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.

D 1	Appropr	iateness	COF	414 DD	, D 1 DD1	D 4	34.11			F	inal '	Tabu	latio	ıs		
Procedure	Categ	gory	SOE	Adults RR	L Peds RRL	Rating	Median	1	2	3	4	5	6	7	8	9
CT chest without IV contrast	Usua approp	ally oriate	Limited	≎≎≎ 1-10 mSv	0	8	8	0	0	0	0	1	1	5	7	3
			References		Stud	y Quality										
			10 (19553198)			4										
			28 (8184042)			4										
			27 (25032812)			4										
US echocardiography transthoracic with IV contrast	Usua approp		Strong	O 0 mSv	O 0 mSv [ped]	8	8	0	1	1	0	1	0	3	8	6
			References		Stud	y 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	Usua approp		Limited	��� 1-10 mSv	0	8	8	0	0	0	1	0	1	4	7	4
			References	Stud	y Quality											

		10 (19553198)			4										
		31 (32255688)			4										
		27 (25032812)			4			1				1			
MRA pulmonary arteries without and with IV contrast	Usually appropriate	Limited	O 0 mSv	O 0 mSv [ped]	7	7	0	0	0	1	2	2	10	2	0
		References		Study	Quality										
		32 (18356434)			3										
		33 (33202566)			1										
CT chest with IV contrast	May be appropriate	Limited	��� 1-10 mSv	���� 3- 10 mSv [ped]	6	6	0	1	0	2	3	7	3	1	0
		References		Study	Quality										
		10 (19553198)			4										
		27 (25032812)			4										
		26 (31875234)			4										
CTA chest with IV contrast	May be appropriate (Disagreement)	Expert Opinion	⊕⊕⊕ 1-10 mSv	���� 3- 10 mSv [ped]	5	5	0	0	2	2	2	0	4	5	2
		References		Study	Quality										
		10 (19553198)			4										
		30 (16484354)			3										
		27 (25032812)			4										
		29 (17116729)			3					_					
CT chest without and with IV contrast	May be appropriate (Disagreement)	Expert Opinion	��� 1-10 mSv	���� 3- 10 mSv [ped]	5	5	1	0	3	2	1	8	2	0	0
		References		Study	Quality										
		10 (19553198)			4										
		24 (18774307)			2										
		27 (25032812)			4										
MRA chest without and with IV contrast	May be appropriate (Disagreement)	Expert Opinion	O 0 mSv	O 0 mSv [ped]	5	5	0	1	1	2	2	3	8	0	0

Arteriography pulmonary	May approp	Limited	���� 10-3 mSv	0	4	4	0	1	1	11	2	2	0	0	0
		References		Stud	y Quality										
		24 (18774307)			2										
		25 (7956388)			4										
US echocardiography transesophageal with IV contrast	May approp	Limited	O 0 mSv	O 0 mSv [ped]	4	4	0	4	3	6	4	0	0	0	0
		References		Stud	y Quality										
		38 (8181373)			4										
		40 (12848887)			4										
MRA pulmonary arteries without IV contrast	Usually approp	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	2	2	5	3	3	1	1	0	0
MRA chest without IV contrast	Usually approp	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	1	4	8	1	3	0	0	0	0
US echocardiography transthoracic resting	Usually approp	t Limited O.O.mSv		O 0 mSv [ped]	3	3	5	5	8	0	0	0	1	1	0
		References		Stud	y Quality										
		38 (8181373)			4										
US echocardiography transesophageal	Usually approp	Limited	O 0 mSv	O 0 mSv [ped]	3	3	6	3	5	2	3	0	1	0	0
		References		Stud	y Quality										
		38 (8181373)			4										
		39 (2212350)			3										
Radiography chest	Usually approp	Limited	≎ <0.1 mS		2	2	9	3	3	3	1	0	1	0	0
		References		Stud	y Quality										
		36 (14742303)			3										
		37 (29141890)			4										
Pertechnetate albumin pulmonary scan	Usually approp	Limited	��� 1-10 mSv		2	2	8	4	2	3	2	0	0	1	0

References	Study Quality
34 (3968579)	4
35 (4070672)	4

Variant 2: Adult. Presenting with shortness of breath, or hemothorax, or hemoptysis. Patient has history of epistaxis and family history of hereditary hemorrhagic telangiectasia (HHT). Suspected PAVM. Initial imaging.

