

**American College of Radiology  
ACR Appropriateness Criteria®**

**Acute Onset Flank Pain-Suspicion of Stone Disease (Urolithiasis)**

**Variant 1: Acute onset flank pain. Suspicion of stone disease. No history or remote history of stone disease. Initial imaging.**

| Procedure                                 | Appropriateness Category          | SOE            | Adults RRL    | Peds RRL            | Rating | Median | Final Tabulations |   |   |   |   |    |   |   |    |
|---|-----------------------------------|----------------|---------------|---------------------|--------|--------|-------------------|---|---|---|---|----|---|---|----|
|   |                                   |                |               |                     |        |        | 1                 | 2 | 3 | 4 | 5 | 6  | 7 | 8 | 9  |
| CT abdomen and pelvis without IV contrast | Usually appropriate               | Strong         | ⊕⊕⊕ 1-10 mSv  | ⊕⊕⊕⊕ 3-10 mSv [ped] | 9      | 9      | 0                 | 0 | 0 | 0 | 0 | 0  | 1 | 2 | 14 |
|   |                                   |                | References    | Study Quality       |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 24 (16600742) | 4                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 23 (19890646) | 4                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 22 (19457812) | 2                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 21 (19230922) | 3                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 20 (27533351) | 3                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 19 (23374764) | 3                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 18 (19251939) | 3                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 17 (29625137) | 2                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 16 (11110945) | 1                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 15 (8571915)  | 2                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 3 (11756098)  | 3                   |        |        |                   |   |   |   |   |    |   |   |    |
| US kidneys and bladder retroperitoneal    | May be appropriate (Disagreement) | Expert Opinion | 0 0 mSv       | 0 0 mSv [ped]       | 5      | 5      | 0                 | 2 | 1 | 0 | 0 | 12 | 1 | 1 | 0  |
|   |                                   |                | References    | Study Quality       |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 40 (28611874) | 1                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 39 (27154825) | 3                   |        |        |                   |   |   |   |   |    |   |   |    |
|   |                                   |                | 38 (11461855) | 4                   |        |        |                   |   |   |   |   |    |   |   |    |

|               |   |
|---------------|---|
| 37 (12819916) | 2 |
| 35 (27289025) | 3 |
| 36 (27459091) | 3 |
| 34 (17373690) | 2 |
| 33 (11756713) | 3 |
| 30 (28341578) | 2 |
| 16 (11110945) | 1 |
| 11 (28845492) | 3 |
| 42 (27063853) | 3 |
| 41 (26797359) | 2 |

|  |                                   |                |              |                     |   |     |   |   |   |   |   |   |   |   |   |
|--|-----------------------------------|----------------|--------------|---------------------|---|-----|---|---|---|---|---|---|---|---|---|
| US color Doppler kidneys and bladder retroperitoneal | May be appropriate (Disagreement) | Expert Opinion | ○ 0 mSv      | ○ 0 mSv [ped]       | 5 | 5   | 5 | 3 | 3 | 1 | 0 | 4 | 1 | 0 | 0 |
| Radiography abdomen and pelvis                       | May be appropriate                |                | ☹☹☹ 1-10 mSv | ☹☹☹ 0.3-3 mSv [ped] | 4 | n/a | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Radiography intravenous urography                    | Usually not appropriate           | Strong         | ☹☹☹ 1-10 mSv | ☹☹☹ 0.3-3 mSv [ped] | 3 | 3   | 5 | 3 | 4 | 3 | 1 | 1 | 0 | 0 | 0 |

|               |               |
|---------------|---------------|
| References    | Study Quality |
| 31 (12898174) | 1             |
| 32 (9836541)  | 1             |

|  |                         |         |         |               |   |   |   |   |   |   |   |   |   |   |   |
|--|-------------------------|---------|---------|---------------|---|---|---|---|---|---|---|---|---|---|---|
| MRI abdomen and pelvis without IV contrast | Usually not appropriate | Limited | ○ 0 mSv | ○ 0 mSv [ped] | 3 | 3 | 3 | 2 | 7 | 4 | 0 | 1 | 0 | 0 | 0 |
|--|-------------------------|---------|---------|---------------|---|---|---|---|---|---|---|---|---|---|---|

