

CT and angiographic findings of segmental arterial mediolysis (SAM)

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Learning objectives

- To understand pathophysiology of segmental arterial mediolysis (SAM)
- To familiar with clinical presentation and guideline for diagnosis of SAM
- To recognize abdominal computed tomography (CT) and angiographic findings of SAM

Background

- Segmental medial arteriolysis (SAM)
- First described in 1976
- By Slavin and Gonzalez-Vitale
- Previously called “Segmental mediolytic arteritis”
- Changed to “Segmental medial arteriolysis”
- Due to lack of true inflammation

Non-arteriosclerotic, noninflammatory vascular disease of unknown origin

Background

- No genetic predilection
- Unknown inciting event leading to arterial injury
- Experimenting with and exogenous agent (vasoconstrictive stimuli) in dogs
 - Alpha-1 adrenergic receptor agonists or beta-2 agonists
 - Releasing of norepinephrine

Pathophysiology

Pathophysiology

Vacuolization and lysis of outer smooth muscle cell in the media



Separates the outer medial muscle from the adventitia



Patchy transmural loss of the external elastic lamina

Pathophysiology

Progression of mediolysis

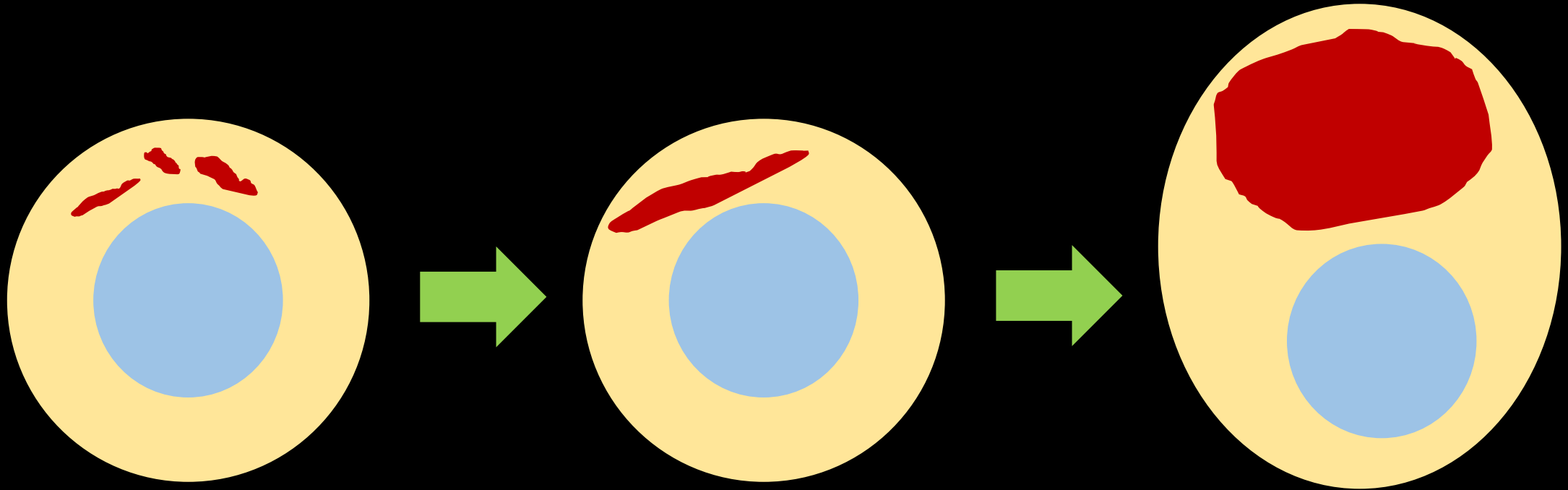


Destroyed internal elastic lamina and the intima



Blood filled gap lumen with intact adventitial layer

Pathophysiology



Vacuolization and lysis of outer smooth muscle cell in the media

Destroyed internal elastic lamina and the intima

Blood filled gap lumen with intact adventitial layer

Pathophysiology

- The imaging findings reflect the pathophysiological change.
- Six types of angiographic findings were suggested by Slavin.
 - Arterial dilatation
 - Single aneurysm
 - Multiple aneurysms
 - Dissecting hematomas
 - Arterial stenosis
 - Arterial occlusions.

