American College of Radiology
ACR Appropriateness Criteria®

Renal Failure

Variant 1: Renal failure. Acute kidney injury (AKI), unspecified. Initial imaging.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
US kidneys retroperitoneal	Usually appropriate	Strong	O 0 mSv	O 0 mSv [ped]	8	8	0	0	0	0	1	1	1	6	8

References	Study Quality
31 (26581096)	3
27 (26283754)	4
4 (24011084)	3
30 (23751145)	3
28 (12008814)	4
29 (21098348)	3
3 ()	4
26 (416685)	2

US duplex Doppler kidneys retroperitoneal	May be appropriate	Strong	O 0 mSv	O 0 mSv [ped]	6	6	0	0	1	1	3	8	2	0	0

References	Study Quality
34 (27133237)	2
36 (26728776)	2
35 (25746587)	Good
4 (24011084)	3
33 (23731713)	2
37 (22771884)	3

	32 (22595689)	2														
	17 (15458458)	3														
CT abdomen and pelvis without IV contrast	May be appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	5	5	0	0	0	4	9	2	0	0	0
	References	Study Quality														
	16 (22578224)	3														
	15 (12819916)	2														
MRI abdomen without IV contrast	May be appropriate	Limited	O 0 mSv	O 0 mSv [ped]	4	4	3	2	2	7	2	0	1	0	0
	References	Study Quality														
	21 (27362585)	3														
	22 (26925411)	4														
	23 (10739798)	4														
MRI abdomen and pelvis without IV contrast	May be appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	4	4	2	2	3	5	5	0	0	0	0
MRA abdomen without IV contrast	May be appropriate	Strong	O 0 mSv	O 0 mSv [ped]	4	4	2	2	1	5	6	1	0	0	0
	References	Study Quality														
	4 (24011084)	3														
	9 (-3132600)	4														
	18 (21542417)	2														
	19 (25539255)	1														
	17 (15458458)	3														
	20 (23550187)	2														
MAG3 renal scan	May be appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	4	4	2	1	5	7	1	1	0	0	0
	References	Study Quality														
	25 (11852301)	4														
CT abdomen without IV contrast	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	3	3	4	3	5	2	2	0	1	0	0

MRU without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	4	3	2	4	1	1	0	0	0
CTA abdomen and pelvis with IV contrast	Usually not appropriate	Limited	☢☢☢☢ 10-30 mSv		2	2	8	3	2	4	0	0	0	0	0

References	Study Quality
9 (-3132600)	4

MRI abdomen without and with IV contrast	Usually not appropriate	Limited	O 0 mSv	O 0 mSv [ped]	2	2	7	7	2	1	0	0	0	0	0

References	Study Quality
21 (27362585)	3
22 (26925411)	4
23 (10739798)	4

MRI abdomen and pelvis without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	2	2	8	5	2	1	0	1	0	0	0
MRA abdomen without and with IV contrast	Usually not appropriate	Strong	O 0 mSv	O 0 mSv [ped]	2	2	8	2	3	2	2	0	0	0	0

References	Study Quality
4 (24011084)	3
9 (-3132600)	4
18 (21542417)	2
19 (25539255)	1
17 (15458458)	3
20 (23550187)	2

MRU without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	2	2	7	6	0	4	0	0	0	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
DMSA renal scan	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	2	2	4	7	4	2	0	0	0	0	0

CT abdomen with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	1	1	10	3	3	0	1	0	0	0	0
CT abdomen without and with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	1	1	10	2	4	0	1	0	0	0	0
CT abdomen and pelvis with IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	1	1	9	5	3	0	0	0	0	0	0

References	Study Quality
16 (22578224)	3
15 (12819916)	2

CT abdomen and pelvis without and with IV contrast	Usually not appropriate	Limited	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	1	1	10	4	3	0	0	0	0	0	0

References	Study Quality
16 (22578224)	3
15 (12819916)	2

CTU without and with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	1	1	10	5	2	0	0	0	0	0	0
Arteriography kidney	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv		1	1	12	2	2	0	1	0	0	0	0

Variant 2: Renal failure. Chronic kidney disease (CKD). Initial imaging.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
US kidneys retroperitoneal	Usually appropriate	Limited	O 0 mSv	O 0 mSv [ped]	8	8	0	0	0	2	3	1	1	5	5