|               |               |
|---------------|---------------|
| References    | Study Quality |
| 25 (15900055) | 3             |
| 26 (8911161)  | 2             |

|   |                         |         |         |               |   |   |   |   |   |   |   |   |   |   |   |
|---|-------------------------|---------|---------|---------------|---|---|---|---|---|---|---|---|---|---|---|
| MRI abdomen and pelvis without and with IV contrast | Usually not appropriate | Limited | ○ 0 mSv | ○ 0 mSv [ped] | 3 | 3 | 4 | 3 | 5 | 5 | 0 | 0 | 0 | 0 | 0 |
|---|-------------------------|---------|---------|---------------|---|---|---|---|---|---|---|---|---|---|---|

|               |               |
|---------------|---------------|
| References    | Study Quality |
| 25 (15900055) | 3             |
| 26 (8911161)  | 2             |

|  |                         |                  |                |                       |   |   |   |   |   |   |   |   |   |   |   |
|--|-------------------------|------------------|----------------|-----------------------|---|---|---|---|---|---|---|---|---|---|---|
| MRU without IV contrast                            | Usually not appropriate | Limited          | 0 0 mSv        | 0 0 mSv [ped]         | 3 | 3 | 4 | 0 | 5 | 3 | 3 | 2 | 0 | 0 | 0 |
|  |                         | References       | Study Quality  |                       |   |   |   |   |   |   |   |   |   |   |   |
|  |                         | 26 (8911161)     | 2              |                       |   |   |   |   |   |   |   |   |   |   |   |
|  |                         | 28 (23532422)    | 3              |                       |   |   |   |   |   |   |   |   |   |   |   |
| MRU without and with IV contrast                   | Usually not appropriate | Limited          | 0 0 mSv        | 0 0 mSv [ped]         | 3 | 3 | 5 | 1 | 3 | 2 | 4 | 2 | 0 | 0 | 0 |
|  |                         | References       | Study Quality  |                       |   |   |   |   |   |   |   |   |   |   |   |
|  |                         | 27 (11133546)    | 2              |                       |   |   |   |   |   |   |   |   |   |   |   |
|  |                         | 28 (23532422)    | 3              |                       |   |   |   |   |   |   |   |   |   |   |   |
| CT abdomen and pelvis with IV contrast             | Usually not appropriate | Limited          | ☹☹☹ 1-10 mSv   | ☹☹☹☹ 3-10 mSv [ped]   | 2 | 2 | 4 | 5 | 6 | 1 | 1 | 0 | 0 | 0 | 0 |
|  |                         | References       | Study Quality  |                       |   |   |   |   |   |   |   |   |   |   |   |
|  |                         | 14 (27611106)    | 3              |                       |   |   |   |   |   |   |   |   |   |   |   |
|  |                         | 13 (30225609)    | 3              |                       |   |   |   |   |   |   |   |   |   |   |   |
|  |                         | 12 (24504541)    | 3              |                       |   |   |   |   |   |   |   |   |   |   |   |
| CT abdomen and pelvis without and with IV contrast | Usually not appropriate | Expert Consensus | ☹☹☹☹ 10-30 mSv | ☹☹☹☹☹ 10-30 mSv [ped] | 2 | 2 | 4 | 6 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| CTU without and with IV contrast                   | Usually not appropriate | Expert Consensus | ☹☹☹☹ 10-30 mSv | ☹☹☹☹☹ 10-30 mSv [ped] | 2 | 2 | 3 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |

**Variant 2: Acute onset flank pain in patient with known current stone disease, diagnosed on recent imaging. Recurrent symptoms of stone disease. Follow-up imaging.**

| Procedure                                 | Appropriateness Category | SOE    | Adults RRL   | Peds RRL            | Rating | Median | Final Tabulations |   |   |   |   |   |   |   |    |
|---|--------------------------|--------|--------------|---------------------|--------|--------|-------------------|---|---|---|---|---|---|---|----|
|   |                          |        |              |                     |        |        | 1                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  |
| CT abdomen and pelvis without IV contrast | Usually appropriate      | Strong | ☹☹☹ 1-10 mSv | ☹☹☹☹ 3-10 mSv [ped] | 9      | 9      | 0                 | 1 | 0 | 0 | 0 | 0 | 3 | 3 | 10 |

