



# Medical Mystery Case: A Bird's Eye View

PODCAST 33



# Continuing Medical Education

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# Learning Objectives

1. Describe the need for blood analysis prior to giving contrast medium for imaging.
2. Review the use of blood analyzers in detecting kidney injury.
3. Explain the role of point-of-care analyte testing in imaging.
4. Apply new information and technologies to improve patient care.

# Disclosures

This continuing medical education program was supported by Siemens Healthineers.

Content was developed by Medavera, Inc. for distribution on the *On Medical Grounds* podcast.

There are no additional disclosures for this program.

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2. To obtain credit for this program, all materials at the link below must be reviewed in full including the podcast, slides, and show notes with additional references.

## [A Bird's Eye View](#)

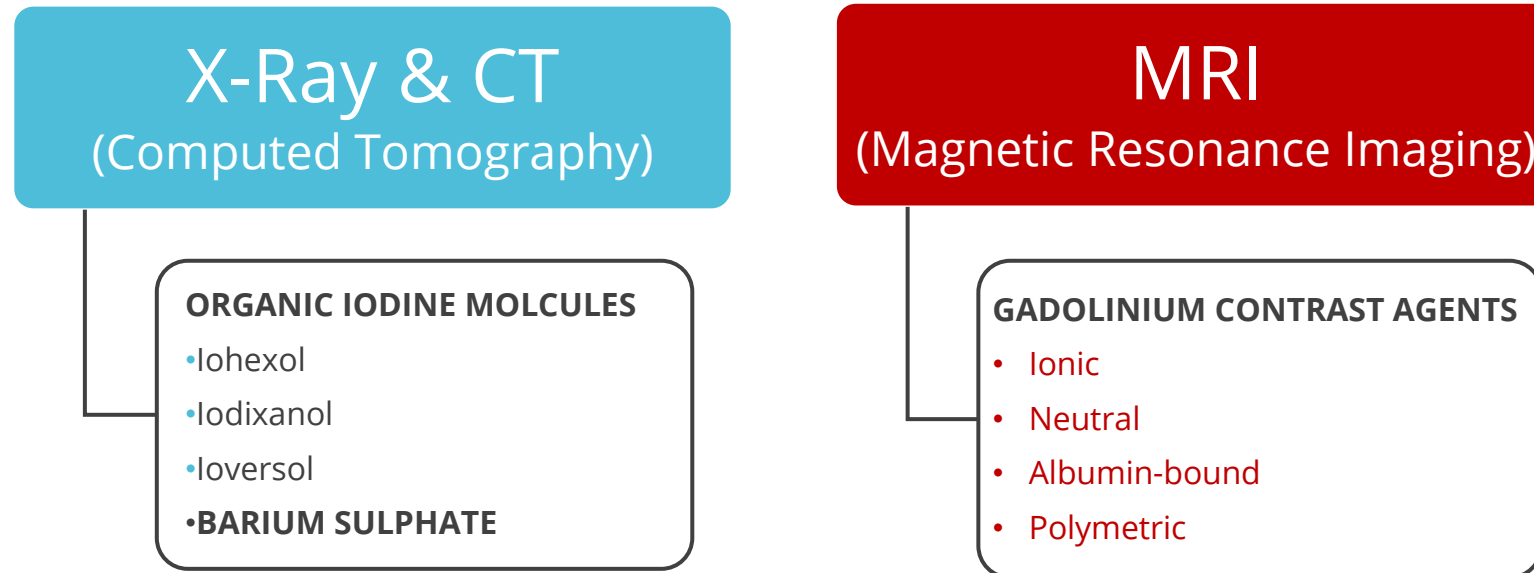
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# Contrast Media: Uses and Laboratory Measures

# Contrast Media

- Medical contrast media, also referred to as contrast agents or contrast medium, come in many forms and typically fall within two main groups, associated with the type of imaging being used.



## Enhance Visualization of Imaging

Contrast media are used to enhance the distinction, or contrast, of structures or fluids within the body.

Resulting images contain increased differentiation with better views of internal structures.

Proven to be incredibly valuable in diagnostic imaging, contrast dyes and media are also known to effect laboratory results, including several common assays.