Clinical presentation

Clinical presentation

- Classic clinical presentation
 - Aneurysm rupture
 - Sudden, life-threatening hemorrhage of the abdomen
 - Retroperitoneal hemorrhage
 - Arterial dissection / occlusion
 - End organ damage
 - Hematuria, stroke, hematochezia
- Any age (middle aged to elderly population)
- No sex predisposition
 - In recent systemic review, slightly male predominance (1.5:1)

Vascular distribution

- According to study of Peng et al.
- The most common vascular territories affected by SAM were the renal arteries (47%), superior mesenteric artery (46%), and celiac trunk (46%), hepatic artery (23%), iliac arteries (18%), and splenic artery (14%)
- Most patients had involvement of two or more vascular territories.

Peng KX, Davila VJ, Stone WM, Shamoun FE, Naidu SG, McBane RD, et al.
Natural History and Management Outcomes of Segmental Arterial Mediolytic.
Journal of Vascular Surgery. 2018;67(1).

Guideline for diagnosis

Clinical History	<ul style="list-style-type: none">- Absence of congenital predisposition for dissection such as Ehlers-Danlos, Marfan- Absence of more plausible diagnosis such as FMD, collagen vascular disorder, or arteritis
Clinical Presentation	Abdominal pain, hypertension, hypotension, hematuria, no symptom
Imaging	Dissection, fusiform aneurysm, occlusion, beaded appearance, wall thickening No associated contiguous aortic dissection or atherosclerosis
Laboratory	Absence of inflammatory marker

Differential diagnosis

Differential diagnosis	Age / Gender	Laboratory findings	Vascular distribution	Imaging findings
SAM	Any age	No serological marker	Renal Celiac Mesenteric	Dissection with string of beads appearance Wall thickening Thrombosis
FMD	Young to middle age Female	No serological marker	Renal Carotid	String of beads appearance No dissection
Mycotic aneurysm	Variable	- Positive blood culture - Raised WBC	Vessel bifurcation	Psuedoaneurysm
Necrotizing angitis	Variable	- P-ANCA positive - High ESR and CRP	Renal Mesenteric	PAN: small < 1 cm aneurysm Wegener's: small vessel narrowing or aneurysms Behcet's: small vessel narrowing