|  |                                   | References       | Study Quality  |                       |   |     |   |   |   |   |   |    |   |   |   |  |
|--|-----------------------------------|------------------|----------------|-----------------------|---|-----|---|---|---|---|---|----|---|---|---|--|
|  |                                   | 15 (8571915)     | 2              |                       |   |     |   |   |   |   |   |    |   |   |   |  |
|  |                                   | 16 (11110945)    | 1              |                       |   |     |   |   |   |   |   |    |   |   |   |  |
| US kidneys and bladder retroperitoneal               | May be appropriate                | Limited          | 0 0 mSv        | 0 0 mSv [ped]         | 6 | 6   | 0 | 0 | 0 | 2 | 4 | 10 | 1 | 0 | 0 |  |
|  |                                   | References       | Study Quality  |                       |   |     |   |   |   |   |   |    |   |   |   |  |
|  |                                   | 36 (27459091)    | 3              |                       |   |     |   |   |   |   |   |    |   |   |   |  |
| US color Doppler kidneys and bladder retroperitoneal | May be appropriate (Disagreement) | Expert Opinion   | 0 0 mSv        | 0 0 mSv [ped]         | 5 | 5   | 5 | 3 | 2 | 2 | 1 | 3  | 1 | 0 | 0 |  |
| CT abdomen and pelvis with IV contrast               | May be appropriate                | Limited          | ☼☼☼ 1-10 mSv   | ☼☼☼☼ 3-10 mSv [ped]   | 4 | 4   | 0 | 2 | 0 | 7 | 6 | 1  | 1 | 0 | 0 |  |
|  |                                   | References       | Study Quality  |                       |   |     |   |   |   |   |   |    |   |   |   |  |
|  |                                   | 45 (31300208)    | 3              |                       |   |     |   |   |   |   |   |    |   |   |   |  |
|  |                                   | 44 (25082439)    | 3              |                       |   |     |   |   |   |   |   |    |   |   |   |  |
|  |                                   | 43 (29675722)    | 3              |                       |   |     |   |   |   |   |   |    |   |   |   |  |
| Radiography abdomen and pelvis                       | May be appropriate                |                  | ☼☼☼ 1-10 mSv   | ☼☼☼ 0.3-3 mSv [ped]   | 4 | n/a | 0 | 0 | 0 | 0 | 0 | 0  | 0 | 0 | 0 |  |
| CT abdomen and pelvis without and with IV contrast   | Usually not appropriate           | Expert Consensus | ☼☼☼☼ 10-30 mSv | ☼☼☼☼☼ 10-30 mSv [ped] | 3 | 3   | 4 | 3 | 9 | 0 | 1 | 0  | 0 | 0 | 0 |  |
| CTU without and with IV contrast                     | Usually not appropriate           | Expert Consensus | ☼☼☼☼ 10-30 mSv | ☼☼☼☼☼ 10-30 mSv [ped] | 3 | 3   | 1 | 1 | 7 | 5 | 2 | 0  | 1 | 0 | 0 |  |
| MRI abdomen and pelvis without IV contrast           | Usually not appropriate           | Expert Consensus | 0 0 mSv        | 0 0 mSv [ped]         | 3 | 3   | 5 | 1 | 6 | 4 | 0 | 1  | 0 | 0 | 0 |  |
| MRI abdomen and pelvis without and with IV contrast  | Usually not appropriate           | Expert Consensus | 0 0 mSv        | 0 0 mSv [ped]         | 3 | 3   | 5 | 2 | 7 | 2 | 1 | 0  | 0 | 0 | 0 |  |
| MRU without IV contrast                              | Usually not appropriate           | Expert Consensus | 0 0 mSv        | 0 0 mSv [ped]         | 3 | 3   | 4 | 1 | 4 | 5 | 2 | 1  | 0 | 0 | 0 |  |

