Clinical and Coding Conundrums

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Clinical and Coding Conundrums

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At the completion of this educational activity, the documentation specialist will be able to:

- Identify clinical clues and indicators for complex medical conditions
- Discuss the importance of ensuring lesser reported diagnoses are supported in the record
- Describe query opportunities to facilitate accurate code capture for
  - Respiratory failure following surgery
  - Shock
  - Encephalopathy
  - ATN
**Clinical and Coding Conundrums**

68yo male smoker with hypertension presents c/o acute onset RUQ pain associated with intractable nausea and vomiting.

US + for cholecystitis and cholelithiasis.

Pre-op evaluation is notable for mild, stable dyspnea on exertion. 02 Sat, exam, CRI, and EKG are unremarkable.

Patient undergoes laparoscopic cholecystectomy and is slow to awaken from anesthesia. After two hours his o2 sat remain 90% on Vent-mask associated with lethargy. The surgeon admits him to SICU and the intensivist is consulted.

What might the intensivist document?

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**How Physicians Commonly Document This Condition**

- Postop resp failure
- Acute resp failure
- Hypoxemia
- Acute resp insufficiency
- s/p cholecystectomy
- Post-procedural respiratory failure
- Wheezing
- Atelectasis
- Lethargy

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**Clinical and Coding Conundrums**

- Clinical uncertainty especially within first 24h
  - Asymptomatic patient
    - Still under effects of anesthetics, opioids, and benzodiazepines
  - A developing condition may not produce typical symptoms in this context
  - Potential signs of acute resp failure may be related to anesthesia
  - Routine support inherent to procedure
    - ENT and thoracic surgery — expect some ventilator time
Clinical Indicators of Acute Resp Failure

<table>
<thead>
<tr>
<th>Imminent respiratory arrest</th>
<th>Severe respiratory distress</th>
<th>Objective criteria for acute resp failure</th>
<th>Close monitoring and intensives treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Eyeball test&quot;</td>
<td>Agitation</td>
<td>RR &gt; 28</td>
<td>&gt; 40% FIO2</td>
</tr>
<tr>
<td>Depressed mental status</td>
<td>Retractions/use of accessory muscles</td>
<td>pO2 &lt; 60 or &gt; 10 below baseline pO2</td>
<td>Noninvasive ventilation e.g., BiPAP</td>
</tr>
<tr>
<td>Poor respiratory effort, i.e., &quot;he’s getting tired&quot;</td>
<td>Fragmented speech</td>
<td>pCO2 &gt; 50 with pH &lt; 7.35 or 10 mmHg increase in baseline pCO2</td>
<td>Intensive ventilation e.g., intubation</td>
</tr>
<tr>
<td>Cyanosis</td>
<td>Dipsy/sloris</td>
<td>pO2 &lt; 80 or &gt; 10 below baseline pO2</td>
<td>Continuous pulsoximetry</td>
</tr>
<tr>
<td></td>
<td>Dusky skin</td>
<td></td>
<td>Determine most likely cause and initiate management, e.g., steroids, Furosemide, Metropenem</td>
</tr>
</tbody>
</table>

Clinical and Coding Conundrums

Postop resp failure?
- In MICU, the patient develops some mild wheezing which resolved with Albuterol nebs. He is soon extubated to nasal cannula @4 liters. Oxycodone is given for pain. He gradually becomes lethargic with RR 8. An ABG is obtained: pH 7.28, pO2 59, pCO2 65. BiPAP is started but the patient begins vomiting and urgent intubation is required.
- What might the intensivist document?

