

American College of Radiology
ACR Appropriateness Criteria®

Pulmonary Arteriovenous Malformation (PAVM)

Variant 1: Adult. Presenting with a transient ischemic attack, or seizures, or brain abscess, or altered sensorium. Chest radiography reveals a lung nodule. Suspected pulmonary arteriovenous malformation (PAVM). Next imaging study.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
CT chest without IV contrast	Usually appropriate	Limited	☹☹☹ 1-10 mSv	☹☹☹☹ 3-10 mSv [ped]	8	8	0	0	0	0	1	1	5	7	3
		References		Study Quality											
		10 (19553198)		4											
		28 (8184042)		4											
		27 (25032812)		4											
US echocardiography transthoracic with IV contrast	Usually appropriate	Strong	○ ○ mSv	○ ○ mSv [ped]	8	8	0	1	1	0	1	0	3	8	6
		References		Study Quality											
		1 (24008954)		4											
		45 (23429940)		3											
		43 (17317734)		2											
		41 (19091794)		1											
		42 (1746435)		3											
		44 (34322523)		2											
		46 (19276509)		4											
CTA pulmonary arteries with IV contrast	Usually appropriate	Limited	☹☹☹ 1-10 mSv		8	8	0	0	0	1	0	1	4	7	4
		References		Study Quality											

Arteriography pulmonary	May be appropriate	Limited	⊕⊕⊕⊕ 10-30 mSv		4	4	0	1	1	11	2	2	0	0	0
		References	Study Quality												
		24 (18774307)	2												
		25 (7956388)	4												
US echocardiography transesophageal with IV contrast	May be appropriate	Limited	○ 0 mSv	○ 0 mSv [ped]	4	4	0	4	3	6	4	0	0	0	0
		References	Study Quality												
		38 (8181373)	4												
		40 (12848887)	4												
MRA pulmonary arteries without IV contrast	Usually not appropriate	Expert Consensus	○ 0 mSv	○ 0 mSv [ped]	3	3	2	2	5	3	3	1	1	0	0
MRA chest without IV contrast	Usually not appropriate	Expert Consensus	○ 0 mSv	○ 0 mSv [ped]	3	3	1	4	8	1	3	0	0	0	0
US echocardiography transthoracic resting	Usually not appropriate	Limited	○ 0 mSv	○ 0 mSv [ped]	3	3	5	5	8	0	0	0	1	1	0
		References	Study Quality												
		38 (8181373)	4												
US echocardiography transesophageal	Usually not appropriate	Limited	○ 0 mSv	○ 0 mSv [ped]	3	3	6	3	5	2	3	0	1	0	0
		References	Study Quality												
		38 (8181373)	4												
		39 (2212350)	3												
Radiography chest	Usually not appropriate	Limited	⊕ <0.1 mSv	⊕ <0.03 mSv [ped]	2	2	9	3	3	3	1	0	1	0	0
		References	Study Quality												
		36 (14742303)	3												
		37 (29141890)	4												
Pertechnetate albumin pulmonary scan	Usually not appropriate	Limited	⊕⊕⊕ 1-10 mSv		2	2	8	4	2	3	2	0	0	1	0

		27 (25032812)		4													
		29 (17116729)		3													
CT chest with IV contrast	Usually appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	7	7	0	0	0	0	1	0	13	3	0		
		References		Study Quality													
		10 (19553198)		4													
		27 (25032812)		4													
		26 (31875234)		4													
CT chest without IV contrast	Usually appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	7	7	0	0	0	1	2	5	3	4	2		
		References		Study Quality													
		10 (19553198)		4													
		28 (8184042)		4													
		27 (25032812)		4													
MRA pulmonary arteries without and with IV contrast	Usually appropriate	Limited	○ ○ mSv	○ ○ mSv [ped]	7	7	0	0	1	0	3	3	7	3	0		
		References		Study Quality													
		32 (18356434)		3													
		33 (33202566)		1													
MRA chest without and with IV contrast	May be appropriate	Expert Consensus	○ ○ mSv	○ ○ mSv [ped]	6	6	0	0	1	1	4	3	7	1	0		
CT chest without and with IV contrast	May be appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢ 3-10 mSv [ped]	5	5	0	0	3	2	9	3	0	0	0		
		References		Study Quality													
		10 (19553198)		4													
		24 (18774307)		2													
		27 (25032812)		4													
Arteriography pulmonary	May be appropriate	Limited	☢☢☢☢ 10-30 mSv		4	4	0	1	0	9	5	1	0	1	0		
		References		Study Quality													

