2016 LLSA Articles Review

Payal Shah, M.D.
11/13/17
Beaumont Health System

Bacterial Meningitis Post-PCV7: Declining Incidence and Treatment

Kowalsky RH, Jaffe DM. Pediatric Emergency Care. 2013; 29(6):758-766

Learning Objectives

- Identify current epidemiology of bacterial meningitis in various age groups
- Implement an evidence based approach to empiric therapy in suspected bacterial meningitis

Bacterial Meningitis Overview

- Definition: Infection-mediated inflammation of the pia, arachnoid, and subarachnoid space
- Aseptic versus bacterial
- 4% mortality in children
- Neurologic sequelae in survivors

Historical Background

- Epidemiology has changed in the last 20 years
- Before 1988 Hib accounted for 70% of bacterial meningitis in children younger than 5
- Now most common, Streptococcus pneumoniae
  - PCV7 developed
    - Routinely administered to children younger than 23 months, and children 24-59 months if high risk

Impact of PCV7 on Pneumococcal Disease

- 97% efficacy in preventing one of 7 serotypes
- 89% efficacy in preventing any of the remaining 90 serotypes
- Prevention of other pneumococcal disease
- Most positively impacted group was children less than 2 years old

Emerging Serotypes

- Nonvaccine serotypes 19A and 22F have been on the increase
- PCV13 was licensed in 2010

Epidemiology of Bacterial Meningitis

- Streptococcus pneumoniae is the most common cause of bacterial meningitis in children
  - 1-3 months: Strep agalactiae, gram neg rods, strep pneumoniae
  - 3m-3years: S. pneumoniae, N. Meningitidis, S. agalactiae
  - 3-10 yo: S. pneumoniae, N. Meningitidis
  - 10-19 yo: N. Meningitidis, S. pneumoniae

History and Physical Examination

- Findings in older versus younger children
- Physical examination for shock, neurologic deficits, cutaneous findings, bulging fontanelle
  - 73% had been febrile within 72 hours of presentation

Laboratory Evaluation

- Obtain CSF and blood cultures early
- White blood cell count
- CSF glucose, protein, cell count and differential, gram stain, viral testing
- BMP, glucose, coagulation factors

Effect of Pre-treatment on CSF Findings

- Sterilization of CSF was most rapid in children with meningococcal meningitis
- WBC count and neutrophil count are the least likely to normalize

Lumbar Puncture

- Herniation
  - unlikely
- CT scan before LP
  - indications

Bacterial versus Aseptic Meningitis

- BMS
  - Positive CSF Gram stain
  - CSF Protein 80mg/dL or greater
  - CSF neutrophils 1000cells/uL or greater
  - Peripheral ANC 10,000 cells/uL or greater
  - Seizure before or at time of presentation
- Rapid detection of enterovirus by PCR
- Procalcitonin

Empiric Therapy

- Monitoring and stabilization
- Obtain CSF culture but do not wait to treat in shock state
- IV antibiotics

Empiric Therapy

- Younger than 1 month:
  - Coverage for S. agalactiae, E. Coli, Listeria
    - Ampicillin plus cefotaxime or aminoglycoside
    - Empiric Acyclovir
- Older than 1 month:
  - Coverage for S. pneumoniae and N. meningitidis
  - Vancomycin plus ceftriaxone or cefotaxime

Empiric Therapy

- A word on steroids...

Summary

- S. pneumoniae is still the most common agent of bacterial meningitis in children outside of the neonatal period
- PCV7 vaccine has caused a decline in pneumococcal meningitis, but there is an increase in non-PCV7-serotype meningitis
- No single test is diagnostic
- BMS can be used to identify patients at low risk for bacterial meningitis
- The role of corticosteroids in unclear

Hyperglycemic Crisis

Van Ness-Otunnu R, Hack JB. Hyperglycemic crisis. J Emerg Med. 2013; 45(5):797-805

Introduction

- Hyperglycemic crisis:
  - Includes DKA and HHS
  - Extreme metabolic derrangements
- Diabetes since 2010 effects 285 million adults worldwide and estimates health expenditures of $376 billion
- Incidence of Type 1 diabetes is increasing globally in children <5 years old
- There is an earlier age of onset of type 2 diabetes

Introduction

- Prevalence of DKA at initial diagnosis was greater than 25%
- Average duration of hospital stay is 3.6 days
  - Involves ICU care, significant morbidity, and mortality
- Mortality in both adults and children
- Improved understanding, prevention, and advances in management has resulted in declining death rates

Diagnostic Criteria for DKA and HHS

- DKA
  - Blood glucose>250mg/dL
  - Moderate ketonuria
  - Arterial pH of <7.3 and bicarbonate<15mEq/L
- HHS
  - Diabetic patient with altered mental status
  - Glucose>600 mg/dL
  - No ketonuria
  - pH typically >7.3 and bicarbonate>15 mEq/L
  - Serum osmolality >320 mOsm/kg