References	Study Quality

30 (23751145)	3															
43 (20651174)	2															
6 (25730699)	4															
8 (26391748)	4															
42 (27796695)	3															
39 (26610178)	4															
44 (-3163170)	4															
CT abdomen and pelvis without IV contrast	May be appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	4	4	0	0	1	10	2	2	0	0	0	
References	Study Quality															
16 (22578224)	3															
15 (12819916)	2															
MRI abdomen without IV contrast	May be appropriate	Limited	O 0 mSv	O 0 mSv [ped]	4	4	3	2	3	6	2	1	0	0	0	
References	Study Quality															
21 (27362585)	3															
22 (26925411)	4															
9 (-3132600)	4															
MRA abdomen without IV contrast	May be appropriate	Strong	O 0 mSv	O 0 mSv [ped]	4	4	1	1	2	7	5	1	0	0	0	
References	Study Quality															
9 (-3132600)	4															
18 (21542417)	2															
19 (25539255)	1															
39 (26610178)	4															
US duplex Doppler kidneys retroperitoneal	May be appropriate	Limited	O 0 mSv	O 0 mSv [ped]	4	4	1	1	4	5	3	1	0	0	0	
References	Study Quality															
37 (22771884)	3															

CT abdomen without IV contrast	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	3	3	5	3	2	2	4	1	0	0	0
MRI abdomen and pelvis without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	6	0	4	2	4	1	0	0	0
MRA abdomen without and with IV contrast	Usually not appropriate	Strong	O 0 mSv	O 0 mSv [ped]	3	3	4	2	4	3	4	0	0	0	0

References	Study Quality
9 (-3132600)	4
18 (21542417)	2
19 (25539255)	1
39 (26610178)	4

CTA abdomen and pelvis with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv		2	2	7	2	3	5	0	0	0	0	0
MRI abdomen and pelvis without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	2	2	8	2	4	2	1	0	0	0	0
MRU without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	2	2	5	5	1	2	1	1	0	0	0
MAG3 renal scan	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	2	2	7	2	5	2	1	0	0	0	0
DMSA renal scan	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	2	2	8	2	4	1	1	1	0	0	0
CT abdomen with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	1	1	12	3	2	0	0	0	0	0	0
CT abdomen without and with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	1	1	10	3	3	1	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	9	4	3	0	0	1	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	5	2	0	0	0	0	0	0
CTU without and with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	1	1	11	3	3	0	0	0	0	0	0
Arteriography kidney	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		1	1	10	3	3	1	0	0	0	0	0

References	Study Quality
38 ()	4

MRI abdomen without and with IV contrast	Usually not appropriate	Limited	O 0 mSv	O 0 mSv [ped]	1	1	9	2	4	1	1	0	0	0	0

References	Study Quality
21 (27362585)	3
22 (26925411)	4
9 (-3132600)	4

MRU without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	9	3	4	0	0	1	0	0	0
Radiography abdomen and pelvis	Usually not appropriate		☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	1	n/a	0	0	0	0	0	0	0	0	0

Variant 3: Renal failure. Kidney disease of unknown duration. Initial imaging.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
US kidneys retroperitoneal	Usually appropriate	Strong	O 0 mSv	O 0 mSv [ped]	9	9	0	0	0	0	2	0	1	3	11

References	Study Quality
31 (26581096)	3

References	Study Quality
27 (26283754)	4
4 (24011084)	3
30 (23751145)	3
28 (12008814)	4
29 (21098348)	3
3 ()	4
26 (416685)	2

CT abdomen and pelvis without IV contrast	May be appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	5	5	0	0	0	4	8	2	1	0	0

References	Study Quality
16 (22578224)	3
15 (12819916)	2

US duplex Doppler kidneys retroperitoneal	May be appropriate (Disagreement)	Expert Opinion	O 0 mSv	O 0 mSv [ped]	5	5	0	0	0	4	7	2	2	2	0

References	Study Quality
34 (27133237)	2
36 (26728776)	2
35 (25746587)	Good
4 (24011084)	3
33 (23731713)	2
37 (22771884)	3
32 (22595689)	2
17 (15458458)	3

MRI abdomen without IV contrast	May be appropriate	Limited	O 0 mSv	O 0 mSv [ped]	4	4	2	4	2	7	1	0	0	1	0

References	Study Quality
21 (27362585)	3
22 (26925411)	4
23 (10739798)	4

MRI abdomen and pelvis without IV contrast	May be appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	4	4	2	4	2	4	4	0	0	1	0
MRA abdomen without IV contrast	May be appropriate	Strong	O 0 mSv	O 0 mSv [ped]	4	4	3	0	4	8	1	0	1	0	0

References	Study Quality
4 (24011084)	3
19 (25539255)	1
17 (15458458)	3
20 (23550187)	2