		24 (18774307)	2													
		25 (7956388)	4													
MRA pulmonary arteries without IV contrast	Usually not appropriate	Expert Consensus	0 0 mSv	0 0 mSv [ped]	3	3	1	5	9	3	1	0	0	0	0	
MRA chest without IV contrast	Usually not appropriate	Expert Consensus	0 0 mSv	0 0 mSv [ped]	3	3	0	1	12	1	2	1	0	0	0	
US echocardiography transthoracic resting	Usually not appropriate	Limited	0 0 mSv	0 0 mSv [ped]	3	3	3	5	6	3	1	0	0	1	1	
		References	Study Quality													
		38 (8181373)	4													
US echocardiography transesophageal	Usually not appropriate	Limited	0 0 mSv	0 0 mSv [ped]	3	3	5	2	6	5	0	0	1	1	0	
		References	Study Quality													
		38 (8181373)	4													
		39 (2212350)	3													
Radiography chest	Usually not appropriate	Limited	⚠ <0.1 mSv	⚠ <0.03 mSv [ped]	3	3	2	5	4	6	0	0	0	0	0	
		References	Study Quality													
		36 (14742303)	3													
		37 (29141890)	4													
US echocardiography transesophageal with IV contrast	Usually not appropriate	Limited	0 0 mSv	0 0 mSv [ped]	3	3	2	5	3	3	3	1	0	0	0	
		References	Study Quality													
		38 (8181373)	4													
		40 (12848887)	4													
Pertechnetate albumin pulmonary scan	Usually not appropriate	Limited	⚠⚠⚠ 1-10 mSv		2	2	9	3	1	5	1	0	0	1	0	
		References	Study Quality													
		34 (3968579)	4													
		35 (4070672)	4													

Variant 3: Adult. Asymptomatic with a family history of HHT and suspected PAVM. Initial imaging.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
CTA chest with IV contrast	Usually appropriate	Limited	⊕⊕⊕ 1-10 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	7	7	0	0	0	1	3	2	10	1	0
		References		Study Quality											
		10 (19553198)		4											
		30 (16484354)		3											
		27 (25032812)		4											
		29 (17116729)		3											
CT chest without IV contrast	Usually appropriate	Limited	⊕⊕⊕ 1-10 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	7	7	0	0	0	1	3	2	9	1	1
		References		Study Quality											
		10 (19553198)		4											
		28 (8184042)		4											
		27 (25032812)		4											
MRA pulmonary arteries without and with IV contrast	Usually appropriate	Limited	○ ○ mSv	○ ○ mSv [ped]	7	7	0	0	1	1	2	2	7	4	0
		References		Study Quality											
		32 (18356434)		3											
		33 (33202566)		1											
US echocardiography transthoracic with IV contrast	Usually appropriate	Strong	○ ○ mSv	○ ○ mSv [ped]	7	7	0	1	1	0	1	1	5	8	0
		References		Study Quality											
		1 (24008954)		4											
		45 (23429940)		3											
		43 (17317734)		2											
		41 (19091794)		1											

			42 (1746435)		3														
			44 (34322523)		2														
			46 (19276509)		4														
CTA pulmonary arteries with IV contrast	Usually appropriate	Limited	⊕⊕⊕ 1-10 mSv		7	7	0	0	0	0	1	3	5	7	0				
			References		Study Quality														
			10 (19553198)		4														
			31 (32255688)		4														
			27 (25032812)		4														
MRA chest without and with IV contrast	May be appropriate	Expert Consensus	○ ○ mSv	○ ○ mSv [ped]	6	6	0	0	1	2	4	3	7	0	0				
CT chest with IV contrast	May be appropriate	Limited	⊕⊕⊕ 1-10 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	5	5	0	0	0	3	11	2	1	0	0				
			References		Study Quality														
			10 (19553198)		4														
			27 (25032812)		4														
			26 (31875234)		4														
CT chest without and with IV contrast	May be appropriate	Limited	⊕⊕⊕ 1-10 mSv	⊕⊕⊕⊕ 3-10 mSv [ped]	5	5	1	0	0	4	9	3	0	0	0				
			References		Study Quality														
			10 (19553198)		4														
			24 (18774307)		2														
			27 (25032812)		4														
Arteriography pulmonary	Usually not appropriate	Limited	⊕⊕⊕⊕ 10-30 mSv		3	3	2	4	8	1	0	1	0	1	0				
			References		Study Quality														
			24 (18774307)		2														
MRA pulmonary arteries without IV contrast	Usually not appropriate	Expert Consensus	○ ○ mSv	○ ○ mSv [ped]	3	3	1	7	10	1	0	0	0	0	0				