# Contrast Media Can Interfere With Some Laboratory Tests

## Gadolinium-Based Agents

Creatinine

Iron

Zinc

Copper

Calcium

Protein

Bilirubin

Magnesium

Angiotensin  
-converting  
enzyme

## Iodine-Based Agents

Copper

Iron

Phosphate

Bilirubin

Protein assays

**Obtaining values for these laboratory markers before imaging may be necessary to prevent interference with diagnoses.**

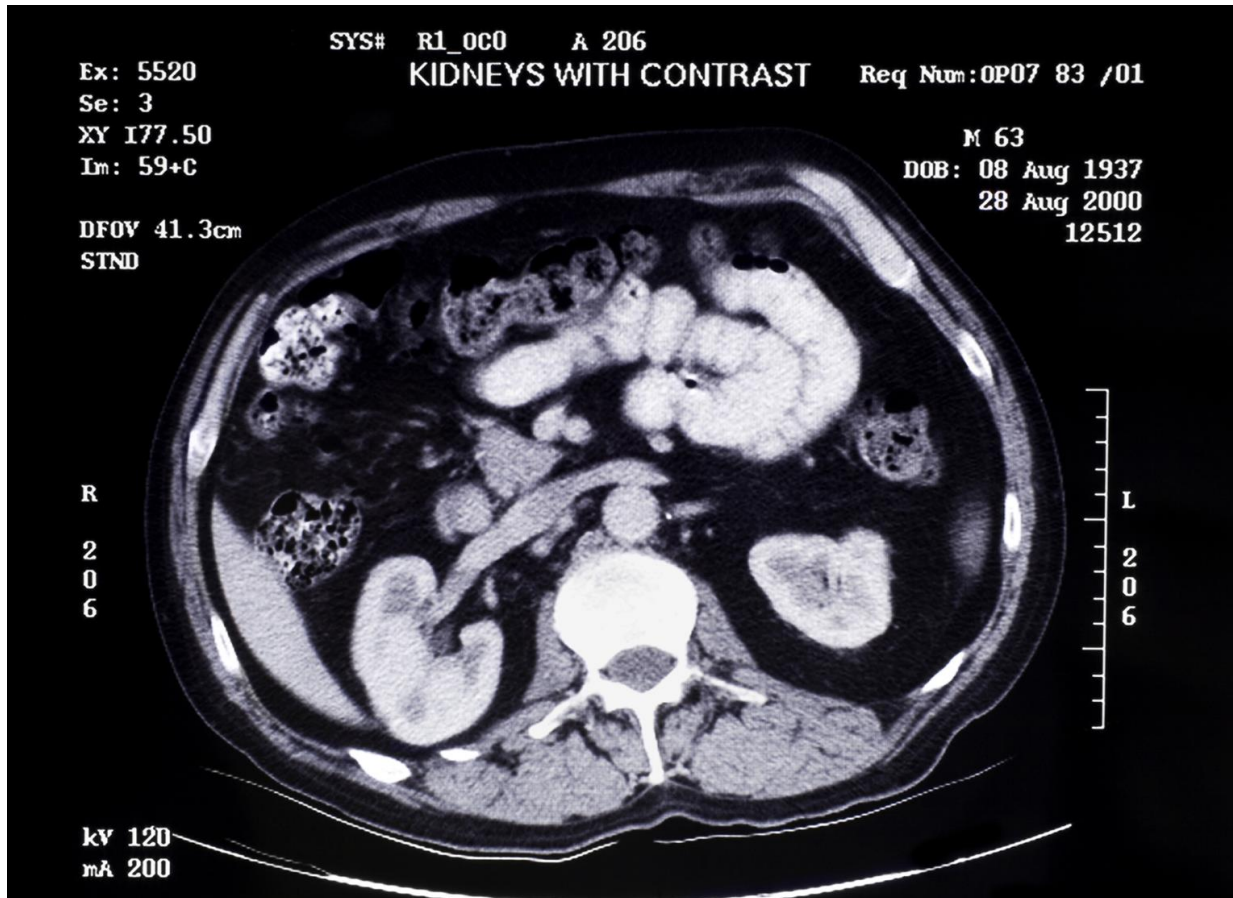


# Contrast Media and Kidneys

## Post-Contrast Acute Kidney Injury

- Once Contrast-Induced Nephropathy (CIN), the American College of Radiology has determined that the condition is better classified as post-contrast acute kidney injury (PC-AKI).
- The change is primarily due to many renal injuries being associated but not caused by the contrast.
- PC-AKI and CIN definitions vary slightly; however, most use the following criteria within 48 hours of contrast administration.
  1. Serum creatinine increase 0.3 mg/dl
  2. Increase in serum creatinine 50%
  3. Urine output of less than 0.5 ml/kg/hr for at least 6 hours.

# Risk Factors for PC-AKI



- There is consensus that the most important risk factor for PC-AKI is pre-existing severe renal insufficiency.
- Multiple other risk factors have been proposed:
  - Diabetes mellitus
  - Dehydration
  - Cardiovascular disease
  - Diuretic use
  - Advanced age
  - Hypertension
  - Hyperuricemia
  - Multiple iodinated contrast medium doses in a short time interval

# NSF & PC-AKI Differ By Causative Agents and Symptoms

## GADOLINIUM BASED CONTRAST MEDIA

### NEPHROGENIC SYSTEMIC FIBROSIS (NSF)

- Affects the skin and other organs in some patients with advanced CKD (chronic kidney disease)