Imaging Findings

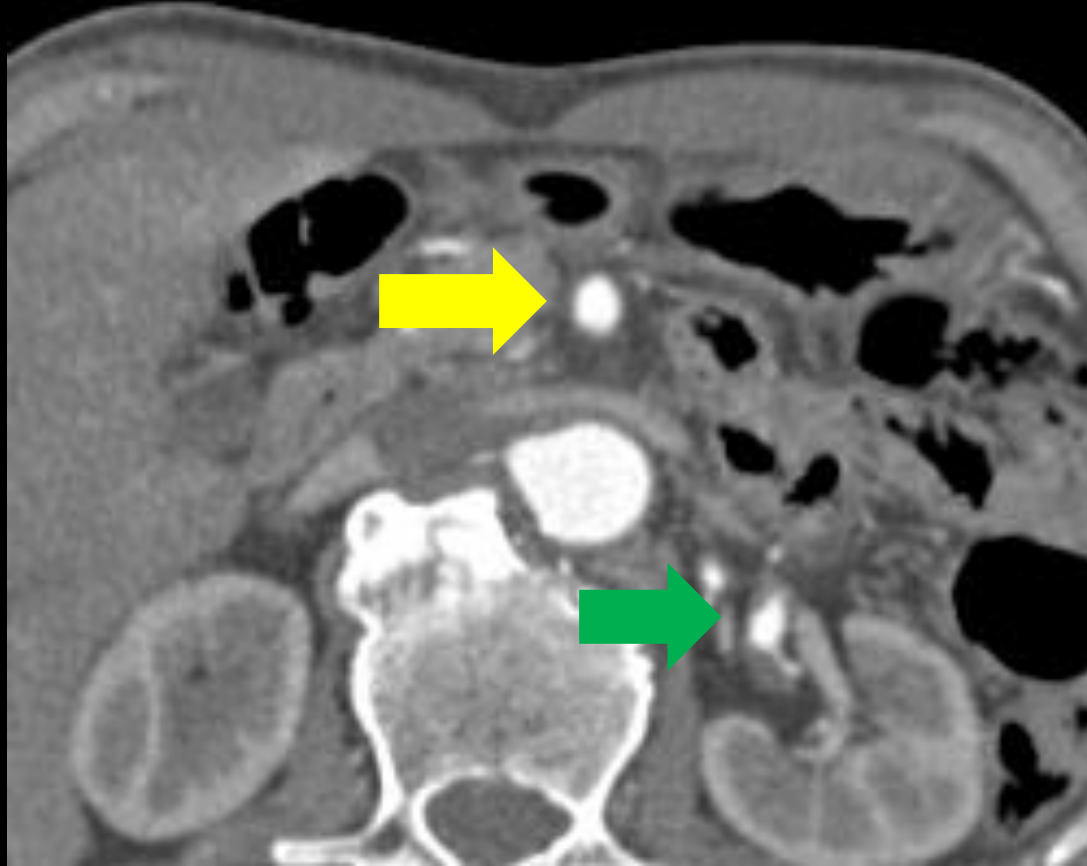
Imaging Findings

- The histopathological diagnosis of SAM is not available in many cases.
- The radiologic findings have an importance role in the diagnosis of SAM.
- Abdominal CT finding includes intra-abdominal hematoma, mesenteric hematoma and retroperitoneal hematoma.
- Active bleeding may represent in some cases.
- Digital subtraction angiography (DSA) is a useful substitute for histopathological diagnosis and can detect specific findings of SAM

Imaging Findings

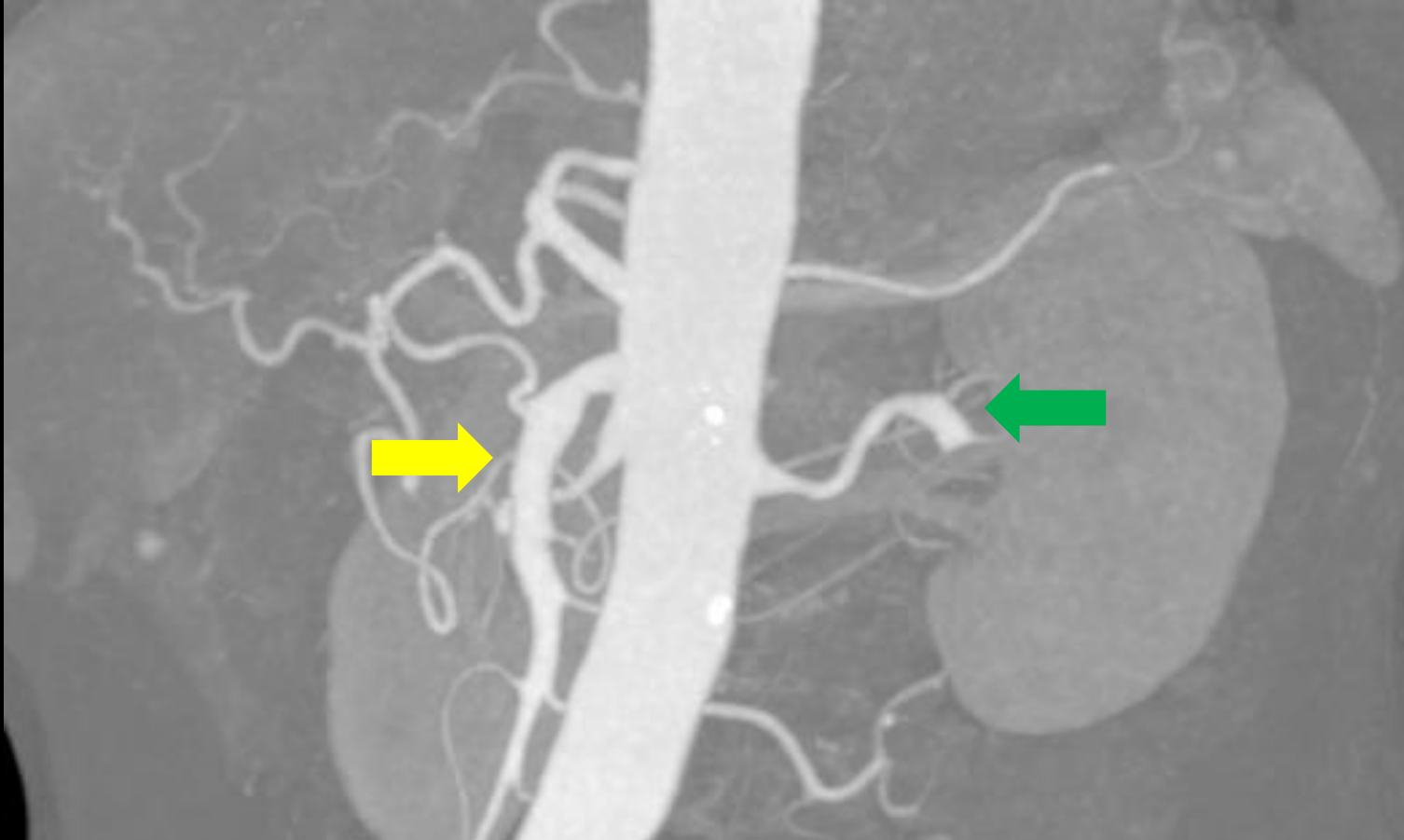
- Arterial dilatation / aneurysm
 - Vacuolization and lysis of outer smooth muscle cell in media
- String of beads appearance
 - Segmental distribution with normal uninvolved segments in between
- Occlusion
 - Intramural hematoma and dissecting aneurysm, granulation