Clinician Judgment and Coding Department Strategy

- Correct documentation and coding
  - Postop resp failure or postprocedural resp failure (MCC)
  - Requires a surgical misadventure created the condition (+PSI)
  - Meets criteria
  - Acute resp failure with hypercapnia (MCC)
  - Meets criteria
  - Acute pulmonary/resp insufficiency following nonthoracic surgery (MCC)
    - No guidelines for diagnosis. Pulmonologist survey consider it synonymous with resp failure.
    - In practice... less severe pulmonary issues.
    - Patient doesn’t meet criteria for resp failure, e.g., no resp distress, mild hypoxemia corrects with 32% FIO2, wheezing, etc.
- Inadequate documentation and coding
  - Hypoxemia/hypoxia (not CC/MCC)
    - Symptom code! Will need clarification.
  - Aspiration pneumonitis (MCC)
    - Subsequent to respiratory decline and not primarily responsible.
What Happened in This Case?

- Patient remained on ventilator overnight
- Nebulizers administered
- Opioids and sedation withdrawn the next morning
- Patient extubated after an additional 8h on the ventilator
- Now has a headache!
- J95.821, acute postprocedural resp failure, coded at discharge

More About Postop Resp Failure

Resp failure following trauma and surgery
- Coding Clinic Fourth Quarter 2011
  - Acute resp failure is a common postop complication
  - Often requires mechanical ventilation > 48 hours after surgery
  - Reintubation with mechanical ventilation after postop extubation
  - Impaired gas exchange: Hypoxemia or hypercarbia
  - Requires more than just supplemental oxygen or intensified observation
  - Risk factors
    - Specific to the patient’s general health
    - Trauma to chest wall can lead to inadequate gas exchange
    - Type of anesthetic
    - Incision near diaphragm

Clinical and Coding Conundrums

Postprocedural resp failure: Who’s at risk?
- Plastic Reconstructive Surg. 2013 Nov; 132 (5)
  - Validated Model for Predicting Postop Resp Failure: Analysis of 1,706 Abd Wall Reconstructions
    - 6% developed postop resp failure
      - Longer LOS and higher mortality rates
    - 8 variables significantly associated with postop resp failure
      - History of COPD
      - Dyspnea at rest
      - Dependent functional status
      - Malnutrition
      - Recurrent incarcerated hernia or concurrent intraabd. procedure
      - ASA score > 3 (patient with severe systemic disease with constant threat to life)
      - Prolonged operative time
Postop Resp Failure Is a PSI

PSI 11 Has No Weight in PSI-90 Composite ... Yet

Postprocedural Respiratory Failure

What about the quality impact on surgeon and hospital?
- Patient Safety Indicator (PSI)
  - Hospitals in lowest quartile receive 1% reduction in Medicare payment for fiscal year
- MCC ...significant impact on DRG
- Insurance denials ... considered inherent without additional resource use
- Physician public reporting
  - Society Thoracic Surgery star ratings
    - Includes time on vent after CABG (>24 hours considered “prolonged” and “complication”)
  - Propublica surgeon scorecard
  - Administrative data on Medicare patients
  - Risk adjusted: Mortality, readmissions, complications
  - Surgeon assigned a low, medium, or high adjusted rate of complications
  - American Board of Orthopedic Surgery announced data would affect board certification renewals
    - https://projects.propublica.org/surgeons/
  - Physician Compare
    - https://www.medicare.gov/physiciancompare/
Query Example

Patient presented with AAA and underwent operative repair. Postoperatively, patient was weaned from ventilator to venturi mask. He remained tachypneic with hypoxic and an ABG showed: pH 7.312, pCO2 38.9 and pO2 of 69.5 on FIO2 .50. After study, was the patient being treated for:

• Postoperative respiratory failure as complication of surgery
• Postoperative pulmonary insufficiency as complication of surgery
• Acute respiratory failure unrelated to surgery
• Acute respiratory insufficiency unrelated to surgery
• Other __________________________
• No further specification can be provided

Clinical and Coding Conundrums

Circulatory shock

• Septic (MCC)
• Hypovolemic (MCC)
• Obstructive (MCC)
• Cardiogenic (MCC)
• Kills

Clinical Indicators of Shock

• Systemic Hypotension: MAIN SIGN OF SHOCK
  – Systolic BP <90
  – Mean Arterial Pressure (MAP) <70
  – Tachycardia
• Tissue Hypoperfusion
  – Dermatologic: cold/clammy skin
  – Renal: Oliguria (<30ml/hour)
  – Neurologic: encephalopathy, delirium, obtundation
• Elevated Lactic Acid (>4mmol/L)
### Acute Hypotension vs. Shock