- Very rare, affects about 4% of patients with advanced CKD
- Not reported in people with mild kidney damage or normal kidney function
- Can be painful, debilitating, and fatal. Reduces movement of the joints and can cause internal organ damage
- Symptoms include:
  - Burning and itching of skin
  - Red or dark patches on skin
  - Joint stiffness and muscle weakness
- Disease can develop within 24 hours to 3 months after exposure

## IODINE CONTAINING CONTRAST MEDIA

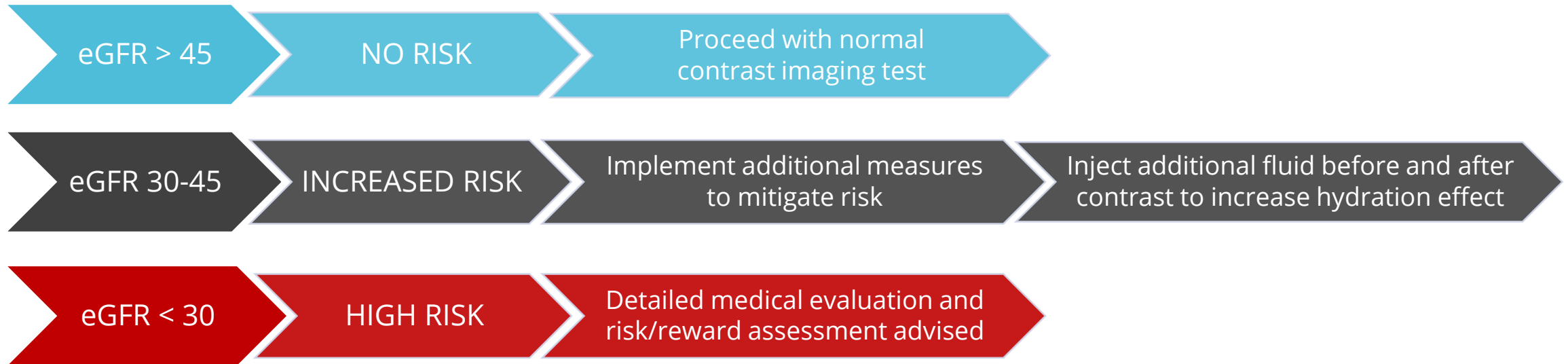
### POST-CONTRAST ACUTE KIDNEY INJURY

- Can result in temporary and sometimes permanent reduction in kidney function in those with pre-existing kidney problems
- Only affects those with very poor or deteriorating kidney function and can lead to serious kidney, heart, and blood vessel problems
- About 2% of people receiving contrast dye can develop CI-AKI
- Risk increases for those with diabetes, a history of heart and blood diseases, and CKD
- Symptoms include:
  - Tiredness and poor appetite
  - Swelling in the feet and ankles
  - Dry and itchy skin
- Typically develops 48-72 hours after exposure to CT dyes

# Testing Kidney Function

Kidney function can be assessed from serum creatinine with a bedside blood analysis system or with standard laboratory testing. More accurate testing is done with the eGFR test (estimated glomerular filtration rate) which takes into consideration the patient's age, race, and gender as well as serum creatinine value to measure how well a patient's kidneys are working. Some bedside analyzers calculate eGFR automatically and others must use an external program.