Pathophysiology of DM

- Insufficient endogenous insulin resulting in hyperglycemia
- Type 1 DM=autoimmune destruction of pancreatic beta cells=absolute insulin deficiency
- Type 2 DM=progressive insulin resistance and defects in insulin secretion=relative insulin deficiency=requires exogenous insulin

Risk Factors for Hyperglycemic Crisis

- Young patients without health insurance
- Age<2 years
- Ethnic minority status
- Infection
- Inadequate exogenous insulin
- Low BMI
- Cardiac, psychological, GI, Neurologic, Toxicologic, Pharmacologic, Other

Clinical Presentation

- History
- ROS
- Physical examination

Diagnostic Testing

- First critical step: bedside glucose
- Screening ECG
- Urine ketones, BMP, lactic acid, venous pH, serum osmolality, beta-hydroxybutyrate
- Other tests based on clinical circumstance

Goals of Management of Hyperglycemic Crisis in Adults

- Uncover and manage the underlying cause
- Replace fluids
- Correct acidosis
- Improve mental status
- Optimize renal perfusion
- Replete electrolytes

Fluids and Sodium Management

- Volume resuscitation: focus on hydration status, sodium correction(factor), urine output
- Special considerations for pediatric and elderly populations

Insulin in Treatment

- Bedside glucose checks hourly initially, every 1-2 hours while on insulin drip
- Turn off any subcutaneous insulin pumps
- IV insulin infusion of 0.14 units/kg/h
  - Consider bolus if glucose does not decrease in the first hour by 10%
  - Rate of glucose decrease should be 50-75 mg/dL/hr
  - Switch fluids/insulin overtime

Electrolytes to Consider

- Potassium
  - Dehydration and Insulin therapy can cause a total body depletion of potassium
  - Maintain a serum potassium between 4-5 mEq/L
    - If K<3.3 then add 20mEq K to normal saline bolus
- Bicarbonate
  - No sustained benefit
- Phosphate
  - Not recommended

Resolution of Hyperglycemic Crisis

- For DKA:
  - Blood glucose<200 mg/dL + 2 of the following: serum bicarbonate>15 mEq/L, venous pH>7.3, calculated anion gap <12mEq/L
- For HHS:
  - Normalized serum osmolality, resolution of vital sign abnormalities, restored mentation

Conclusion

- Hyperglycemic crisis demands early recognition
- We in the ED are at the forefront of treatment
- An organized approach to hyperglycemia, fluid balance, electrolyte abnormalities, and normalizing acid-base status favors improved outcomes

Fever in the Postoperative Patient

Narayan M, Medinilla SP. Fever in the postoperative patient. Emerg Med Clin North Am. 2013; 31(4):1045-58

Introduction

- Definition of Fever: Temperature greater than 38 degrees C or 100.4 F
- Early post-operative fever is usually noninfectious
- Classic W's of postoperative fever has fallen out of favor
- Timing of the fever after a procedure is important: immediate, acute, subacute, and delayed
- 90% of fevers occurring by the 5th day post op have an identifiable source
- Most common source at 5 days postop: wound infection>UTI>pneumonia

Inflammation and Healing

- Immediate postoperative fever =during the procedure or up to 1 hour following it
  - Caused by release of inflammatory mediators which increase capillary permeability and are healing responders
  - Severity of the procedure in terms of extent of soft tissue trauma leads to release of IL-6 which results in fever
  - Usually a benign course with resolution of fever

Emergent Causes of Early Postoperative Fever

- Necrotizing Soft-Tissue Infections:
  - Invasive: necrotizing fasciitis, clostridial gas gangrene, fournier gangrene, streptococcal cellulitis
  - Present within hours to days of initial procedure
  - Prior to surgery risk factors
  - Broad spectrum antibiotics and early surgical debridement is the key to lower morbidity and mortality

Emergent Causes of Early Postoperative Fever

- Pulmonary embolism:
  - Associated with a low grade temp<38.3C
  - Short lived fever

Emergent Causes of Early Postoperative Fever

- Anastomotic leak/Intra-Abdominal Abscess
  - Look for in fever and abdominal pain following an intra-abdominal procedure
  - Signs/Symptoms
  - Can present within 1 week up to several months
  - Requires broad spectrum antibiotics and prompt surgical consultation

Emergent Causes of Early Postoperative Fever

- Alcohol withdrawal:
  - Broad spectrum from tremulousness to delirium tremens
  - Up to 1/3rd may have no infectious source
  - Treat with benzodiazepines in accordance with the CIWA scale
  - Challenging

Emergent Causes of Early Postoperative Fever

- Adrenal Insufficiency
  - Primary versus secondary
  - Secondary causes include exogenous steroids or endogenous steroids by tumors
  - Treatment: supportive care, hydrocortisone 100mg IV q6, and treatment of the underlying problem such as sepsis

