

American College of Radiology
ACR Appropriateness Criteria®

Liver Lesion — Initial Characterization

Variant 1: Indeterminate, greater than 1 cm liver lesion on initial imaging with US. Normal liver. No suspicion or evidence of extrahepatic malignancy or underlying liver disease.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
MRI abdomen without and with IV contrast	Usually appropriate	Strong	O 0 mSv	O 0 mSv [ped]	8	8	0	0	0	0	0	0	3	7	7
		References		Study Quality											
		11 (24270109)		4											
		12 (18580333)		1											
		15 (21597893)		2											
		16 (22194486)		3											
		19 (20578020)		2											
		14 (19673015)		3											
		18 (25971695)		4											
		10 (23776623)		4											
CT abdomen with IV contrast multiphase	Usually appropriate	Strong	☢☢☢☢ 10-30 mSv		8	8	0	0	0	0	0	0	8	8	1
		References		Study Quality											
		11 (24270109)		4											
		9 (19542399)		2											
		13 (19688670)		3											
		12 (18580333)		1											
		10 (23776623)		4											

		13 (19688670)	3												
		12 (18580333)	1												
		10 (23776623)	4												
CT abdomen without and with IV contrast	Usually not appropriate	Strong	☼☼☼☼ 10-30 mSv	☼☼☼☼☼ 10-30 mSv [ped]	3	3	1	7	6	2	2	0	0	0	0
		References	Study Quality												
		11 (24270109)	4												
		9 (19542399)	2												
		13 (19688670)	3												
		12 (18580333)	1												
		10 (23776623)	4												
Image-guided biopsy liver	Usually not appropriate	Limited	Varies	Varies	2	2	3	7	8	0	0	0	0	0	0
		References	Study Quality												
		21 (27623001)	4												
		20 (28119260)	4												
		28 (27080009)	4												
		23 (27017289)	3												
		22 (26649339)	3												
		26 (24531352)	3												
		25 (23980215)	3												
		4 (28927870)	4												
		24 (29299367)	3												
		27 (26847020)	4												
Liver spleen scan	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv		2	2	8	5	3	0	1	0	0	0	0
RBC scan abdomen and pelvis	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv		2	2	8	4	3	1	1	0	0	0	0
Octreotide scan with SPECT or SPECT/CT chest and abdomen	Usually not appropriate	Expert Consensus	☼☼☼☼ 10-30 mSv		1	1	12	2	2	0	1	0	0	0	0

US abdomen	May be appropriate (Disagreement)	Expert Opinion	0 0 mSv	0 0 mSv [ped]	5	5	0	0	3	6	6	1	1	0	1
		References		Study Quality											
		9 (19542399)		2											
		29 (19666405)		3											
CT abdomen without and with IV contrast	Usually not appropriate	Strong	⊕⊕⊕⊕ 10-30 mSv	⊕⊕⊕⊕⊕ 10-30 mSv [ped]	3	3	0	8	8	2	0	0	0	0	0
		References		Study Quality											
		9 (19542399)		2											
		12 (18580333)		1											
		10 (23776623)		4											
Image-guided biopsy liver	Usually not appropriate	Limited	Varies	Varies	3	3	4	4	5	3	2	0	0	0	0
		References		Study Quality											
		21 (27623001)		4											
		20 (28119260)		4											
		28 (27080009)		4											
		23 (27017289)		3											
		22 (26649339)		3											
		26 (24531352)		3											
		25 (23980215)		3											
		24 (29299367)		3											
		27 (26847020)		4											
Liver spleen scan	Usually not appropriate	Expert Consensus	⊕⊕⊕ 1-10 mSv		1	1	10	2	2	1	1	0	1	0	0
Octreotide scan with SPECT or SPECT/CT chest and abdomen	Usually not appropriate	Expert Consensus	⊕⊕⊕⊕ 10-30 mSv		1	1	11	3	2	0	0	1	0	0	0
FDG-PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	⊕⊕⊕⊕ 10-30 mSv	⊕⊕⊕⊕⊕ 3-10 mSv [ped]	1	1	10	4	2	0	1	0	0	0	0