	Appropriateness	propriateness Cotogony SOE Adults RRL Peds RRL Rating Med							F	inal	Tabu	latio	ns		
Procedure	Category	SOE	Adults RRL	Peds RRL	Rating	Median	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	2	0	0	1	2	6	9
		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	���� 3- 10 mSv [ped]	8	8	0	0	0	0	1	1	2	8	5
		References		Study	Quality										
		10 (19553198)			4										
		31 (32255688)			4										
		27 (25032812)			4				_						
CTA chest with IV contrast	Usually appropriate	Limited	��� 1-10 mSv	ତତତତ 3- 10 mSv [ped]	7	7	0	0	1	1	3	1	4	7	0
		References		Study	Quality										
		10 (19553198)			4										
		30 (16484354)			3										

		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	y 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	y Quality										
		10 (19553198)			4										
		28 (8184042)			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	1	0	3	3	7	3	0
		References		Study	y Quality										
		32 (18356434)	ı		3										
		33 (33202566)			1										
MRA chest without and with IV contrast	May be appropriate	Expert Consensus	O 0 mSv	O 0 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	y Quality										
		10 (19553198)		4											
		24 (18774307)	l .		2										
		27 (25032812)			4										
Arteriography pulmonary	May be appropriate	Limited	ଡଡଡଡ 10-3 mSv	0	4	4	0	1	0	9	5	1	0	1	0

		References		Study	y Quality										
		24 (18774307)			2										
		25 (7956388)			4										
MRA pulmonary arteries without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	1	5	9	3	1	0	0	0	0
MRA chest without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	0	1	12	1	2	1	0	0	0
US echocardiography transthoracic resting	Usually not appropriate	Limited	O 0 mSv	O 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	O 0 mSv	O 0 mSv [ped]	3	3	5	2	6	5	0	0	1	1	0
		References		Study Quality											
		38 (8181373)		Study Quanty 4											
		39 (2212350)			3										
Radiography chest	Usually not appropriate	Limited	≎ <0.1 mSv		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	O 0 mSv	O 0 mSv [ped]	3	3	2	5	3	3	3	1	0	0	0
		References		Study	Quality										
		38 (8181373)		Study Quanty 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											

25 (4070(72)	,
35 (4070672)	4

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

	Appropriateness	Appropriateness SOE Adults RRL Peds RRL Rating Median							F	inal	Tabu	latio	ns		
Procedure	Category	SOE	Adults RRL	Peds RRL	Rating	Median	1	2	3	4	5	6	7	8	9
CTA chest with IV contrast	Usually appropriate	Limited	��� 1-10 mSv		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	O 0 mSv	O 0 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	O 0 mSv	O 0 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		
44 (34322523) 2		
46 (10076700)		
46 (19276509) 4		
CTA pulmonary arteries with IV contrast Limited Limited Limited Description: Limited Description: Descripti	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 O 0 mSv [ped] 6 0 0 1 2 4 3	7	0 0
CT chest with IV contrast May be appropriate Limited Dimited D	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 Limited State 1-10 mSv [ped] 5 5 1 0 0 4 9 3	0	0 0
References Study Quality		
10 (19553198) 4		
24 (18774307)		
27 (25032812) 4		
Arteriography pulmonary Usually not appropriate Limited Limited Discrete the second state of the secon	0	1 0
References Study Quality		

MRA pulmonary arteries without IV contrast	Usually appropi	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	1	7	10	1	0	0	0	0	0
MRA chest without IV contrast	Usually appropi	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	0	3	8	2	3	0	1	0	0
US echocardiography transthoracic resting	Usually appropi	Limited	O 0 mSv	O 0 mSv [ped]	3	3	2	3	12	0	0	0	0	0	0
		References		Study	y Quality										
		38 (8181373)		,	4										
Radiography chest	Usually appropi	Limited	⊕ <0.1 mSv	v <0.03 mSv [ped]	3	3	3	3	5	2	3	1	0	0	0
		References		Study	y Quality										
		36 (14742303)			3										
		37 (29141890)			4										
US echocardiography transesophageal with IV contrast	Usually	Limited	O 0 mSv	O 0 mSv [ped]	3	3	2	4	4	5	1	1	0	0	0
		References		Study	y Quality										
		38 (8181373)			4										
		40 (12848887)			4										
US echocardiography transesophageal	Usually appropr	Limited	O 0 mSv	O 0 mSv [ped]	2	2	7	4	5	3	0	1	0	0	0
		References		Study	y Quality		•	•	•	•	•	•	•		
		38 (8181373)			4										
		39 (2212350)			3										
Pertechnetate albumin pulmonary scan	Usually appropi	Limited	��� 1-10 mSv		2	2	9	5	1	4	1	0	0	0	0
		References		Study	y Quality			•	•	•	•	•	•		
		34 (3968579)		4											
		35 (4070672)			4										
	L	, /	I	4											