<table>
<thead>
<tr>
<th>Hypotension indicators</th>
<th>Shock indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transient</td>
<td>Persistent without intervention</td>
</tr>
<tr>
<td>Mild or absence of symptoms e.g., lucid, up in chair, eating breakfast, etc.</td>
<td>Symptoms, e.g., acute delirium, lethargic, cool extremities, chest pain</td>
</tr>
<tr>
<td>Normal urine output</td>
<td>Reduced urine output</td>
</tr>
<tr>
<td>Normal lactic acid level</td>
<td>Elevated lactic acid level (&gt;4mmol/L)</td>
</tr>
<tr>
<td>Observed or offending medications not administered</td>
<td>Requires RBCs, IV antibiotics, pressors, steroids, ICU management</td>
</tr>
<tr>
<td>Walk from hospital</td>
<td>Carried out of hospital</td>
</tr>
</tbody>
</table>

### Types of Shock

<table>
<thead>
<tr>
<th>Septic (distributive or vasogenic)</th>
<th>Hypovolemia</th>
<th>Obstructive</th>
<th>Cardiogenic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septic Bacterial, fungal, viral, parasitic</td>
<td>Hemorrhagic Trauma, GI bleed, prostat, vaginal</td>
<td>Pulmonary vascular Large PE, severe pulmonary artery rille</td>
<td>Cardiomyopathic MI, severe HF, stunned myocardium, myocarditis</td>
</tr>
<tr>
<td>SIRS Burns, pancreatitis, trauma</td>
<td>Other volume loss Vomiting, diarrhea, heat stroke, third space losses</td>
<td>Mechanical Tension pneumothorax, cardiac tamponade</td>
<td>Arrhythmogenic Atrial or ventricular</td>
</tr>
<tr>
<td>Neurogenic Spinal cord injury, traumatic brain injury</td>
<td></td>
<td>Mechanical Severe mitral or aortic valve disease, ruptured ventricular aneurysm</td>
<td></td>
</tr>
<tr>
<td>Anaphylactic Bee stings, food and drug allergies</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Indications That Shock Was Treated

- **VIP rule**
  - Ventilate: 02, intubate early
  - Infuse rapidly
    - Fluids with normal saline or lactated ringers
    - Sepsis Core Measure (SEP-1) — 30ml/kg bolus
    - Albumin — occasionally
    - RBCs
  - Pump (or Pressors)
    - Norepinephrine
    - Dopamine
    - Dobutamine

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Persistent Hypotension Documented. Is a Query Needed for Shock?

Physician thoughts:
• What is the baseline BP?
• Does the patient appear ill?
• Is there a condition present which might cause shock?

Shock vs. Hypotension

Doubt shock
• 77 yo male with chronic systolic failure (25% EF) s/p right femur fracture repair. SBP 82/40. Patient alert, conversant, asymptomatic. Lisinopril held.
• 29 yo female has intractable migraine with status migrainosus. SBP 79/55. Lethargic, in bed.

Probable shock
• 56yo male s/p CABG. POD #1. SBP 85, receiving 2 units RBCs for hemoglobin 6.9, on norepinephrine.
• 52yo female has right pneumonia with effusion. SBP 89, HR 107, mild delirium, given 2000 ml bolus.

What About Coding Postprocedural Shock?

• T81.1, postprocedural shock
  – Shock during or resulting from a procedure, not elsewhere classified
    • Something happened in the OR to create the condition
    • Use of the term “postop”
  – Complication – must be clearly stated, cause/effect
    • Query provider if any doubt
    • Postprocedure shock unspecified (T8110XA) or postprocedure septic shock (T8112XA) result in a PSI.
      (postop sepsis 13)
      – Risk adjusted
      – Exclusions may apply e.g., severe malnutrition, colon cancer
What About Coding Postprocedural Shock?  Examples from Coding Clinic, Fourth Quarter 2011 Pages: 150-153

**Question:**
- The patient developed refractory cardiogenic shock that required temporary extracorporeal membrane oxygenation (ECMO) support after undergoing aortic valve replacement due to severe aortic stenosis. The provider documented that the patient developed postprocedural shock due to valve replacement itself. What are the code assignments?