			20 (28119260)	4														
			28 (27080009)	4														
			23 (27017289)	3														
			22 (26649339)	3														
			26 (24531352)	3														
			25 (23980215)	3														
			24 (29299367)	3														
			27 (26847020)	4														
FDG-PET/CT skull base to mid-thigh	May be appropriate	Limited	☢☢☢☢ 10-30 mSv	☢☢☢☢ 3-10 mSv [ped]	6	6	0	0	0	0	5	4	5	2	1			
		References	Study Quality															
		42 (19057427)	2															
		40 (24089057)	4															
CT abdomen without and with IV contrast	May be appropriate	Limited	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	5	5	0	2	2	1	11	2	0	0	0			
		References	Study Quality															
		45 (19077417)	4															
		42 (19057427)	2															
		41 (21293130)	3															
		43 (27397022)	4															
		44 (24331274)	4															
		40 (24089057)	4															
MRI abdomen without IV contrast	May be appropriate	Limited	O O mSv	O O mSv [ped]	5	5	1	0	1	3	7	5	0	0	0			
		References	Study Quality															
		49 (21702068)	2															
		41 (21293130)	3															
		48 (28449169)	3															
		50 (25025151)	4															
		47 (24289722)	4															

US abdomen with IV contrast	May be appropriate	Limited	0 0 mSv	0 0 mSv [ped]	5	5	0	0	0	0	10	6	1	0	1
		References		Study Quality											
		35 (20652854)		3											
		37 (17206071)		2											
		48 (28449169)		3											
DOTATATE PET/CT skull base to mid-thigh	May be appropriate	Limited	☢☢☢ 1-10 mSv		5	5	0	1	0	5	7	2	2	0	0
		References		Study Quality											
		8 (25143861)		4											
Octreotide scan with SPECT or SPECT/CT chest and abdomen	May be appropriate	Limited	☢☢☢☢ 10-30 mSv		4	4	2	1	1	6	5	1	1	0	0
		References		Study Quality											
		46 (19713709)		4											
CT abdomen without IV contrast	Usually not appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢☢ 3-10 mSv [ped]	3	3	2	3	6	5	0	0	1	0	0
		References		Study Quality											
		45 (19077417)		4											
		42 (19057427)		2											
		41 (21293130)		3											
		43 (27397022)		4											
		44 (24331274)		4											
		40 (24089057)		4											
Liver spleen scan	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv		1	1	9	3	2	2	0	0	1	0	0
RBC scan abdomen and pelvis	Usually not appropriate	Expert Consensus	☢☢☢ 1-10 mSv		1	1	10	3	2	2	0	0	0	0	0

Variant 4: Indeterminate, greater than 1 cm liver lesion on initial imaging with CT (noncontrast or single-phase) or noncontrast MRI. Known history of an extrahepatic malignancy.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
MRI abdomen without and with IV contrast	Usually appropriate	Limited	0 0 mSv	0 0 mSv [ped]	8	8	0	1	0	0	0	0	2	7	7
		References		Study Quality											
		49 (21702068)		2											
		41 (21293130)		3											
		48 (28449169)		3											
		50 (25025151)		4											
		47 (24289722)		4											
FDG-PET/CT skull base to mid-thigh	Usually appropriate	Limited	☼☼☼☼ 10-30 mSv	☼☼☼☼ 3-10 mSv [ped]	7	7	0	0	0	0	1	6	6	3	1
		References		Study Quality											
		42 (19057427)		2											
		40 (24089057)		4											
CT abdomen with IV contrast multiphase	Usually appropriate	Limited	☼☼☼☼ 10-30 mSv		7	7	0	0	0	0	1	0	8	7	1
		References		Study Quality											
		45 (19077417)		4											
		41 (21293130)		3											
		43 (27397022)		4											
		44 (24331274)		4											
		40 (24089057)		4											
US abdomen with IV contrast	May be appropriate	Limited	0 0 mSv	0 0 mSv [ped]	6	6	0	0	0	1	5	10	1	1	0
		References		Study Quality											
		35 (20652854)		3											
		37 (17206071)		2											
		2 (26427339)		4											