MRA chest without IV contrast	Usually not appropriate	Expert Consensus	0 0 mSv	0 0 mSv [ped]	3	3	0	3	8	2	3	0	1	0	0
US echocardiography transthoracic resting	Usually not appropriate	Limited	0 0 mSv	0 0 mSv [ped]	3	3	2	3	12	0	0	0	0	0	0
		References	Study Quality												
		38 (8181373)	4												
Radiography chest	Usually not appropriate	Limited	☼ <0.1 mSv	☼ <0.03 mSv [ped]	3	3	3	3	5	2	3	1	0	0	0
		References	Study Quality												
		36 (14742303)	3												
		37 (29141890)	4												
US echocardiography transesophageal with IV contrast	Usually not appropriate	Limited	0 0 mSv	0 0 mSv [ped]	3	3	2	4	4	5	1	1	0	0	0
		References	Study Quality												
		38 (8181373)	4												
		40 (12848887)	4												
US echocardiography transesophageal	Usually not appropriate	Limited	0 0 mSv	0 0 mSv [ped]	2	2	7	4	5	3	0	1	0	0	0
		References	Study Quality												
		38 (8181373)	4												
		39 (2212350)	3												
Pertechnetate albumin pulmonary scan	Usually not appropriate	Limited	☼☼☼ 1-10 mSv		2	2	9	5	1	4	1	0	0	0	0
		References	Study Quality												
		34 (3968579)	4												
		35 (4070672)	4												

Variant 4: Adult. Presenting to establish care with a past history of a treated PAVM. Follow-up (surveillance) imaging following embolization of PAVM.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
US echocardiography transthoracic with IV contrast	Usually appropriate	Strong	O O mSv	O O mSv [ped]	8	8	0	0	0	0	1	2	3	9	2
		References		Study Quality											
		1 (24008954)		4											
		45 (23429940)		3											
		43 (17317734)		2											
		41 (19091794)		1											
		42 (1746435)		3											
		44 (34322523)		2											
		46 (19276509)		4											
CTA pulmonary arteries with IV contrast	Usually appropriate	Limited	☢☢☢ 1-10 mSv		8	8	0	0	0	0	1	2	4	9	1
		References		Study Quality											
		31 (32255688)		4											
		27 (25032812)		4											
		54 (35064274)		3											
CTA chest with IV contrast	Usually appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢☢ 3-10 mSv [ped]	7	7	0	0	0	1	1	1	6	8	0
		References		Study Quality											
		10 (19553198)		4											
		30 (16484354)		3											
		47 (26724660)		2											
		27 (25032812)		4											
		29 (17116729)		3											
CT chest with IV contrast	Usually appropriate	Limited	☢☢☢ 1-10 mSv	☢☢☢☢☢ 3-10 mSv [ped]	7	7	0	0	0	0	1	3	12	1	0
		References		Study Quality											
		10 (19553198)		4											