Arterial dilatation / aneurysm



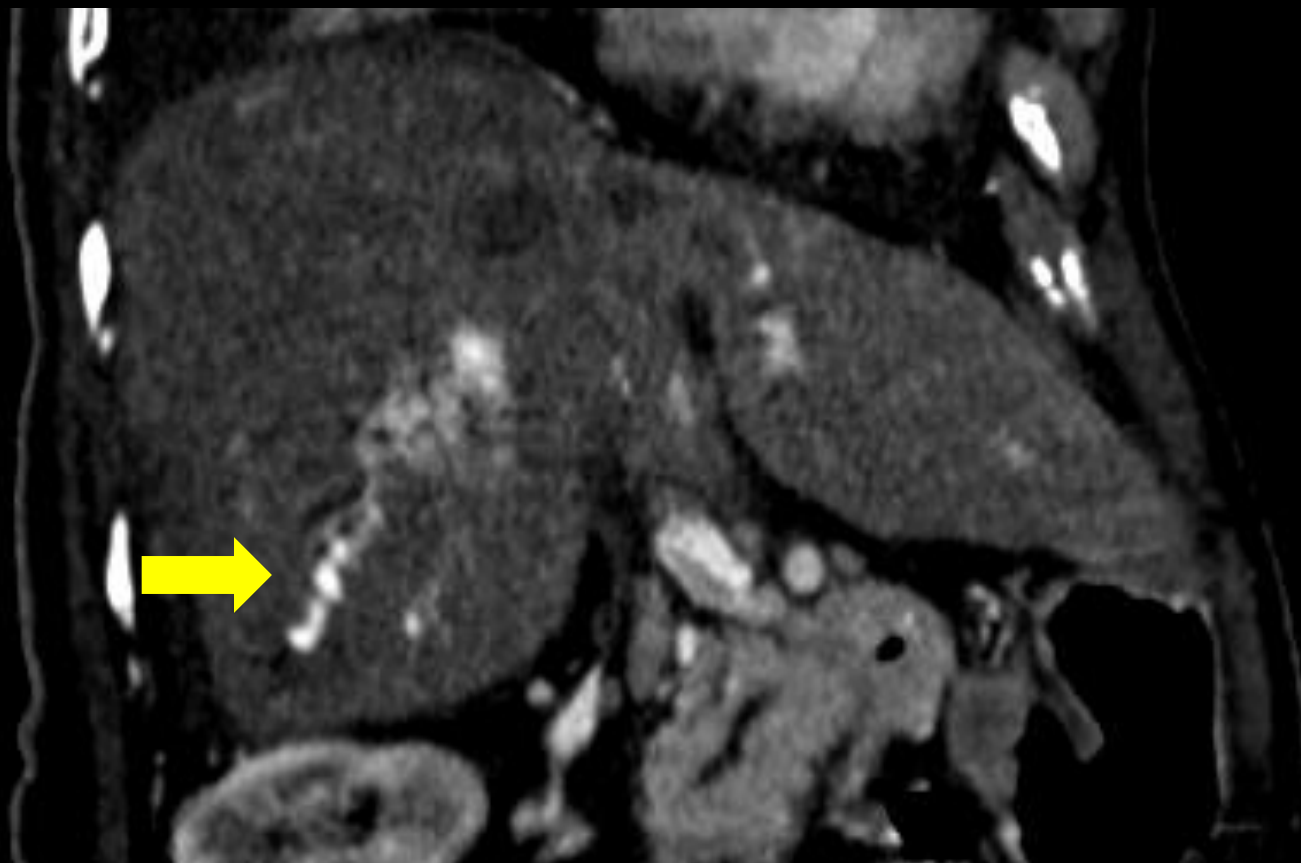
Axial CT of upper abdomen shows dilatation of proximal SMA (yellow arrow) and distal left renal artery (green arrow)