CT abdomen without and with IV contrast	May be appropriate	Limited	☼☼☼☼ 10-30 mSv	☼☼☼☼☼ 10-30 mSv [ped]	5	5	0	1	0	6	10	0	1	0	0
		References		Study Quality											
		45 (19077417)		4											
		41 (21293130)		3											
		43 (27397022)		4											
		44 (24331274)		4											
		40 (24089057)		4											
Image-guided biopsy liver	May be appropriate	Strong	Varies	Varies	5	5	0	0	0	1	9	7	0	1	0
		References		Study Quality											
		21 (27623001)		4											
		20 (28119260)		4											
		28 (27080009)		4											
		23 (27017289)		3											
		22 (26649339)		3											
		54 (25170868)		4											
		26 (24531352)		3											
		25 (23980215)		3											
		53 (21757981)		2											
		51 (21387263)		3											
		24 (29299367)		3											
		27 (26847020)		4											
		52 (29404497)		3											
Octreotide scan with SPECT or SPECT/CT chest and abdomen	May be appropriate	Limited	☼☼☼☼ 10-30 mSv		5	5	1	1	2	3	9	0	1	0	0
		References		Study Quality											
		46 (19713709)		4											
DOTATATE PET/CT skull base to mid-thigh	May be appropriate	Limited	☼☼☼ 1-10 mSv		5	5	0	0	0	2	13	1	2	0	0

		References		Study Quality													
		8 (25143861)		4													
US abdomen	May be appropriate	Limited	0 0 mSv	0 0 mSv [ped]	4	4	2	5	0	3	5	0	1	1	0		
		References		Study Quality													
		9 (19542399)		2													
Liver spleen scan	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv		2	2	8	4	1	2	0	2	0	0	0		
RBC scan abdomen and pelvis	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv		1	1	9	3	1	3	0	1	0	0	0		

Variant 5: Incidental liver lesion, greater than 1 cm on US, noncontrast or single-phase CT, or noncontrast MRI. Known chronic liver disease.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
MRI abdomen without and with IV contrast	Usually appropriate	Strong	O 0 mSv	O 0 mSv [ped]	9	9	0	0	0	0	0	1	2	4	10
	References			Study Quality											
	35 (20652854)			3											
	65 (20882620)			2											
	64 (21563246)			2											
	73 (20657216)			3											
	61 (21969663)			3											
	57 (20098330)			2											
	71 (28723741)			4											
	70 (28078512)			3											
	62 (27835984)			2											
	63 (25192607)			3											
	72 (23116806)			4											
	67 (23011874)			4											

		56 (20806437)			3												
CT abdomen with IV contrast multiphase	Usually appropriate	Moderate	⚠⚠⚠⚠ 10-30 mSv			8	8	0	0	0	0	0	1	5	10	1	
		References			Study Quality												
		57 (20098330)			2												
		59 (23883211)			3												
		56 (20806437)			3												
US abdomen with IV contrast	Usually appropriate	Limited	0 0 mSv		0 0 mSv [ped]	7	7	1	0	0	1	4	2	7	1	1	
		References			Study Quality												
		35 (20652854)			3												
		31 (21390342)			3												
		32 (21188330)			4												
		77 (18834687)			3												
		78 (25812115)			4												
		79 (25202903)			4												
		72 (23116806)			4												
		56 (20806437)			3												
		76 (25717230)			4												
Image-guided biopsy liver	May be appropriate	Limited	Varies		Varies	4	4	1	2	5	2	5	1	0	0	1	
		References			Study Quality												
		54 (25170868)			4												
		6 (-3148733)			4												
		27 (26847020)			4												
		74 (29038857)			4												
		75 (18669577)			4												
		52 (29404497)			3												
CT abdomen without and with IV contrast	Usually not appropriate	Moderate	⚠⚠⚠⚠ 10-30 mSv		⚠⚠⚠⚠⚠ 10-30 mSv [ped]	3	3	0	3	7	0	5	1	1	0	0	

