American College of Radiology
ACR Appropriateness Criteria®

Imaging After Shoulder Arthroplasty

Variant 1: Routine follow-up of the asymptomatic patient with a primary shoulder arthroplasty.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
Radiography shoulder	Usually appropriate	Limited	☢ <0.1 mSv		9	9	0	0	0	0	0	0	1	0	10

References	Study Quality
10 (24618199)	4
13 (22309766)	4
14 (22930212)	3
18 (23473606)	2
16 (30473242)	4
15 (28131693)	4
17 (28111179)	3

CT shoulder with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv		1	1	11	0	0	0	0	0	0	0	0
CT shoulder without IV contrast	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv		1	1	10	0	0	0	1	0	0	0	0
CT shoulder without and with IV contrast	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv		1	1	11	0	0	0	0	0	0	0	0
MRI shoulder without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	11	0	0	0	0	0	0	0	0
MRI shoulder without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	11	0	0	0	0	0	0	0	0

Bone scan shoulder	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv		1	1	11	0	0	0	0	0	0	0	0
US shoulder	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	11	0	0	0	0	0	0	0	0
Fluoride PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv		1	1	11	0	0	0	0	0	0	0	0
3-phase bone scan with SPECT or SPECT/CT shoulder	Usually not appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	1	1	10	1	0	0	0	0	0	0	0

References	Study Quality
12 (26652693)	4

Variant 2: Symptomatic patient with a primary shoulder arthroplasty. Initial imaging.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
Radiography shoulder	Usually appropriate	Limited	☢ <0.1 mSv		9	9	0	0	0	0	0	0	0	0	14

References	Study Quality
10 (24618199)	4
13 (22309766)	4
24 (30241984)	4

CT shoulder with IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		1	1	14	0	0	0	0	0	0	0	0

References	Study Quality
23 (20036583)	4

CT shoulder without IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		1	1	12	1	1	0	0	0	0	0	0

References	Study Quality
23 (20036583)	4

CT shoulder without and with IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		1	1	14	0	0	0	0	0	0	0	0
	References		Study Quality												
	23 (20036583)		4												
MRI shoulder without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	13	1	0	0	0	0	0	0	0
MRI shoulder without and with IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	1	1	14	0	0	0	0	0	0	0	0
Bone scan shoulder	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		1	1	14	0	0	0	0	0	0	0	0
	References		Study Quality												
	21 (19038601)		4												
	22 (536788)		4												
US shoulder	Usually not appropriate	Limited	O 0 mSv	O 0 mSv [ped]	1	1	12	1	0	1	0	0	0	0	0
	References		Study Quality												
	25 (1515896)		4												
Fluoride PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv		1	1	14	0	0	0	0	0	0	0	0
3-phase bone scan with SPECT or SPECT/CT shoulder	Usually not appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	1	1	13	1	0	0	0	0	0	0	0
	References		Study Quality												
	34 (19605662)		4												

Variant 3: Symptomatic patient with a primary shoulder arthroplasty, infection not excluded. Additional imaging following radiographs.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
Image-guided aspiration shoulder	Usually appropriate	Limited	Varies	Varies	9	9	0	0	0	0	0	0	0	0	14

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9

References	Study Quality
35 (24293800)	4
34 (19605662)	4
36 (31563506)	3

MRI shoulder without and with IV contrast	May be appropriate	Limited	O 0 mSv	O 0 mSv [ped]	6	6	1	0	0	1	5	3	2	0	2

References	Study Quality
37 (21862766)	3
39 (12195247)	3
28 (19884021)	4
38 (25264437)	4

MRI shoulder without IV contrast	May be appropriate (Disagreement)	Expert Opinion	O 0 mSv	O 0 mSv [ped]	5	5	5	1	0	2	2	1	1	1	1

References	Study Quality
37 (21862766)	3
39 (12195247)	3
28 (19884021)	4
38 (25264437)	4