Arterial dilatation / aneurysm



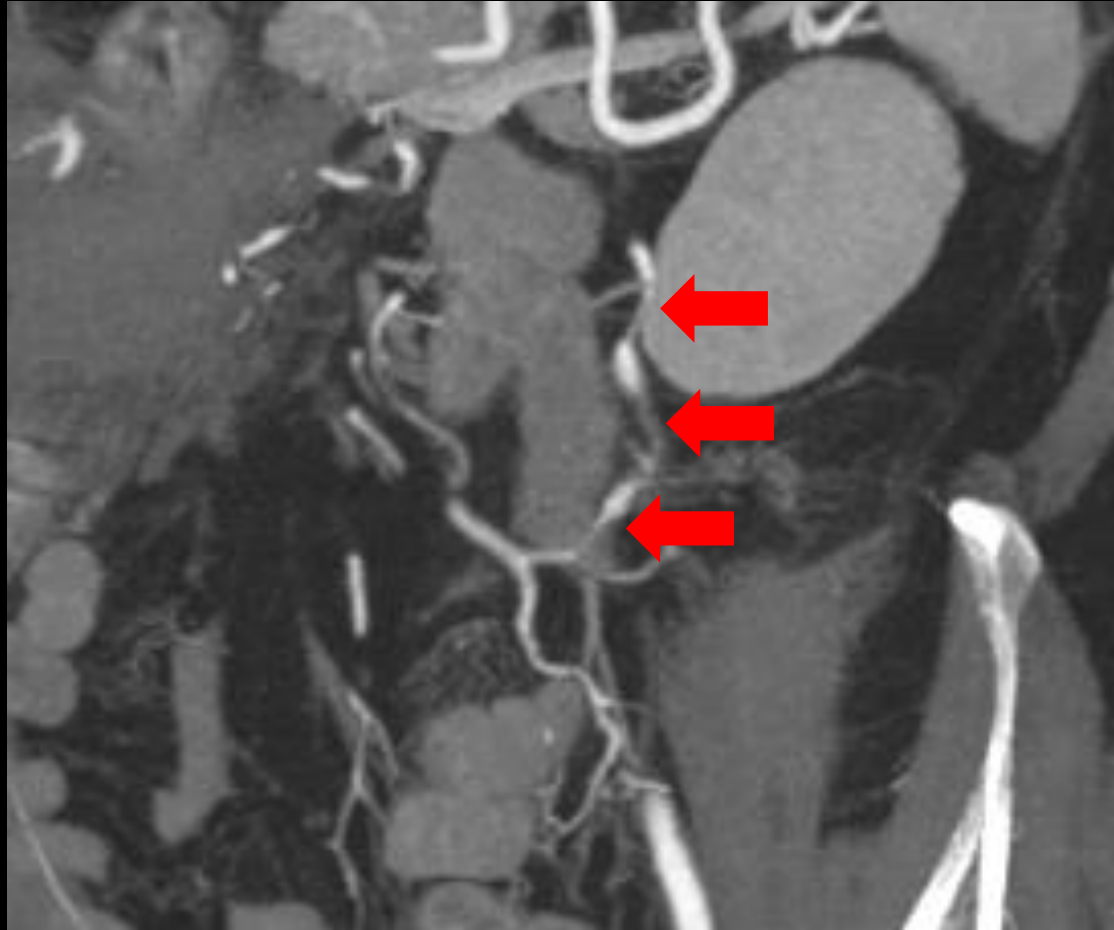
CTA shows dilatation of proximal SMA (yellow arrow) and distal left renal artery (green arrow)

String of bead appearance



CT of the upper abdomen shows string of bead appearance of right hepatic artery (yellow arrow)