**Answer:**
- Assign code 424.1, Aortic valve disorders, as principal diagnosis. Assign code 998.01 (ICD-9 code 781.34), Postoperative shock, cardiogenic, as an additional diagnosis. Assign codes 05.22, Other replacement of aortic valve, and 39.61, Extracorporeal membrane oxygenation (ECMO), for the procedure.

**Question:**
- A 53-year-old male patient status post coronary artery bypass graft (CAGB) was readmitted to the hospital after he developed tachycardia and purulent drainage from the sternal wound. The patient quickly deteriorated after admission, became septic and went into shock two days after admission. With aggressive intravenous antibiotic management, the patient improved and was later discharged. The physician also documented Methicillin resistant Staphylococcus aureus sepsis and postoperative shock, severe type: How should this case be coded?

**Answer:**
- Assign code 998.19, Other postoperative infection, as the principal diagnosis for the infected sternal wires. Assign codes, 018.12, Methicillin resistant Staphylococcus Aureus sepsis, 995.50, Severe sepsis, 995.02, ICD-9 code 710.25, Postoperative shock, septic, and V5.83, Aortocoronary bypass status, as secondary diagnoses. Code assignment is supported by the Official Guidelines for Coding and Reporting, Section 1.C.1.b.

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**Query Examples**

The patient had a drop in blood pressure during the cardiac cath procedure and LV function “dropped” as well. In the op note, BP was noted to be in the low 60s and an IABP was placed. The next day’s progress note stated “BP improved with treatment.”

Can the above clinical findings and treatment be further clarified as:
- Hypotension due to cardiogenic shock
- Hypotension due to other type of shock
- Hypotension without shock
- Other
- Unable to determine

---

**Query Examples**

Patient admitted for STEMI. The patient underwent cardiac cath and percutaneous intervention with a drug-eluting stent. Operative report describes hypotension which required treatment with dopamine. BPs recorded were 61/44 and 77/43.

Based on this information, can the patient’s hypotension be further specified as:
- Hypotension due to cardiogenic shock
- Hypotension due to other type of shock
- Hypotension without shock
- Other
- Unable to determine
Shocking Takeaways

- Early intervention for shock prevents multi-organ failure and death
- Rapid improvement after intervention may not be documented as shock
- Hypotension may be asymptomatic, chronic, and irrelevant
- Distinguishing between hypotension and shock may require query
- Code postprocedural shock only if specifically documented

Acute Confusion, Delirium, and Encephalopathy

- Inability to maintain a coherent stream of thought or action
- 30% of hospitalized older adults
- What is baseline?
- Mild cases are often undiagnosed
- Heralding symptom of major illness
  - Cause is usually outside the brain
- Brain is vulnerable
- 33% persist at 6 months
- Mortality rate 20%–40%
- Clinical diagnosis, i.e., opinion of the clinician
  - No “troponin” to measure
- Terms used synonymously
- Lack of clear guidelines

Confusing overlap

- Acute encephalopathy
- Acute delirium
- Acute confusion

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### Clinical Indicators for Types of Confusion

<table>
<thead>
<tr>
<th>Disturbance in attention</th>
<th>Acute encephalopathy (MCC)</th>
<th>Acute delirium d/t known physi. cond. (CC)</th>
<th>Acute psychosis (CC)</th>
<th>Dementia (w/o functional disturbance) (Not CC/MCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudden</td>
<td>Sudden</td>
<td>Sudden</td>
<td>Sudden</td>
<td>Normal</td>
</tr>
<tr>
<td>Insidious</td>
<td>Sudden</td>
<td>Insidious</td>
<td>Insidious</td>
<td>Insidious</td>
</tr>
</tbody>
</table>