CT abdomen without IV contrast	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	3	3	4	4	3	2	2	1	1	0	0
MRA abdomen without and with IV contrast	Usually not appropriate	Limited	O 0 mSv	O 0 mSv [ped]	3	3	7	1	2	6	1	0	0	0	0

References	Study Quality
4 (24011084)	3
9 (-3132600)	4
18 (21542417)	2
19 (25539255)	1
17 (15458458)	3
20 (23550187)	2

MRU without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	4	3	1	3	2	2	0	0	0
MRU without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	2	2	8	4	2	3	0	0	0	0	0
MAG3 renal scan	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	2	2	7	3	4	2	1	0	0	0	0
DMSA renal scan	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	2	2	7	4	2	3	1	0	0	0	0

CT abdomen with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	1	1	11	4	2	0	0	0	0	0	0
CT abdomen without and with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	1	1	10	4	2	0	1	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	10	5	2	0	0	0	0	0	0
CT abdomen and pelvis without and with IV contrast	Usually not appropriate	Limited	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	1	1	9	6	2	0	0	0	0	0	0

References	Study Quality
16 (22578224)	3
15 (12819916)	2

CTA abdomen and pelvis with IV contrast	Usually not appropriate	Limited	☢☢☢☢ 10-30 mSv		1	1	9	2	3	3	0	0	0	0	0

References	Study Quality
9 (-3132600)	4

CTU without and with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	1	1	10	3	4	0	0	0	0	0	0
Arteriography kidney	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv		1	1	12	2	3	0	0	0	0	0	0
MRI abdomen without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	9	2	5	1	0	0	0	0	0
MRI abdomen and pelvis without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	9	1	4	3	0	0	0	0	0
Radiography abdomen and pelvis	Usually not appropriate		☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	1	n/a	0	0	0	0	0	0	0	0	0

Variant 4: Renal failure. Neurogenic bladder. Initial imaging.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
US kidneys retroperitoneal	Usually appropriate	Limited	O 0 mSv	O 0 mSv [ped]	8	8	0	0	0	1	2	2	3	1	8

References	Study Quality
54 (23073657)	4
56 (29339880)	4
53 (29072046)	4
48 (26304502)	4
49 (26067125)	4
52 (24706504)	3
55 (22177149)	4

CT abdomen and pelvis without IV contrast	May be appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	5	5	0	0	0	4	8	3	0	0	0

References	Study Quality
16 (22578224)	3

MRI abdomen and pelvis without IV contrast	May be appropriate	Limited	O 0 mSv	O 0 mSv [ped]	4	4	2	2	3	4	4	1	1	0	0

References	Study Quality
50 (26266405)	4

DMSA renal scan	May be appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	4	4	1	2	3	7	3	1	0	0	0

References	Study Quality
52 (24706504)	3
51 (21484032)	2

CT abdomen without IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	3	3	4	2	5	4	1	0	1	0	0
	References		Study Quality												
	16 (22578224)		3												
US duplex Doppler kidneys retroperitoneal	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	4	1	5	2	3	1	0	0	1
Fluoroscopy voiding cystourethrography	Usually not appropriate	Expert Consensus	☢☢ 0.1-1mSv	☢☢ 0.03-0.3 mSv [ped]	2	2	7	6	2	0	0	0	0	0	0
MRI abdomen without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	2	2	6	3	5	1	1	0	1	0	0
CT abdomen with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	1	1	10	2	3	1	1	0	0	0	0
CT abdomen without and with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	1	1	10	4	1	1	1	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	10	4	1	1	1	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]	1	1	10	4	1	1	1	0	0	0	0
CTA abdomen and pelvis with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv		1	1	10	4	0	1	2	0	0	0	0
CTU without and with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	1	1	10	4	1	1	1	0	0	0	0
Fluoroscopy cystography	Usually not appropriate	Expert Opinion	☢☢☢ 1-10 mSv		1	1	9	4	1	1	0	0	0	0	0

MRI abdomen without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	9	3	2	1	2	0	0	0	0
MRI abdomen and pelvis without and with IV contrast	Usually not appropriate	Limited	O 0 mSv	O 0 mSv [ped]	1	1	9	3	1	3	1	0	0	0	0

References	Study Quality
50 (26266405)	4

MRU without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	8	1	1	4	1	0	0	0	0
MRU without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	10	2	1	2	2	0	0	0	0
MAG3 renal scan	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	1	1	9	2	4	2	0	0	0	0	0
Radiography abdomen and pelvis	Usually not appropriate		☢☢☢ 1-10 mSv	☢☢☢ 0.3-3 mSv [ped]	1	n/a	0	0	0	0	0	0	0	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.**