String of bead appearance



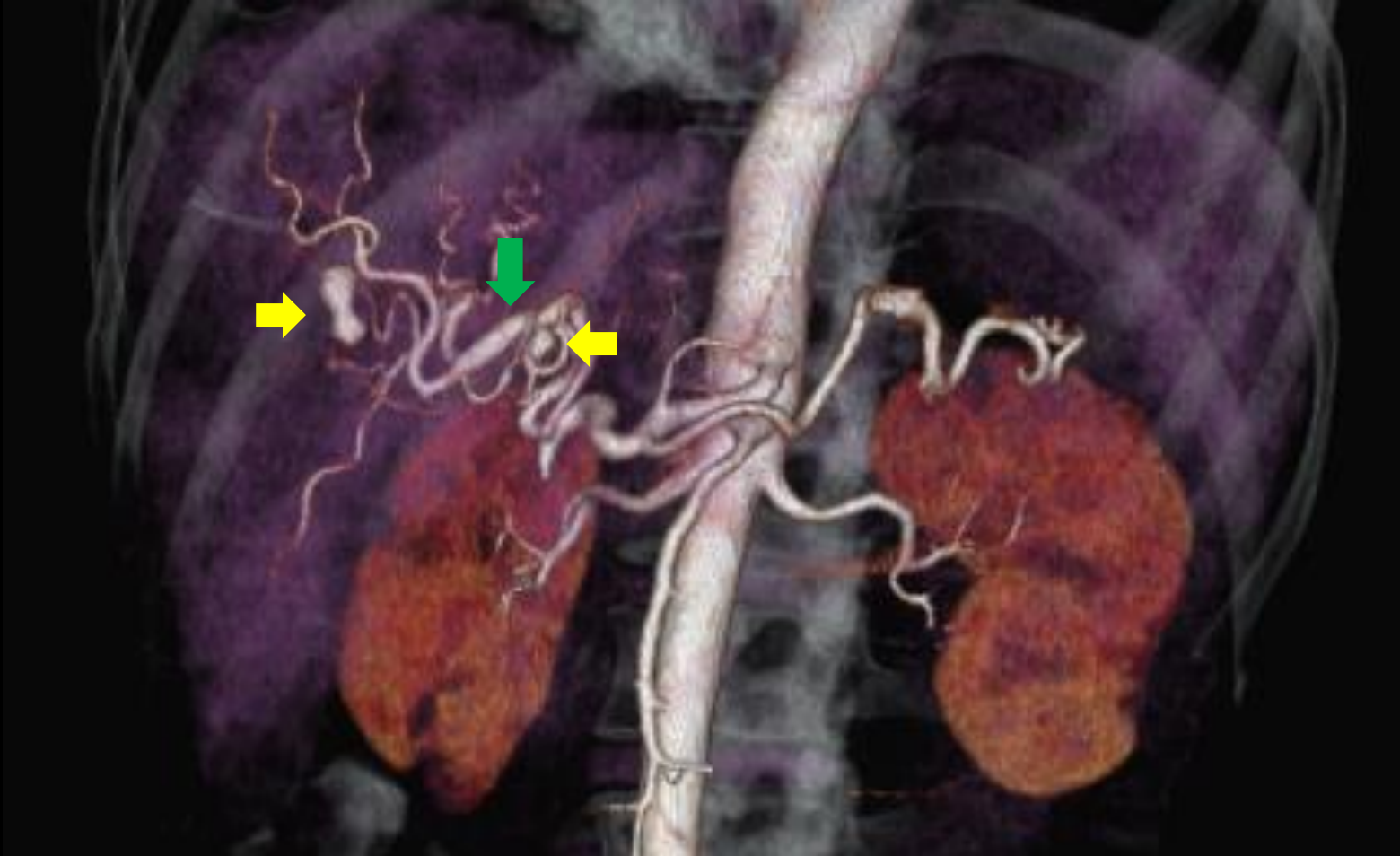
Coronal oblique view of the upper abdomen shows string of bead appearance of SMA (blue arrow)