### Causes of Acute Confusion, Delirium, and Encephalopathy

<table>
<thead>
<tr>
<th>Metabolic causes</th>
<th>Drugs and toxins</th>
<th>Infections</th>
<th>Brain disorders</th>
<th>Multi-organ failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrolytes: Na+, K+, Ca++</td>
<td>Prescribed psychoactives</td>
<td>Sepsis</td>
<td>CNS infection</td>
<td>Heart</td>
</tr>
<tr>
<td>Endocrine: thyroid, pituit.</td>
<td>OTIC, antihistamines</td>
<td>Fever-related delirium</td>
<td>Seizures</td>
<td>Liver</td>
</tr>
<tr>
<td>Glucose</td>
<td>Drugs of abuse: heroin, Metha</td>
<td>UPI</td>
<td>CNS encephalopathy</td>
<td>Renal</td>
</tr>
<tr>
<td>CO2 narcosis</td>
<td>Withdrawals</td>
<td>Pneumonia</td>
<td>Psych disorders</td>
<td>Respiratory</td>
</tr>
<tr>
<td>Hypoxemia</td>
<td>Side effects: Cyp, anti-epileptics</td>
<td>Tumor</td>
<td>Hematologic catastrophe, e.g., AML blast crisis</td>
<td></td>
</tr>
<tr>
<td>Wernicke’s encephalopathy</td>
<td>Poison: MeOH, CO, inhalations</td>
<td>Stroke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B12 deficiency</td>
<td>IDH</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Mini-Med School: AEIOU TIPPS

- Alcohol
- Endocrine
- Infection
- Opioids
- Uremia
- Trauma
- Insulin
- Psychiatric illness
- Poison
- Stroke/seizure
Which One Is It?

• Just the definitions, please …
  - Acute encephalopathy:
    • National Institute Neurologic Disease and Stroke: “Encephalopathy is a term for any diffuse disease of the brain that alters brain function or structure”
    • UpToDate: “Acute toxic-metabolic encephalopathy which encompasses delirium and the acute confusional state, is an acute condition of global cerebral dysfunction in the absence of primary structural brain disease.”
    • The American Psychiatric Association DSM-V Manual doesn’t recognize encephalopathy apart from delirium
  - Acute delirium:
    • JohnsHopkins Medicine: “Delirium is an acute disorder of attention and global cognition (memory and perception)”
    • US National Library of Medicine (Medline): “Delirium is sudden severe confusion due to rapid changes in brain function that occur with physical or mental illness”

Multiple Correct Answers … Clinician Documentation or Query Choice

Delerium by the Book

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Encephalopathy Has Greater Impact on DRG and Risk Than Delirium

- Types of encephalopathy
  - Encephalopathy, unspecified G93.40 (MCC)
  - Metabolic encephalopathy G93.41 (MCC)
  - Other encephalopathy G93.49 (MCC)
  - Toxic encephalopathy G93 (MCC)
    - Code first toxic agent
    - Encephalopathy due to diabetic hypoglycemia (MCC)

- Code first toxic agent
  - Encephalopathy due to diabetic hypoglycemia (MCC)

- Coding Clinic, Third Quarter 2013 Page: 21
  - Assign code E11.649, Type 2 diabetes mellitus with hypoglycemia without coma, as the principal diagnosis. Assign also code G93.41, Metabolic encephalopathy, as an additional diagnosis.

- Alcoholic encephalopathy G31.2 (not a CC/MCC)
- Degeneration of nervous system due to alcohol
- Hypertensive encephalopathy I67.4 (CC)
- Hypertensive encephalopathy... See Failure, hepatic
- Thiamine deficiency usually assoc. with alcoholism

Coding Clinic Help!