|                                   |                         |                  |               |                     |   |   |   |   |   |   |   |   |   |   |   |  |
|-----------------------------------|-------------------------|------------------|---------------|---------------------|---|---|---|---|---|---|---|---|---|---|---|--|
| MRU without and with IV contrast  | Usually not appropriate | Limited          | ○ 0 mSv       | ○ 0 mSv [ped]       | 3 | 3 | 5 | 0 | 5 | 4 | 1 | 2 | 0 | 0 | 0 |  |
|                                   |                         | References       | Study Quality |                     |   |   |   |   |   |   |   |   |   |   |   |  |
|                                   |                         | 28 (23532422)    | 3             |                     |   |   |   |   |   |   |   |   |   |   |   |  |
| Radiography intravenous urography | Usually not appropriate | Expert Consensus | ☼☼☼ 1-10 mSv  | ☼☼☼ 0.3-3 mSv [ped] | 2 | 2 | 5 | 5 | 3 | 3 | 0 | 1 | 0 | 0 | 0 |  |

**Variant 3: Pregnant patient. Acute onset flank pain. Suspicion of stone disease. Initial or follow-up imaging.**

| Procedure  | Appropriateness Category          | SOE            | Adults RRL    | Peds RRL            | Rating | Median | Final Tabulations |   |   |   |   |   |   |   |   |  |
|--|-----------------------------------|----------------|---------------|---------------------|--------|--------|-------------------|---|---|---|---|---|---|---|---|--|
|  |                                   |                |               |                     |        |        | 1                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |  |
| US kidneys and bladder retroperitoneal               | Usually appropriate               | Limited        | ○ 0 mSv       | ○ 0 mSv [ped]       | 7      | 7      | 0                 | 0 | 0 | 0 | 0 | 3 | 7 | 3 | 4 |  |
|  |                                   | References     | Study Quality |                     |        |        |                   |   |   |   |   |   |   |   |   |  |
|  |                                   | 54 (23771120)  | 4             |                     |        |        |                   |   |   |   |   |   |   |   |   |  |
|  |                                   | 53 (20833847)  | 4             |                     |        |        |                   |   |   |   |   |   |   |   |   |  |
|  |                                   | 52 (15075842)  | 4             |                     |        |        |                   |   |   |   |   |   |   |   |   |  |
| CT abdomen and pelvis without IV contrast            | May be appropriate                | Limited        | ☼☼☼ 1-10 mSv  | ☼☼☼☼ 3-10 mSv [ped] | 6      | 6      | 0                 | 0 | 1 | 3 | 2 | 8 | 3 | 0 | 0 |  |
|  |                                   | References     | Study Quality |                     |        |        |                   |   |   |   |   |   |   |   |   |  |
|  |                                   | 47 (18042011)  | 4             |                     |        |        |                   |   |   |   |   |   |   |   |   |  |
| MRU without IV contrast                              | May be appropriate                | Limited        | ○ 0 mSv       | ○ 0 mSv [ped]       | 5      | 5      | 1                 | 1 | 1 | 0 | 9 | 4 | 0 | 1 | 0 |  |
|  |                                   | References     | Study Quality |                     |        |        |                   |   |   |   |   |   |   |   |   |  |
|  |                                   | 50 (17954650)  | 4             |                     |        |        |                   |   |   |   |   |   |   |   |   |  |
|  |                                   | 49 (15126809)  | 3             |                     |        |        |                   |   |   |   |   |   |   |   |   |  |
|  |                                   | 48 (8544647)   | 2             |                     |        |        |                   |   |   |   |   |   |   |   |   |  |
| US color Doppler kidneys and bladder retroperitoneal | May be appropriate (Disagreement) | Expert Opinion | ○ 0 mSv       | ○ 0 mSv [ped]       | 5      | 5      | 4                 | 2 | 2 | 0 | 1 | 1 | 3 | 4 | 0 |  |

