DIAGNOSTIC YIELD OF A HEMATURIA PROTOCOL CT IN YOUNG PATIENTS WITH RENAL COLIC: IS THE CONTRASTED PHASE NECESSARY?

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BACKGROUND

• Hematuria is a common symptom of urinary tract disease and a common finding in young adults [1-5].

• There are numerous causes of hematuria to include calculi, neoplasm, infection, inflammation, trauma, and renal disease.

• Hematuria can represent a risk for malignancy and therefore merits thorough evaluation [6-7] and a hematuria CT is a valuable modality for detecting the source of hematuria [8-10].

• However, the appropriate strategy for imaging young adults with hematuria has been controversial.
BACKGROUND

- In its best practice policy guideline for asymptomatic microscopic hematuria, the American Urologic Association recommends upper tract imaging with either excretory urography or CT and states that if CT is chosen, no further imaging is needed if unenhanced images show urolithiasis in a patient who is at low risk of malignancy [11,12].

- The American College of Radiology ranks hematuria CT as the most appropriate imaging test in the care of most adults with persistent hematuria [13].

- Several studies have found few clinically significant upper urinary tract findings in younger patients. Additionally, there are increased concerns about radiation in this younger population, which has lead some to question the utility of a full hematuria CT in young adults with microscopic hematuria [14-17].
CENTRAL HYPOTHESIS

• A single noncontrast CT urolithiasis study may be an appropriate initial exam for young patient’s with hematuria and clinical signs of renal colic:
  • The increasing use of a hematuria CT as the initial imaging test raises additional concerns about the added radiation exposure to this younger, more radiosensitive population.
  • Additionally, elimination of the risks of contrast reactions and contrast induced nephropathy, and the added cost of IV contrast administration, also are desirable if contrast enhancement is not required in the initial stages of imaging evaluation.
PURPOSE

• The purpose of this study is to evaluate if the non-contrast phase alone is sufficient in young patients with clinical signs of urolithiasis such as renal colic.
MATERIALS AND METHODS

• Single-center retrospective cross-sectional study
  • Naval Medical Center San Diego, California
  • IRB approved, HIPAA compliant
  • Informed consent was waived

• Eligible Patients
  • Consecutive patients with a CT hematuria protocol exam for new onset hematuria who were imaged between March 1, 2012 through March 1, 2013
Eligible Patients:
n=719

Excluded Patients:
Patients were excluded as follows (Total of 246 patients excluded):
- History of renal mass/malignancy: n = 28
- Prior hematuria workup or hematuria CT: n = 87
- History of urolithiasis: n = 80
- Cancelled exams/incomplete records: n = 49

Included Patients:
n=473

Exclusion Criteria:
- History of renal mass or renal malignancy.
- History of undergoing a previous workup for hematuria or previous hematuria CT
- History of prior urolithiasis.
- Cancelled exams/incomplete records.
Included patients: n = 473

Patients 40 or younger: n = 169

Renal Colic: n = 39

No Renal Colic: n = 115

Renal Colic Unspecified: n = 15
CT HEMATURIA PROTOCOL

- Siemens SOMOTOM Definition Flash
- 100-120 kV, 120-350 mAs
- Reconstructed slice thickness 3.0 mm
- Viewed on Carestream Vue PACS
- 100-130 ml of Isovue 370 IV contrast
CT HEMATURIA PROTOCOL

• PATIENTS OVER 50 YEARS OLD
  • Single bolus technique:
    • Noncontrast phase
    • One initial bolus of IV contrast given
    • Nephrographic phase CT at 2 minutes
    • Excretory phase CT at 9 minutes

• PATIENTS UNDER 50 YEARS OLD
  • Split bolus technique
    • Noncontrast phase
    • Half dose of contrast given initially and second half dose of contrast given at 7 minutes
    • Single combined contrast enhanced CT with both nephrographic and excretory phase at 9 minutes
IMAGE ANALYSIS

• Each positive hematuria CT study was reviewed by an abdominal radiologist to determine whether abnormalities were evident on the non-contrast phase images alone, or if the contrast enhanced phases of the hematuria CT were required to determine the etiology of the hematuria.