- Metabolic encephalopathy (G93.41)
  - Coding Clinic, Fourth Quarter 2003 Pages: 58 to 59
  - Metabolic encephalopathy is always due to an underlying cause. There are many causes of metabolic encephalopathy, such as brain tumors, brain metastasis, cerebral infarction or hemorrhage, cerebral ischemia, uremia, poisoning, systemic infection, etc. Metabolic encephalopathy is also a common finding in 12-33% of patients suffering from multiple organ failure. The development of metabolic encephalopathy may be the first manifestation of a critical systemic illness and may be caused by various reasons—one of the most important being sepsis.

What Is Not Considered Encephalopathy?

- Postictal confusion following a seizure
  - Coding Clinic, Fourth Quarter 2013 Pages: 89-90
  - Encephalopathy due to postictal state is not coded separately since it is integral to the condition

- Coma
- DTs and drug withdrawals
- Dementia ... unless there is a transient period of confusion reversed to baseline with treatment of acute illness. The baseline must be clearly documented.
Query Examples

72yo female presents with acute confusion and lethargy. ED documented the cause of confusion to be drug-induced delirium. HP and progress notes documented encephalopathy, acute respiratory failure, and COPD exacerbation. Patient treated with IV fluids, oxygen, nebulizers, steroids, and discontinuation of Clonazepam. Her confusion resolved by discharge.

After study, could the etiology of the patient's confusion be specified as:
- Toxic encephalopathy
- Drug-induced delirium only
- Other
- Unable to determine

Query Examples

The patient is an 82yo female with a history of mild dementia but normally conversant and ambulatory per neighbor. The patient developed acute vomiting with diarrhea and was found down. The ED doc noted her to be poorly arousable without focal neurologic deficits. Admit labs included a sodium of 152, BUN 43, and creatinine of 1.2. In the H&P she was diagnosed with gastroenteritis, severe hydration, and delirium. Her delirium was reported as resolved on day 3 of her hospitalization and at baseline mental status.

After study, can the delirium be further specified as:
- Metabolic encephalopathy
- Acute delirium only due to hydration
- Exacerbation of dementia only
- Other
- Unable to determine

Lucid Takeaways

- Acute confusion often indicates systemic illness and risk of mortality
- Physicians often consider acute confusion, acute delirium, and acute encephalopathy to be synonymous
- Ask the physician to be specific about what type of acute confusion, AMS, or ALOC
- Query physician for suspected cause, e.g., UTI, Lorazepam, AKI, etc.
Acute Tubular Necrosis (ATN)

- Acute kidney injury
  - Abrupt decrease in renal function
  - KDIGO criteria
    - Creatinine increase > 1.5X baseline within 7 days
    - ≥ 0.3 mg/dl increase within 48 hours
  - Most common causes in hospital
    - Prerenal disease, reduced renal blood flow, e.g., hypovolemia, cardiogenic
    - Acute tubular necrosis (ATN), prolonged and severe ischemia, damaged tubules
    - Postrenal, obstruction, e.g., hydronephrosis, BPH

Additional, more detailed image: [www.brown.edu/Courses/Digital_Path/systemic_path/renal/R2.jpg](http://www.brown.edu/Courses/Digital_Path/systemic_path/renal/R2.jpg)

Frequency of AKI in Hospitalized Adults

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATN</td>
<td>45%</td>
</tr>
<tr>
<td>Acute/CKD</td>
<td>13%</td>
</tr>
<tr>
<td>Prerenal</td>
<td>21%</td>
</tr>
<tr>
<td>Postrenal</td>
<td>10%</td>
</tr>
<tr>
<td>Misc</td>
<td>11%</td>
</tr>
</tbody>
</table>

(Kidney Failure Study Group)

Kidney Anatomy

Nephrons

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Clinical Indicators Used to Differentiate AKI