Arteriography pulmonary	May be appropriate	Limited	⊕⊕⊕⊕ 10-30 mSv		5	5	0	0	0	3	8	5	0	1	0
		References		Study Quality											
		10 (19553198)		4											
MRA chest without and with IV contrast	May be appropriate	Expert Consensus	○ ○ mSv	○ ○ mSv [ped]	5	5	0	0	1	3	5	2	5	1	0
MRA pulmonary arteries without IV contrast	Usually not appropriate	Expert Consensus	○ ○ mSv	○ ○ mSv [ped]	3	3	1	5	10	3	0	0	0	0	0
MRA chest without IV contrast	Usually not appropriate	Expert Consensus	○ ○ mSv	○ ○ mSv [ped]	3	3	0	2	7	3	5	0	0	0	0
US echocardiography transthoracic resting	Usually not appropriate	Limited	○ ○ mSv	○ ○ mSv [ped]	3	3	5	3	9	1	0	0	1	0	1
		References		Study Quality											
		38 (8181373)		4											
US echocardiography transesophageal	Usually not appropriate	Limited	○ ○ mSv	○ ○ mSv [ped]	3	3	6	3	9	0	0	1	0	1	0
		References		Study Quality											
		38 (8181373)		4											
		39 (2212350)		3											
Radiography chest	Usually not appropriate	Limited	⊕ <0.1 mSv	⊕ <0.03 mSv [ped]	3	3	6	3	2	6	1	0	2	0	0
		References		Study Quality											
		36 (14742303)		3											
		37 (29141890)		4											
US echocardiography transesophageal with IV contrast	Usually not appropriate	Limited	○ ○ mSv	○ ○ mSv [ped]	3	3	3	3	3	6	2	0	0	0	0
		References		Study Quality											
		38 (8181373)		4											
		40 (12848887)		4											

Variant 5: Adult. Asymptomatic with abnormal imaging on CT or chest radiography suggestive of PAVM. Next imaging study.

Procedure	Appropriateness Category	SOE	Adults RRL	Peds RRL	Rating	Median	Final Tabulations								
							1	2	3	4	5	6	7	8	9
US echocardiography transthoracic with IV contrast	Usually appropriate	Strong	O 0 mSv	O 0 mSv [ped]	8	8	0	0	1	0	0	2	4	7	3
		References		Study Quality											
		1 (24008954)		4											
		45 (23429940)		3											
		43 (17317734)		2											
		41 (19091794)		1											
		42 (1746435)		3											
		44 (34322523)		2											
		46 (19276509)		4											
CTA pulmonary arteries with IV contrast	Usually appropriate	Limited	⊕⊕⊕ 1-10 mSv		8	8	0	0	0	1	2	0	4	9	1
		References		Study Quality											
		10 (19553198)		4											
		31 (32255688)		4											
		27 (25032812)		4											
MRA pulmonary arteries without and with IV contrast	Usually appropriate	Limited	O 0 mSv	O 0 mSv [ped]	7	7	0	0	0	2	4	1	6	4	0
		References		Study Quality											
		32 (18356434)		3											
		33 (33202566)		1											
Arteriography pulmonary	May be appropriate	Limited	⊕⊕⊕⊕ 10-30 mSv		6	6	0	0	0	2	4	9	2	0	0
		References		Study Quality											
		24 (18774307)		2											

		25 (7956388)			4											
CTA chest with IV contrast	May be appropriate (Disagreement)	Expert Opinion	⊗⊗⊗ 1-10 mSv	⊗⊗⊗⊗ 3-10 mSv [ped]	5	5	0	1	0	2	3	0	2	9	0	
		References			Study Quality											
		10 (19553198)			4											
		27 (25032812)			4											
		29 (17116729)			3											
CT chest with IV contrast	May be appropriate (Disagreement)	Expert Opinion	⊗⊗⊗ 1-10 mSv	⊗⊗⊗⊗ 3-10 mSv [ped]	5	5	2	4	1	2	0	6	2	0	0	
		References			Study Quality											
		10 (19553198)			4											
		27 (25032812)			4											
		26 (31875234)			4											
CT chest without and with IV contrast	May be appropriate (Disagreement)	Expert Opinion	⊗⊗⊗ 1-10 mSv	⊗⊗⊗⊗ 3-10 mSv [ped]	5	5	2	4	2	2	2	5	0	0	0	
		References			Study Quality											
		10 (19553198)			4											
		24 (18774307)			2											
		27 (25032812)			4											
MRA chest without and with IV contrast	May be appropriate	Expert Consensus	○ ○ mSv	○ ○ mSv [ped]	5	5	0	1	0	2	6	0	7	1	0	
CT chest without IV contrast	May be appropriate	Limited	⊗⊗⊗ 1-10 mSv	⊗⊗⊗⊗ 3-10 mSv [ped]	4	4	2	4	2	5	2	2	0	0	0	
		References			Study Quality											
		10 (19553198)			4											
		28 (8184042)			4											
		27 (25032812)			4											
MRA chest without IV contrast	May be appropriate	Expert Consensus	○ ○ mSv	○ ○ mSv [ped]	4	4	0	3	0	7	7	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.