|  |                         |                  |                |                       |   |     |    |   |   |   |   |   |   |   |   |
|--|-------------------------|------------------|----------------|-----------------------|---|-----|----|---|---|---|---|---|---|---|---|
| MRI abdomen and pelvis without IV contrast         | Usually not appropriate | Expert Consensus | ○ 0 mSv        | ○ 0 mSv [ped]         | 2 | 2   | 5  | 6 | 3 | 0 | 1 | 1 | 1 | 0 | 0 |
| Radiography abdomen and pelvis                     | Usually not appropriate |                  | ⊗⊗⊗ 1-10 mSv   | ⊗⊗⊗ 0.3-3 mSv [ped]   | 2 | n/a | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CT abdomen and pelvis with IV contrast             | Usually not appropriate | Expert Consensus | ⊗⊗⊗ 1-10 mSv   | ⊗⊗⊗⊗ 3-10 mSv [ped]   | 1 | 1   | 11 | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 0 |
| CT abdomen and pelvis without and with IV contrast | Usually not appropriate | Expert Consensus | ⊗⊗⊗⊗ 10-30 mSv | ⊗⊗⊗⊗⊗ 10-30 mSv [ped] | 1 | 1   | 10 | 4 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| CTU without and with IV contrast                   | Usually not appropriate | Expert Consensus | ⊗⊗⊗⊗ 10-30 mSv | ⊗⊗⊗⊗⊗ 10-30 mSv [ped] | 1 | 1   | 11 | 1 | 3 | 0 | 1 | 1 | 0 | 0 | 0 |
| Radiography intravenous urography                  | Usually not appropriate | Limited          | ⊗⊗⊗ 1-10 mSv   | ⊗⊗⊗ 0.3-3 mSv [ped]   | 1 | 1   | 11 | 0 | 4 | 1 | 1 | 0 | 0 | 0 | 0 |

|              |               |
|--------------|---------------|
| References   | Study Quality |
| 51 (1433534) | 4             |

|   |                         |                  |         |               |   |   |    |   |   |   |   |   |   |   |   |
|---|-------------------------|------------------|---------|---------------|---|---|----|---|---|---|---|---|---|---|---|
| MRI abdomen and pelvis without and with IV contrast | Usually not appropriate | Expert Consensus | ○ 0 mSv | ○ 0 mSv [ped] | 1 | 1 | 13 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| MRU without and with IV contrast                    | Usually not appropriate | Expert Consensus | ○ 0 mSv | ○ 0 mSv [ped] | 1 | 1 | 12 | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 0 |

**Variant 4: Acute onset flank pain. Suspicion of stone disease. CT without contrast is inconclusive for the presence of stones. Next imaging study.**

| Procedure                        | Appropriateness Category | SOE              | Adults RRL     | Peds RRL              | Rating | Median | Final Tabulations |   |   |   |   |   |   |   |   |
|----------------------------------|--------------------------|------------------|----------------|-----------------------|--------|--------|-------------------|---|---|---|---|---|---|---|---|
|                                  |                          |                  |                |                       |        |        | 1                 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| CTU without and with IV contrast | May be appropriate       | Expert Consensus | ⊗⊗⊗⊗ 10-30 mSv | ⊗⊗⊗⊗⊗ 10-30 mSv [ped] | 6      | 6      | 0                 | 0 | 0 | 1 | 5 | 9 | 2 | 0 | 0 |



## **Appendix Key**

A more complete discussion of the items presented below can be found by accessing the supporting documents at the designated hyperlinks.

**Appropriateness Category:** The panel's recommendation for a procedure based on the assessment of the risks and benefits of performing the procedure for the specified clinical scenario.

**SOE:** Strength of Evidence. The assessment of the amount and quality of evidence found in the peer reviewed medical literature for an appropriateness recommendation.

- **References:** The citation number and PMID for the reference(s) associated with the recommendation.
- **Study Quality:** The assessment of the quality of an individual reference based on the number of study quality elements described in the reference.

**RRL:** Relative Radiation Level. A population based assessment of the amount of radiation a typical patient may be exposed to during the specified procedure.

**Rating:** The final rating (1-9 scale) for the procedure as determined by the panel during rating rounds.

**Median:** The median rating (1-9 scale) for the procedure as determined by the panel during rating rounds.

**Final tabulations:** A histogram showing the number of panel members who rated the procedure as noted in the column heading (ie, 1, 2, 3, etc.).

Additional supporting documents about the AC methodology and processes can be found at [www.acr.org/ac](http://www.acr.org/ac).