitation members



- Leader, p.31-32
- Team member, p.32



Elements of effective resuscitation team dynamics



- Closed loop communication, p.32
- Clear messages, p.32
- Clear roles and responsibilities, p.33
- Knowing limitations, p.34
- Knowledge sharing, p.34
- Constructive intervention, p.34
- Reevaluating and summarizing, p.35
- Mutual respect, p.35



Part 4, pages 37-47

Recognition of Respiratory Distress and Failure



Impairment of oxygenation and ventilation



- Physiology of respiratory system, p.37-38
- Hypoxemia, p.38:
 - Emphasis on 9 signs of tissue hypoxia
- Hypercarbia, 40



Identification of respiratory problems (*excellent chart on p.46*)



By severity, p.43:

1. Respiratory distress:
 - 7 signs
2. Respiratory failure:
 - 8 signs

By type, p.43-45:

1. Upper airway obstruction
2. Lower airway obstruction
3. Lung tissue disease
4. Disordered control of breathing



Part 5, pages 49-67

Management of Respiratory Distress and Failure



Principles of targeted management



- 1. Oxygenation/ventilation stabilized**
2. Upper airway obstruction
3. Lower airway obstruction
4. Lung tissue disease
5. Disordered control of breathing:
 - p.50



Upper airway obstruction



- Understand management of:
 - Management of croup, p.51
 - Management of anaphylaxis, p.52



Lower airway obstruction



- Understand management of:
 - Bronchiolitis, p.53
 - Acute asthma, p.53
 - Excellent chart on p.54



Lung tissue disease



- Understand management of:
 - Infectious pneumonia, p.55
 - Chemical pneumonitis, p.55
 - Aspiration pneumonitis, p.55
 - Cardiogenic pulmonary edema, p.56
 - Non-cardiogenic pulmonary edema (ARDS [p.56])



Disordered control of breathing



- Understand management of:
 - Increased ICP, p.57
 - Poisoning/drug overdose, p.57
 - Neuromuscular disease, p.57
- **Page 58 has great chart on respiratory distress and failure management:**
 - Well worth the review



Part 6, pages 69-83

Recognition of Shock



Definition of shock, p.69



- Shock is a critical condition that results from inadequate tissue delivery of O₂ and nutrients to meet tissue metabolic demand:
 - It is often, but not always, characterized by inadequate peripheral and end-organ perfusion
 - Shock does not depend on BP measurement



Understand the unique nature of children in regards to shock



- Compensatory mechanisms, p.72
- Effect on blood pressure, p.72



Identification of shock and recognition flowchart, p.83



Severity, p.72

- Compensated shock, p.73
- Hypotensive shock, p.73:
 - **Hypotension formula, p.73**

Type, p.74-

- Hypovolemic, p.74
- Distributive, p.75-78
- Cardiogenic, p.78-79
- Obstructive, p.79-82



Part 7, pages 85-111

Management of Shock



Fundamentals of shock management, p.85-86



1. Optimizing O_2 content of the blood
2. Improving volume and distribution of cardiac output
3. Reducing O_2 demand
4. Correcting metabolic derangements



Correcting metabolic derangements, p.87



- Many conditions that lead to shock may result in or be complicated by metabolic derangements, including:
 1. Hypoglycemia
 - Understand the dosages and administration concentrations, p.94-95
 2. Hypocalcemia
 3. Hyperkalemia
 4. Metabolic acidosis



Therapeutic end points, p.87



- Heart rate/blood pressure WNL for age
- Normal pulses
- Capillary refill <2 seconds
- Warm extremities
- Normal mental status
- Urine output >1 mL/Kg/hour
- Decreased serum lactate
- Reduced base deficit
- Scvo₂ >70%



Fluid volume and rate of delivery chart, p.93



- Hypovolemic, p.74
- Distributive, p.75-78
- Cardiogenic, p.78-79
- Obstructive, p.79-82:
 - See also specific managements for Obstructive shock, p.105-106
- **Fantastic review chart, p.107**