3-phase bone scan and WBC scan and sulfur colloid scan shoulder	May be appropriate	Limited	☢☢☢☢ 10-30 mSv		5	5	2	0	0	4	7	0	1	0	0

References	Study Quality
21 (19038601)	4
11 (16702459)	4
22 (536788)	4
30 (30193652)	4

US shoulder	May be appropriate	Limited	O 0 mSv	O 0 mSv [ped]	5	5	0	0	1	1	8	2	2	0	0

References	Study Quality
41 (12646465)	4
40 (12720010)	4
42 (23971477)	4

WBC scan and sulfur colloid scan shoulder	May be appropriate (Disagreement)	Expert Opinion	☢☢☢☢ 10-30 mSv		5	5	2	0	0	0	8	3	1	0	0

References	Study Quality
41 (12646465)	4
40 (12720010)	4
42 (23971477)	4

3-phase bone scan and WBC scan and sulfur colloid scan with SPECT or SPECT/CT shoulder	May be appropriate	Limited	☢☢☢☢ 10-30 mSv		5	5	0	0	1	0	7	3	1	1	0

References	Study Quality
21 (19038601)	4
11 (16702459)	4
22 (536788)	4
30 (30193652)	4
33 (32657859)	4
31 (33289359)	2
32 (33361187)	3

CT shoulder with IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		3	3	7	0	0	3	4	0	0	0	0

References	Study Quality
3 (17015609)	4

Bone scan shoulder	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		3	3	6	1	3	4	0	0	0	0	0

References	Study Quality
21 (19038601)	4

		22 (536788)		4											
		30 (30193652)		4											
3-phase bone scan with SPECT or SPECT/CT shoulder	Usually not appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	3	3	4	1	5	3	1	0	0	0	0
		References		Study Quality											
		21 (19038601)		4											
		22 (536788)		4											
		30 (30193652)		4											
		20 (-3194396)		3											
CT shoulder without IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		1	1	8	1	1	2	2	0	0	0	0
		References		Study Quality											
		3 (17015609)		4											
CT shoulder without and with IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		1	1	12	2	0	0	0	0	0	0	0
		References		Study Quality											
		3 (17015609)		4											
Fluoride PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv		1	1	14	0	0	0	0	0	0	0	0

Variant 4: Symptomatic patient with a primary shoulder arthroplasty, infection excluded. Suspected loosening. Additional imaging following radiographs.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
CT shoulder without IV contrast	Usually appropriate	Strong	☢☢☢ 1-10 mSv		8	8	0	0	0	0	0	0	2	9	3
		References		Study Quality											
		50 (23479714)		4											
		10 (24618199)		4											
		47 (24286563)		3											

		55 (23412251)	4													
		53 (20551186)	1													
		57 (26234665)	3													
		54 (28561262)	4													
		49 (29426742)	4													
		51 (28796543)	2													
		52 (27186794)	2													
		56 (25922110)	2													
		48 (32364883)	4													
MRI shoulder without IV contrast	Usually appropriate	Limited	O 0 mSv	O 0 mSv [ped]	8	8	0	0	0	0	1	0	3	7	3	
		References	Study Quality													
		37 (21862766)	3													
		39 (12195247)	3													
		58 (16829248)	4													
		38 (25264437)	4													
US shoulder	May be appropriate (Disagreement)	Expert Opinion	O 0 mSv	O 0 mSv [ped]	5	5	5	0	1	1	4	3	0	0	0	
		References	Study Quality													
		10 (24618199)	4													
3-phase bone scan with SPECT or SPECT/CT shoulder	May be appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	5	5	0	0	5	1	7	1	0	0	0	
		References	Study Quality													
		21 (19038601)	4													
		22 (536788)	4													
		30 (30193652)	4													
		20 (-3194396)	3													
Bone scan shoulder	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		3	3	3	1	5	1	2	2	0	0	0	
		References	Study Quality													