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

	Appropriateness	COF		D 1 DD1	.	3.5.31			F	inal	Tabu	latio	ıs		
Procedure	Category	SOE	Adults RRL	Peds RRL	Rating	Median	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	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	���� 3- 10 mSv [ped]	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	ଫଫଫ 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										
		47 (26724660)		2											
		27 (25032812)			4										
		29 (17116729)			3										
CT chest without IV contrast	Usually appropriate	Strong	��� 1-10 mSv	���� 3- 10 mSv [ped]	7	7	1	0	0	1	4	4	2	5	3
		References		Study	Quality										
		12 (23912618)			3										
		53 (26560716)			2										
		50 (14963181)			2										
		51 (1535899)			2										
		49 (16415131)			4										
		30 (16484354)			3										
		47 (26724660)			2										
		27 (25032812)			4										
		48 (16371535)		4											
		52 (33459902)			3			1			1				
CT chest without and with IV contrast	Usually appropriate	Limited	��� 1-10 mSv	ଫଟଟଟ 3- 10 mSv [ped]	7	7	1	0	1	0	3	3	9	0	0
		References		Study											
		10 (19553198)			4										
		47 (26724660)			2										
		27 (25032812)			4										
		29 (17116729)			3		r	1			1		,		
MRA pulmonary arteries without and with IV contrast	Usually appropriate	Strong	O 0 mSv	O 0 mSv [ped]	7	7	0	0	1	1	2	4	5	4	0
		References		Study	Quality										
		58 (25851199)			3										
		56 (25012936)		2											
		55 (33449178)		2											

		57 (35914744)		2											
Arteriography pulmonary	May be appropriate	Limited	❤❤❤❤ 10-30 mSv	���� 3- 10 mSv [ped]	5	5	0	0	0	3	8	5	0	1	0
		References		Study	y Quality										
		10 (19553198)			4										
MRA chest without and with IV contrast	May be appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	5	5	0	0	1	3	5	2	5	1	0
MRA pulmonary arteries without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	1	5	10	3	0	0	0	0	0
MRA chest without IV contrast	Usually not appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	3	3	0	2	7	3	5	0	0	0	0
US echocardiography transthoracic resting	Usually not appropriate	Limited	O 0 mSv	v O 0 mSv 3 3		5	3	9	1	0	0	1	0	1	
		References		Study Quality											
		38 (8181373)													
US echocardiography transesophageal	Usually not appropriate	Limited	O 0 mSv	O 0 mSv [ped]	3	3	6	3	9	0	0	1	0	1	0
		References		Study	y Quality										
		38 (8181373)			4										
		39 (2212350)			3										
Radiography chest	Usually not appropriate	Limited	⊕ <0.1 mSv		3	3	6	3	2	6	1	0	2	0	0
		References		Study	y Quality										
		36 (14742303)			3										
		37 (29141890)			4										
US echocardiography transesophageal with IV contrast	Usually not appropriate	Limited	O 0 mSv	O 0 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.

D 1	Appropriateness	SOF	4.1.1/ PD7	D 1 DET	D. (1	3.6.31	Final Tabulations								
Procedure	Category	SOE	Adults RRL	Peds RRL	Rating	Median	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)													
		44 (34322523)													
		46 (19276509)													
CTA pulmonary arteries with IV contrast	Usually appropriate	Limited	��� 1-10 mSv	���� 3- 10 mSv [ped]	8	8	0	0	0	1	2	0	4	9	1
		References		Study		-									
		10 (19553198)													
		31 (32255688)		4											
		27 (25032812)													
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									•		
	32 (18356434)			3											
		33 (33202566)			1										
Arteriography pulmonary	May be appropriate	Limited	���� 10-30 mSv	0	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	y Quality										
		10 (19553198)			4										
		27 (25032812)													
		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 Q													
		10 (19553198)													
		27 (25032812)													
		26 (31875234)													
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											
		10 (19553198)													
		24 (18774307)													
		27 (25032812)				1		_							
MRA chest without and with IV contrast	May be appropriate	Expert Consensus	O 0 mSv	O 0 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)													
		27 (25032812)		4				1	1	1		1			
MRA chest without IV contrast	May be appropriate	Expert Consensus	O 0 mSv	O 0 mSv [ped]	4	4	0	3	0	7	7	0	0	0	0

MRA pulmonary arteries without IV contrast	Usually approp		Expert Consensus			O 0 mSv [ped]	3	3	1	6	10	2	0	0	0	0	0
US echocardiography transthoracic resting	Usually approp		Limited	Limited O 0 mSv		O 0 mSv [ped]	3	3	6	3	6	2	1	0	2	0	0
			References			Study Quality											
			38 (8181373)			4											
US echocardiography transesophageal with IV contrast	Usually approp		Limited	O 0 mSv	,	O 0 mSv [ped]	3	3	3	3	3	4	4	0	0	0	0
			References		Study Quality												
			38 (8181373)			4											
			40 (12848887)														
US echocardiography transesophageal	Usually approp		Limited	O 0 mSv	,	O 0 mSv [ped]	2	2	8	4	4	2	1	1	0	0	0
		References			Study Quality												
		38 (8181373)			4												
			39 (2212350)				3										

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.