Emergent Causes of Early Postoperative Fever

- Malignant Hyperthermia
  - Results from inhaled anesthetics, muscle relaxants, other drugs
  - Involves derangement of calcium in skeletal muscle
  - Hypermetabolic state=multiorgan dysfunction and failure
  - Treatment is with supportive care and dantrolene

Emergent Causes of Early Postoperative Fever

- Urinary Tract Infection
  - Most common hospital acquired infection
  - Presents 3-5 days after surgery
  - Risk factors include prostate surgery, spinal anesthesia, anorectal surgery
  - Organisms include E. Coli, Klebsiella, Enterobacter, Pseudomonas, and Serratia

Emergent Causes of Early Postoperative Fever

- Surgical patients are all at increased risk for postoperative pneumonia
  - Risk factors include mechanical ventilation, aspiration

Emergent Causes of Early Postoperative Fever

- Catheter-related bloodstream infections
  - Use of catheters can increase bloodstream infections and insertion site specific infections
  - 4 mechanisms:
    - Migration of organisms from the skin
    - Direct contamination by hands or fluid
    - Hematogenous spread
    - Contamination of infusate
  - Consider appropriate antibiotics to cover Staph

Emergent Causes of Early Postoperative Fever

- Infected Prosthetics
  - Orthopedic hardware, VP shunts, abdominal mesh, vascular grafts
  - Can occur weeks to years after the procedure
  - Direct inoculation of surgical site or hematogenous spread

Emergent Causes of Early Postoperative Fever

- Clostridium difficile Infection
  - Occurs after administration of antibiotic
  - Transmission via fecal oral route
  - 20-50% of hospitalized patients are colonized
  - Toxic megacolon is a surgical emergency
  - Treatment is fluid resuscitation and antibiotics

Summary of Postoperative Fever Management

- Consider degree of fever and timing of onset
- Tailor work up to individual case
- Obtain early consultation with the operative team
- Definitive treatment via source control
- Administer antibiotics promptly

Bleeding and Coagulopathies in Critical Care

Hunt, BJ. N Engl J Med 2014; 370:847-59

Introduction

- Definition of coagulopathy
  - The blood's ability to clot is impaired or thrombotic state is present
  - Peripheral blood smear can be a vital tool
  - If it is not a response to a therapeutic agent then evaluate the pattern of bleeding
  - Avoid correction with blood product unless clinically bleeding or a surgical procedure is needed

Major Bleeding

- In acute traumatic coagulopathies:
  - 1:1 or 1:2 transfusion of FFP and PRBC's
    - Incidence of transfusion related acute lung injury and ARDS is increased
- Studies being conducted on use of factor concentrates
  - Tranexamic acid: acts a an antifibrinolytic agent
    - Administer in patients with major bleeding after trauma, within 3 hours, improves survival

Hemostatic Support for Invasive Procedures

- No supportive evidence for the use of FFP to correct abnormal coagulation screen before a procedure
- If prothrombin ratio is less than 1.5, you may proceed with central/arterial catheter insertion

Disseminated Intravascular Coagulation

- Definition: an acquired syndrome with activation of coagulation with loss of localization
  - Similar to those with end stage liver disease
- Can be thrombotic state or bleeding state
- Sepsis is the most common cause
- Up regulation of tissue factor
- Treatment: manage underlying cause

Thrombocytopenia

- Due to decreased production, increased destruction of platelets, or splenic sequestration
- Platelet threshold of 10,000 in stable condition
  - 50,000 if actively bleeding
  - 100,000 if high risk for CNS bleeding
- Transfuse HLA-matched platelets if available

Post-transfusion Purpura

- Platelet specific alloantibody in the recipient which reacts with donor platelets and destroys them
- Seen in multiparous women sensitized during pregnancy
- Treatment is with IVIG, steroids, and plasmapharesis

Thrombotic Microangiopathies

- Includes TTP, HUS, HELLP syndrome
- TTP is a deficiency in ADAMTS13=persistence of von-Willebrand factor=leads to spontaneous platelet aggregation
  - Treatment is with early plasmapheresis
  - Medical emergency, 90% mortality if untreated

Liver Disease

- Most hemostatic proteins are synthesized in the liver
- Acute alcohol intake inhibits platelet aggregation
- Cholestatic liver disease=reduced absorption of lipid soluble vitamins=reduced amount of factors II, VII, IX, X
- In chronic liver failure coagulation is rebalanced

Renal Disease

- Uremic bleeding presents with ecchymosis, purpura, epistaxis, puncture site bleeding
- Dialysis improves platelet function

Bleeding Associate with Antithrombotic Therapy

- Stop the antithrombotic medication
- Consider recombinant activated factor VII and Prothrombin complex concentrate(PCC)
- May be a role for activated charcoal