## If eGFR is:



## Point-of-Care Testing Can Identify Kidney Injury Risk

Contrast media given to patients undergoing MRI, X-ray, or CT scans can affect kidney function in a variety of ways and at varying levels of severity.

Utilizing bedside or point-of-care testing (POCT) blood analysis prior to giving a patient contrast media may identify potential underlying renal issues that could be exacerbated with contrast media.

Rapid turnaround time of these tests can provide results prior to imaging orders, thereby improving patient outcomes.



# Benefits of POCT Blood Analyzers



Increase the accuracy and efficiency of healthcare delivery



Performed at patient bedside



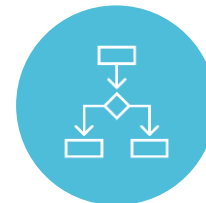
Cost effective and easy to use



Provide rapid and accurate results



Reduced waiting times for lab results allows for quicker, potentially lifesaving medical decisions



Improve healthcare management in diagnosis process



# POCT Blood Analysis for Kidney Function



- Kidney function testing is an important step before contrast imaging.
  - Prevents potential adverse reactions
  - Aids in more accurate medical diagnosis
- Contrast media has been proven to affect the integrity of laboratory results.
- To avoid interference and inaccurate test results, laboratory testing should be done prior to administering contrast.
- The rapidity of POCT makes this method ideal in emergent situations.



Why Was Contrast An Issue for Joe?

# Joe's Labs

**PATIENT: Joseph (Joe) Sutter**

**AGE: 82**

**GENDER: Male**

**INTAKE VITALS:**



**TEMPERATURE:**

99 °F



**HEART RATE:**

62 BPM



**BLOOD PRESSURE:**

143/72

**NOTES:**

Geriatric male patient has a history of bladder cancer and prostate cancer, CAD, hypertension, and hearing loss.

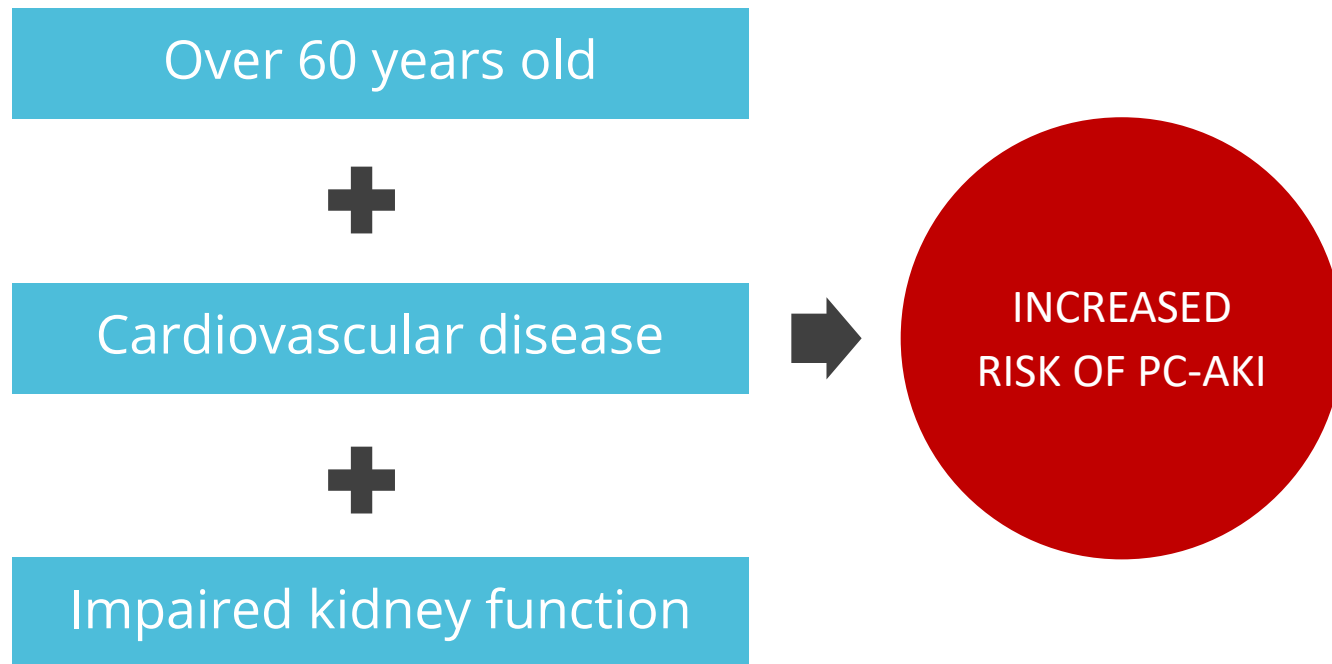
Recently experiencing dizzy spells, stomachache and vomiting, and a possible fall.