		References	Study Quality													
		57 (20098330)	2													
		59 (23883211)	3													
		56 (20806437)	3													
FDG-PET/CT skull base to mid-thigh	Usually not appropriate	Limited	⚠⚠⚠⚠ 10-30 mSv	⚠⚠⚠⚠ 3-10 mSv [ped]	2	2	1	9	3	2	1	0	1	0	0	
		References	Study Quality													
		6 (-3148733)	4													
		60 (19191771)	4													
Liver spleen scan	Usually not appropriate	Expert Consensus	⚠⚠⚠ 1-10 mSv		1	1	9	4	2	0	2	0	0	0	0	
Octreotide scan with SPECT or SPECT/CT chest and abdomen	Usually not appropriate	Expert Consensus	⚠⚠⚠⚠ 10-30 mSv		1	1	11	4	1	0	1	0	0	0	0	
DOTATATE PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	⚠⚠⚠ 1-10 mSv		1	1	9	5	2	0	0	0	1	0	0	
RBC scan abdomen and pelvis	Usually not appropriate	Expert Consensus	⚠⚠⚠ 1-10 mSv		1	1	9	4	3	1	0	0	0	0	0	

Variant 6: Indeterminate, less than 1 cm liver lesion on initial imaging with US. Known history of an extrahepatic malignancy.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
MRI abdomen without and with IV contrast	Usually appropriate	Strong	O 0 mSv	O 0 mSv [ped]	8	8	0	0	1	0	1	0	4	7	4
		References	Study Quality												
		84 (19501995)	2												
		15 (21597893)	2												
CT abdomen with IV contrast multiphase	May be appropriate	Limited	⚠⚠⚠⚠ 10-30 mSv		6	6	0	0	0	1	7	5	4	1	0

		References		Study Quality													
		82 (9885589)		4													
		83 (24674191)		4													
		81 (12439304)		4													
		80 (19842564)		4													
US abdomen with IV contrast	May be appropriate	Limited	O 0 mSv	O 0 mSv [ped]	6	6	0	0	0	0	8	8	1	1	0		
		References		Study Quality													
		9 (19542399)		2													
		30 (24689098)		4													
MRI abdomen without IV contrast	May be appropriate	Strong	O 0 mSv	O 0 mSv [ped]	5	5	0	0	0	8	8	1	1	0	0		
		References		Study Quality													
		84 (19501995)		2													
		15 (21597893)		2													
Image-guided biopsy liver	Usually not appropriate	Expert Consensus	Varies	Varies	3	3	4	2	3	5	3	0	0	0	0		
DOTATATE PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv		3	3	3	4	4	1	4	1	0	0	0		
CT abdomen without IV contrast	Usually not appropriate	Limited	☼☼☼ 1-10 mSv	☼☼☼☼ 3-10 mSv [ped]	2	2	5	6	4	1	1	0	0	0	0		
		References		Study Quality													
		82 (9885589)		4													
		83 (24674191)		4													
		81 (12439304)		4													
		80 (19842564)		4													
CT abdomen without and with IV contrast	Usually not appropriate	Limited	☼☼☼☼ 10-30 mSv	☼☼☼☼☼ 10-30 mSv [ped]	2	2	2	8	8	0	0	0	0	0	0		
		References		Study Quality													

		82 (9885589)		4													
		83 (24674191)		4													
		81 (12439304)		4													
		80 (19842564)		4													
Octreotide scan with SPECT or SPECT/CT chest and abdomen	Usually not appropriate	Expert Consensus	⚠⚠⚠⚠ 10-30 mSv		2	2	5	4	3	2	2	1	0	0	0		
FDG-PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	⚠⚠⚠⚠ 10-30 mSv	⚠⚠⚠⚠ 3-10 mSv [ped]	2	2	4	6	6	1	1	0	0	0	0		
Liver spleen scan	Usually not appropriate	Expert Consensus	⚠⚠⚠ 1-10 mSv		1	1	10	4	2	0	0	0	1	0	0		
RBC scan abdomen and pelvis	Usually not appropriate	Expert Consensus	⚠⚠⚠ 1-10 mSv		1	1	10	4	2	1	0	0	0	0	0		