String of bead appearance



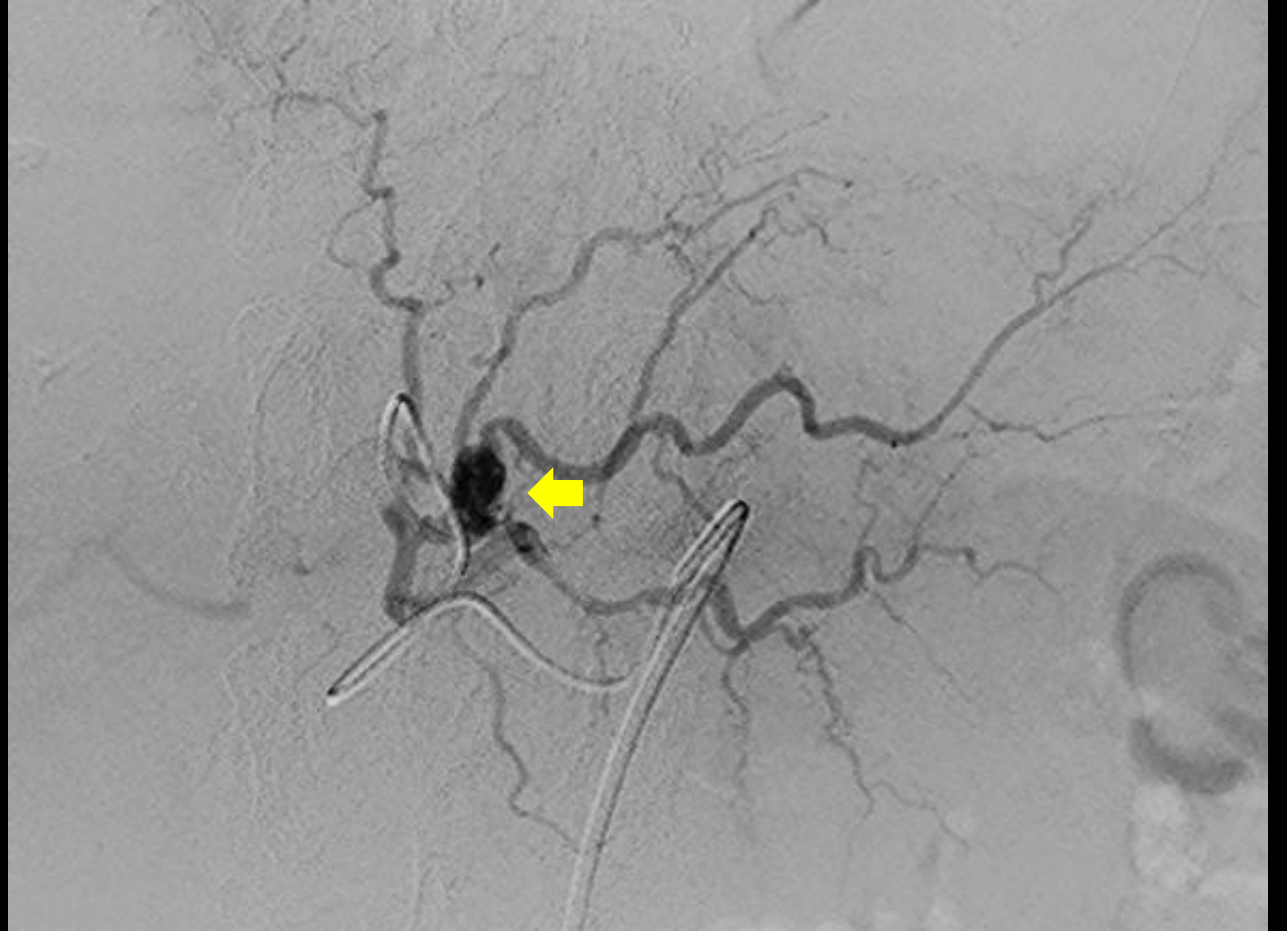
Angiography of SMA reveals string of bead appearance