Next of kin reported uncharacteristic confusion and behavior.

Patient lives independently with frequent family checks.

pH	HCO <sub>3</sub>	Na <sup>+</sup>	K <sup>+</sup>	Ca <sup>++</sup>	Cl <sup>-</sup>	Glu	Crea	Calculated eGFR	BUN	Lactate	HCT	WBC	Hgb	Total bilirubin	Troponin
7.32	16	120 mm/L (low)	6 mmol/L (high)	8.6 mg/dL	97 mm/L (low)	86 mg/dL	1.21 mg/dL (high)	60 ml/min/ 1.73m <sup>2</sup>	32 mg/dL (high)	2.2 mmol/L (high)	40.3	13.3	13.6	1.7	Normal
<b>NORMAL RANGES</b>		136-145	3.5-5 mmol/L		98-107		0.6-1.10	> 60	6-24	< 2					

## Joe's Risk of Developing PC-AKI



Contrast agents clear the body by processing through the kidneys.

Increased exposure to contrast can result in permanent or temporary kidney damage when a patient already has impaired kidney function or other risk factors.

# Appendicitis in Geriatric Patients Is Not Typical

“

**High clinical suspicion and liberal use of CT scanning in elderly patients is necessary to make this diagnosis in a timely fashion.**

— Spangler et al.

”

- Elderly patients with acute appendicitis have a typical clinical presentation only 20% of the time.
- The early use of contrast scans can lead to an accurate and rapid diagnosis. The longer it takes to diagnose and treat, the risk for perforation and post-surgical complications increases.
- All elderly patients that present with abdominal pain should be investigated thoroughly and considered for acute appendicitis.

## Appendicitis Presentation in Geriatric Patients



Up to **50% of all appendicitis deaths** occur in elderly patients.

**Misdiagnosis occurs 54% of the time** in elderly patients.

**20% present after 3 days of symptoms** and 5%-10% present after 1 week of symptoms.

**Delayed and atypical presentations** often lead to misdiagnosis.

**33% have no right lower quadrant pain.**

**50% of misdiagnosed patients have bowel perforation** by the time of surgery.

## How Did POCT Blood Analysis Help Joe?

1. POCT bedside analytes indicated potentially impaired kidney function. While many of Joe's results were borderline, there were differences in enough markers of kidney function to cause concern.
2. POCT results combined with Joe's history indicated an increased risk for PC-AKI.
3. These rapid lab results allowed Joe's physician to make an informed decision about whether or not to order contrast *before* he placed the order for imaging.
4. Joe was diagnosed with appendicitis and treated without further aggravation of his impaired kidney function.

## Summary

The use of hand-held blood analysis systems can improve patient care by giving clinicians necessary and accurate results at the point-of-care.

Using CT scans with contrast to diagnosis acute appendicitis in elderly patients is recommended and often necessary. However, the risk of contrast medium having adverse effects on patients with reduced kidney function, commonly found in elderly patient, is a concern.

The use of bedside blood analysis and laboratory testing for the identification of reduced kidney function is recommended for patients with risk factors for PC-AKI prior to any imaging.





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