• If no finding was detected, the reviewer then evaluated the contrast-enhanced images. If findings were detected only on contrast-enhanced images, they were tabulated as requiring contrast-enhanced images for detection.

• Results of the CT scans were tabulated based on the presence of absence of renal colic.
RESULTS

- Of the 169 patients younger than 40 years of age, 128 had negative examinations. 21 had urolithiasis with findings seen on non-contrast images, 6 of whom had renal colic and 15 who did not.

- The readers only requested contrast on 14 examinations, yielding concerning findings for malignancy on two examinations, one for UCC and one for an ovarian mass, which both proved to be false positive findings on subsequent clinical and imaging evaluations.
RESULTS

• No malignancies or serious findings were missed by omitting the contrast enhanced images.

• No malignancies or serious true findings were found when contrast was requested in patients less than 40.
TABLE 1: Findings on Hematuria CT in Patients Younger Than 40 Stratified by Symptoms of Renal Colic

<table>
<thead>
<tr>
<th>Category (Diagnosis)</th>
<th>Unenhanced Images, Number/Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Evident on Unenhanced Images, Number/Total (%)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Study</td>
<td></td>
</tr>
<tr>
<td>No Renal Colic</td>
<td>87/128 (68%)</td>
</tr>
<tr>
<td>With Renal Colic</td>
<td>27/128 (22%)</td>
</tr>
<tr>
<td>Unspecified</td>
<td>14/128 (11%)</td>
</tr>
<tr>
<td>Total</td>
<td>128/128 (100%)</td>
</tr>
<tr>
<td>Stone</td>
<td></td>
</tr>
<tr>
<td>15/21 (71%)</td>
<td></td>
</tr>
<tr>
<td>Stone</td>
<td></td>
</tr>
<tr>
<td>Multiple Stones</td>
<td></td>
</tr>
<tr>
<td>4/8 (50%)</td>
<td></td>
</tr>
<tr>
<td>RCC</td>
<td></td>
</tr>
<tr>
<td>0/1 (0%), false positive, clot in bladder</td>
<td></td>
</tr>
<tr>
<td>UCC</td>
<td></td>
</tr>
<tr>
<td>1/1 (100%), false positive, clot in bladder</td>
<td></td>
</tr>
<tr>
<td>Bosniak Cyst 1 or 2</td>
<td></td>
</tr>
<tr>
<td>12/18 (67%)</td>
<td></td>
</tr>
<tr>
<td>Bosniak Cyst 3 or 4</td>
<td></td>
</tr>
<tr>
<td>0/0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Extra-Urinary Findings of Consequence</td>
<td>1/1 (100%), false positive fibroid interpreted as an adnexal mass</td>
</tr>
</tbody>
</table>
TRUE POSITIVE CASE

Fig 1. A 39 year old female with left sided renal colic. Small ureterolith at the left ureterovesical junction on the noncontrast portion of the hematuria CT exam.
LIMITATIONS

• Our patient population has a high number of patients under 40 with hematuria, likely due to exercise or work related strenuous activity.

• Differences in hematuria CT technique for patients under 50 versus patients over 50.
  • The split bolus technique in patients under 50 may have a decreased sensitivity for small renal masses compared to a non-split bolus technique.

• Subset of patients (n=15) whose medical records did not indicate if the patient had renal colic on presentation.
CONCLUSION

• These findings suggest that a non-contrast urolithiasis CT may be sufficient in the initial evaluation of hematuria in patients younger than 40, with or without the clinical signs of renal colic. This would avoid additional radiation from the contrast enhanced phases of the hematuria CT in younger patients, who are generally considered to be more radiosensitive, and would also decrease the potential risk of contrast allergy.

• Further prospective studies with a higher number of patients under 40 may be necessary to confirm our results.
REFERENCES


REFERENCES