Variant 7: Indeterminate, less than 1 cm liver lesion on initial imaging with CT (noncontrast or single-phase) or noncontrast MRI. Known history of an extrahepatic malignancy.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations										
							1	2	3	4	5	6	7	8	9		
MRI abdomen without and with IV contrast	Usually appropriate	Limited	O 0 mSv	O 0 mSv [ped]	8	8	0	0	0	0	1	3	4	6	3		
		References	Study Quality														
		86 (16845289)	3														
		87 (20829538)	M														
CT abdomen with IV contrast multiphase	Usually appropriate	Limited	⚠⚠⚠⚠ 10-30 mSv		7	7	0	0	1	0	5	2	9	1	0		
		References	Study Quality														
		82 (9885589)	4														
		85 (15833992)	4														
US abdomen with IV contrast	May be appropriate	Limited	O 0 mSv	O 0 mSv [ped]	6	6	0	0	1	2	4	4	5	1	0		

		References	Study Quality													
		88 (20517816)	4													
		9 (19542399)	2													
Image-guided biopsy liver	May be appropriate	Expert Consensus	Varies	Varies	4	4	3	0	4	6	3	1	0	0	0	0
US abdomen	Usually not appropriate	Limited	0 0 mSv	0 0 mSv [ped]	3	3	3	3	3	3	4	1	0	0	0	0
		References	Study Quality													
		88 (20517816)	4													
CT abdomen without and with IV contrast	Usually not appropriate	Limited	☼☼☼☼ 10-30 mSv	☼☼☼☼☼ 10-30 mSv [ped]	2	2	2	8	8	0	0	0	0	0	0	0
		References	Study Quality													
		82 (9885589)	4													
		85 (15833992)	4													
Octreotide scan with SPECT or SPECT/CT chest and abdomen	Usually not appropriate	Expert Consensus	☼☼☼☼ 10-30 mSv		2	2	6	4	2	3	1	0	1	0	0	0
FDG-PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	☼☼☼☼ 10-30 mSv	☼☼☼☼☼ 3-10 mSv [ped]	2	2	5	6	6	1	0	0	0	0	0	0
DOTATATE PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv		2	2	5	4	2	2	2	1	1	0	0	0
Liver spleen scan	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv		1	1	10	4	2	0	0	0	1	0	0	0
RBC scan abdomen and pelvis	Usually not appropriate	Expert Consensus	☼☼☼ 1-10 mSv		1	1	10	4	2	0	0	1	0	0	0	0

Variant 8: Incidental liver lesion, less than 1 cm on US, noncontrast or single-phase CT, or noncontrast MRI. Known chronic liver disease.

CT abdomen without and with IV contrast	Usually not appropriate	Strong	☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 10-30 mSv [ped]	2	2	2	8	8	0	0	0	0	0	0
		References		Study Quality											
		57 (20098330)		2											
		91 (23932636)		2											
Liver spleen scan	Usually not appropriate	Expert Consensus	☢☢☢☢ 1-10 mSv		1	1	10	4	2	0	0	1	0	0	0
Octreotide scan with SPECT or SPECT/CT chest and abdomen	Usually not appropriate	Expert Consensus	☢☢☢☢☢ 10-30 mSv		1	1	11	4	2	0	0	0	0	0	0
FDG-PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	☢☢☢☢☢ 10-30 mSv	☢☢☢☢☢ 3-10 mSv [ped]	1	1	9	6	2	0	0	0	0	0	0
DOTATATE PET/CT skull base to mid-thigh	Usually not appropriate	Expert Consensus	☢☢☢☢ 1-10 mSv		1	1	10	5	2	0	0	0	0	0	0
RBC scan abdomen and pelvis	Usually not appropriate	Expert Consensus	☢☢☢☢ 1-10 mSv		1	1	10	4	3	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.