		21 (19038601)		4											
		30 (30193652)		4											
CT shoulder with IV contrast	Usually not appropriate	Strong	☢☢☢ 1-10 mSv		1	1	13	1	0	0	0	0	0	0	0
		References		Study Quality											
		50 (23479714)		4											
		10 (24618199)		4											
		47 (24286563)		3											
		55 (23412251)		4											
		53 (20551186)		1											
		57 (26234665)		3											
		54 (28561262)		4											
		49 (29426742)		4											
		51 (28796543)		2											
		52 (27186794)		2											
		56 (25922110)		2											
		48 (32364883)		4											
CT shoulder without and with IV contrast	Usually not appropriate	Strong	☢☢☢ 1-10 mSv		1	1	13	1	0	0	0	0	0	0	0
		References		Study Quality											
		50 (23479714)		4											
		10 (24618199)		4											
		47 (24286563)		3											
		55 (23412251)		4											
		53 (20551186)		1											
		57 (26234665)		3											
		54 (28561262)		4											
		49 (29426742)		4											
		51 (28796543)		2											
		52 (27186794)		2											
		56 (25922110)		2											

		48 (32364883)		4											
MRI shoulder without and with IV contrast	Usually not appropriate	Limited	O 0 mSv	O 0 mSv [ped]	1	1	12	0	0	0	2	0	0	0	0
		References		Study Quality											
		37 (21862766)		3											
		39 (12195247)		3											
		58 (16829248)		4											
		38 (25264437)		4											
Fluoride PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv		1	1	14	0	0	0	0	0	0	0	0

Variant 5: Symptomatic patient with a primary shoulder arthroplasty, infection excluded. Suspected rotator cuff tear or other soft tissue abnormality. Additional imaging following radiographs.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
MRI shoulder without IV contrast	Usually appropriate	Limited	O 0 mSv	O 0 mSv [ped]	9	9	0	0	0	0	1	1	1	4	7
		References		Study Quality											
		37 (21862766)		3											
		10 (24618199)		4											
		39 (12195247)		3											
		58 (16829248)		4											
		63 (16979047)		3											
		38 (25264437)		4											
US shoulder	Usually appropriate	Limited	O 0 mSv	O 0 mSv [ped]	9	9	0	1	0	0	0	1	0	2	10
		References		Study Quality											
		41 (12646465)		4											
		63 (16979047)		3											

		64 (29396098)		4											
CT arthrography shoulder	Usually appropriate	Limited	☢☢☢☢ 10-30 mSv		7	7	1	0	0	0	4	2	4	3	0
		References		Study Quality											
		10 (24618199)		4											
		59 (3715028)		4											
		61 (15829828)		3											
		60 (8020238)		4											
CT shoulder with IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		1	1	12	0	1	0	0	1	0	0	0
		References		Study Quality											
		62 (30268356)		3											
CT shoulder without IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		1	1	9	3	0	1	0	0	0	0	0
		References		Study Quality											
		62 (30268356)		3											
CT shoulder without and with IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv		1	1	13	1	0	0	0	0	0	0	0
		References		Study Quality											
		62 (30268356)		3											
MRI shoulder without and with IV contrast	Usually not appropriate	Limited	O 0 mSv		O 0 mSv [ped]	1	1	11	0	1	0	0	1	0	1	0
		References		Study Quality											
		37 (21862766)		3											
		10 (24618199)		4											
		39 (12195247)		3											
		58 (16829248)		4											
		63 (16979047)		3											
		38 (25264437)		4											

Bone scan shoulder	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv		1	1	13	0	0	0	0	0	0	1	0
Fluoride PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	☢☢☢☢ 10-30 mSv		1	1	13	1	0	0	0	0	0	0	0
3-phase bone scan with SPECT or SPECT/CT shoulder	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	1	1	13	0	0	0	0	0	0	1	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.**