<table>
<thead>
<tr>
<th>Volume status</th>
<th>Pre-renal AKI (&gt;21%)</th>
<th>ATN induced AKI (&gt;45%)</th>
<th>Other intra-renal AKI (&lt;4%)</th>
<th>Post-renal AKI (&lt;10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical scenario</td>
<td>Diarrhea, hemorrhage, hypovolemic shock</td>
<td>Sepsis, shock, Gentamicin, IV contrast</td>
<td>Glomerulonephritis, TTP/HUS</td>
<td>Vascular clots, anuria</td>
</tr>
<tr>
<td>Urinalysis</td>
<td>Normal</td>
<td>Granular and epithelial cell casts, muddy appearance</td>
<td>Hematuria, proteinuria, schistocytes</td>
<td>Normal to some degree</td>
</tr>
<tr>
<td>Urine sodium (mEq/L)</td>
<td>&lt;20</td>
<td>&gt;20</td>
<td>&gt;20</td>
<td>&gt;20</td>
</tr>
<tr>
<td>Fractional excretion of sodium (FENa)</td>
<td>&lt;1% (i.e., 99% of urine Na is reabsorbed)</td>
<td>&gt;2%</td>
<td>&gt;2%</td>
<td>&gt;2%</td>
</tr>
<tr>
<td>Renal ultrasound</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Hydronephrosis</td>
</tr>
<tr>
<td>Response to IVF</td>
<td>Normalization of creatinine &lt;72h</td>
<td>Sluggish improvement</td>
<td>No improvement</td>
<td>No improvement</td>
</tr>
</tbody>
</table>

Typical Conditions Associated With ATN

- **Causes of ATN**
  - Renal ischemia
    - Any pre-existing condition exacerbated by hypotension and/or surgery
  - Sepsis
    - Hypotension, cytokines, inflammation
  - Nephrotoxins (kidney poisons)
    - Aminoglycosides, e.g., gentamicin
    - Heme pigments, i.e., myoglobin from rhabdomyolysis
    - Chemotherapeutic agents, e.g., cisplatin
    - IV contrast for radiologic studies
    - IV immunoglobulin
    - Vancomycin (toxic levels)

What About AKI With Cortical and Medullary Necrosis? (MCC)

- Similar to ATN but much less common
- Acute kidney failure with acute cortical necrosis (N17.1)
  - Ischemia to renal cortex
  - 80% have no urine output
  - Obstetric catastrophe (50%)
    - Abruptio placenta, septic abortion, DIC
    - Sickle cell 14%
    - Hemolytic-uremic syndrome 12%
    - CT appearance may show cortical lucency
    - Renal biopsy definitive
- Acute kidney failure with medullary (papillary) necrosis (N17.2)
  - Pyramidal ischemia and necrosis
  - > 2 risk factors: Pyelonephritis, urinary obstruction, sickle cell, salicylates
  - IVF and MRI characteristc appearance of abnormal papilla
  - Renal biopsy definitive
Query Examples

The patient presented with CHF. Creatinine increased from 1.11 to 2.54 within 48 hours. Nephrology was consulted. Acute kidney injury due to diuresis vs ATN associated with ARB/diuretic use vs poor perfusion with hypotension was noted.

At the time of discharge was the patient felt to have AKI with ATN?
• Yes
• No
• Other __________
• Unable to provide any further information

Query Examples

Patient underwent an anterior lumbar fusion and was noted to have a rise in creatinine. Documentation stated patient had transient hypotension and creatinine was recorded as: 5/6 of 0.71, 5/7 of 1.77, 5/9 of 2.72, 5/12 of 1.76. Physician reported the patient had brown urine, normal UA, FENA > 2. Renal US was normal. Patient was documented to have acute kidney injury.

After study, can the patient’s renal status be further specified as:
• Acute kidney injury due to ATN
• Acute kidney injury only
• Other __________
• Unable to provide additional information

So ... Now What?

• ATN and pre-renal account for approximately 80% cases of inpatient AKI
• Seek an etiology from the physician
  • Obsolete causes may be an MCC
    • Acute glomerulonephritis, rapidly progressive nephritic syndrome, AKI with acute cortical necrosis
    • Other acute kidney failure (N17.8) is a CC
  • Unspecified ... not a CC/MCC
  • Unspecified kidney failure, uremia, renal insufficiency, acute renal disease, nephropathy
Thank you. Questions?

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