Part 8, pages 113-120

Recognition and Management of Bradycardia



Bradycardia



- Is an ominous sign of impending cardiac arrest in infants and children, especially if it is associated with hypotension or evidence of poor tissue perfusion:
 - If despite adequate oxygenation and ventilation, the heart rate is <60 bpm
- **Begin CPR**



Pediatric Bradycardia with a Pulse and poor Perfusion Algorithm



- Understand the order, it is different than ACLS and our protocols:
 - Pay close attention to dosages
 - Page 117



Treat underlying causes, p.120



- Hypoxia
- Hydrogen ion (acidosis)
- Hypothermia:
 - Common in all poor perfusion ill/injured children; even in Florida
- Hyperkalemia
- Heart block
- Toxins/poisons/drugs
- Trauma



Part 9, pages 121-139

Recognition and Management of Tachycardia



Tachycardia defined, p.121



- Heart rate that is fast compared with the normal heart rate for child's age:
 - Sinus tachycardia is a normal response to stress or fever



Tachycardia defined, p.121



- Tachyarrhythmias can be tolerated without symptoms for a variable amount of time:
 - They can also cause acute hemodynamic compromise:
 - Shock and cardiac arrest



Signs of hemodynamic instability, p.121



- Respiratory distress/failure
- Signs of shock, with or without hypotension
- Altered mental status
- Sudden collapse with rapid, weak pulses



Classifications of tachyarrhythmias, p.122



- Narrow QRS Complex: ≤ 0.09 seconds:
 1. Sinus Tachycardia (ST)
 2. SVT
 - PSVT is an inaccurate and outdated term for children
 3. Atrial Flutter
- Wide QRS Complex: > 0.09 seconds:
 1. VT
 2. SVT with aberrant conduction



EKG Characteristics, p.122-125



- ST:
 - HR usually <220 bpm in infants
 - HR usually <180 bpm in children
 - QRS ≤ 0.09 seconds



EKG Characteristics, p.122-125



- ST:
 - HR usually <220 bpm in infants
 - HR usually <180 bpm in children
 - QRS ≤ 0.09 seconds
- SVT:
 - HR usually ≥ 220 bpm in infants
 - HR usually ≥ 180 bpm in children
 - QRS usually narrow



EKG Characteristics, p.122-125



- ST:
 - HR usually <220 bpm in infants
 - HR usually <180 bpm in children
 - QRS ≤ 0.09 seconds
- SVT:
 - HR usually ≥ 220 bpm in infants
 - HR usually ≥ 180 bpm in children
 - QRS usually narrow
- VT:
 - HR ≥ 120 and regular
 - QRS usually > 0.09 seconds



Therapies



- Vagal maneuvers:
 - Ice to the face for all ages
 - Blowing through a straw if old enough
 - Sinus massage for only older children
 - Never ocular pressure
 - p.127
- Synchronized cardioversion:
 - 0.5-1 J/Kg initial
 - 2 J/Kg subsequent dosages
 - p.128



Understand the algorithm, p.134 & 137



- Understand vagal maneuvers when to employ/not employ
- Understand medication therapies and when to employ/not employ
- Understand the nuances of cardioversion and when to employ/not employ



Part 10, pages 141-167

Recognition and Management of Cardiac Arrest



Overview, p.141



- In contrast to adults, cardiac arrest in infants and children does not usually result from a primary cardiac cause (sudden cardiac arrest):
 - It is typically the end result of progressive respiratory failure and shock
 - Hence referred to as hypoxic/asphyxial arrest



Outcomes, p.141



Good news:

- Respiratory failure and shock can generally be reversed if:
 - **Identified and treated early**

Bad news:

- If the infant or child's situation progresses to cardiac arrest:
 - **The outcome is generally poor**



Pathways to Cardiac Arrest, p.142



Hypoxic/Asphyxial Arrest:

- It is the end result of progressive respiratory failure and shock

Sudden Cardiac Arrest:

- Most often caused by the sudden development of VF/Pulseless VT



Recognition of Cardiopulmonary Failure, p.144



- Defined as a combination of respiratory failure and shock
- Characterized by inadequate:
 - Oxygenation
 - Ventilation
 - Tissue perfusion
- Once developed, cardiopulmonary failure may be minutes away and the process may be difficult to reverse



Basic Cardiopulmonary Resuscitation (CPR), p.149



- Understand the steps for proper child assessment in cardiopulmonary arrest
- Understand pulse locations
- Understand proper compression rates, depth, hand(s) locations
- Understand time limits for assessments:
 - And for maximum time for interrupted chest compressions



Understand the nuances of PALS in Cardiac Arrest



- Vascular access (IV/IO), p.150-151
- Endotracheal medication administration, p.151
- Defibrillation, p.152
- Pediatric Cardiac Arrest algorithm, p.155:
 - **NB: Medication administration in VF is not administered until *after 2-minutes of CPR and a second defibrillation***



AEDs and manual defibrillators, p.156-7



- Be proficient in use of an AED
- Be proficient in dosaging for defibrillation:
 - And paddle vs. pad usage



Extracorporeal Life Support (ECLS), p.165



- ECLS is a tool used to benefit infants and children with acute reversible conditions:
 - A special heart-lung machine configuration similar to heart-lung bypass used in the operating room
 - Currently in use in advanced pediatric centers
- This is supplemental information only



Family presence during resuscitation, p.166



- In our EMS settings the AHA recognizes that we are focused on the resuscitation efforts:
 - That said, the AHA tells that if we offer brief explanations and the opportunity for family members to remain with the loved one, that it may comfort them
 - Especially when they witness the dedication and care that we provide



Part 11, pages 171-196

Postresuscitation Management



Overview, p.171



- Although effective resuscitation is a major focus of the PALS Provider Course:
 - Ultimate outcome is often determined by the subsequent care the child receives
- This includes safe ambulance transport to a center with expertise in caring for seriously ill or injured children



Postresuscitation Management, p.171-172



First phase:

- Immediate management:
 - ALS for immediate life threatening conditions
 - Focus on ABCs

Second phase:

- Secondary management:
 - Multiorgan supportive care
 - Transfer/transport by ambulance to appropriate tertiary care facility



Respiratory Management, p.173-177



- For postresuscitation care:
 - Memorize the oxygen saturation requirement
 - Memorize the acceptable CO₂ levels
 - Memorize the appropriate ventilation rates
 - Understand the DOPE mnemonic used in sudden deterioration of an intubated patient
- Be able to apply the algorithm, p.181



Part 12, pages 199-232

Pharmacology



Medications



- This chapter goes to great and simple lengths to review the following of key PALS medications:
 1. Classification
 2. Indications
 3. Dose and administration
 4. Actions
 5. Pharmacokinetics
 6. Monitoring
 7. Adverse effects:
 - By systems
 8. Precautions
 9. Special considerations



Apparent Life-Threatening Event (ALTE)



- 1986 National Institutes of Health and Consensus Development Conference on Infantile Apnea and Home Monitoring defined an Apparent Life-Threatening Event (ALTE) as:
 - “An episode that is frightening to the observer and that is characterized by some combination of apnea (central or occasionally obstructive), color change (usually cyanotic or pallid but occasionally erythematous or plethoric), marked change in muscle tone (usually marked limpness), choking, or gagging. In some cases, the observer fears that the infant has died.”



Apparent Life-Threatening Event (ALTE)



- ALTE is becoming more mainstream as can be researched here:
 - <http://pediatrics.uchicago.edu/chiefs/inpatient/ALTE.htm>
- The information is currently not within PALS but is anticipated in the near future.



In conclusion



- The largest pool of PALS questions surround cardiac arrest and its management:
 - The test is comprised of 33-questions
- Every question can be traced back to the information in the textbook that we have highlighted here



In conclusion



- We hope this study assistance is a benefit for you:
 - Take the time to review before class, this is intended to be a benefit for you
- We wish you all the best



Pediatric Advanced Life Support (PALS) Study Assistance

Provided by the Quality
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