Multiple aneurysms



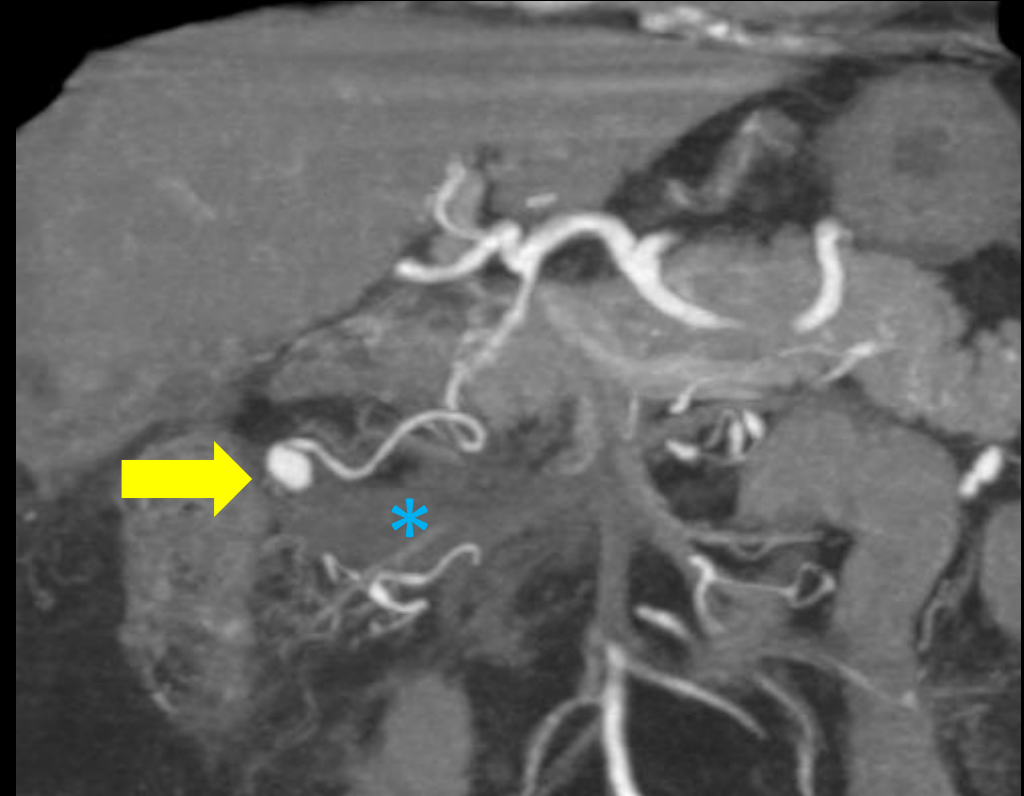
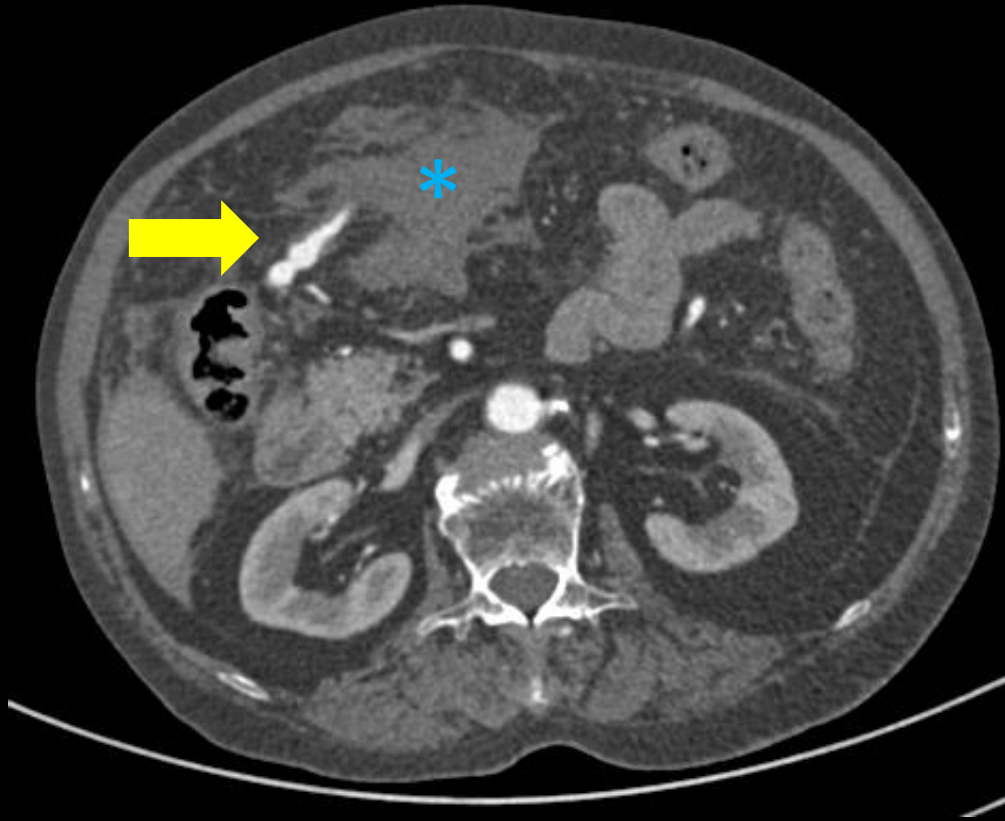
CTA abdomen shows dilatation (green arrow) and multiple aneurysms (yellow arrow) of hepatic artery

Multiple aneurysms



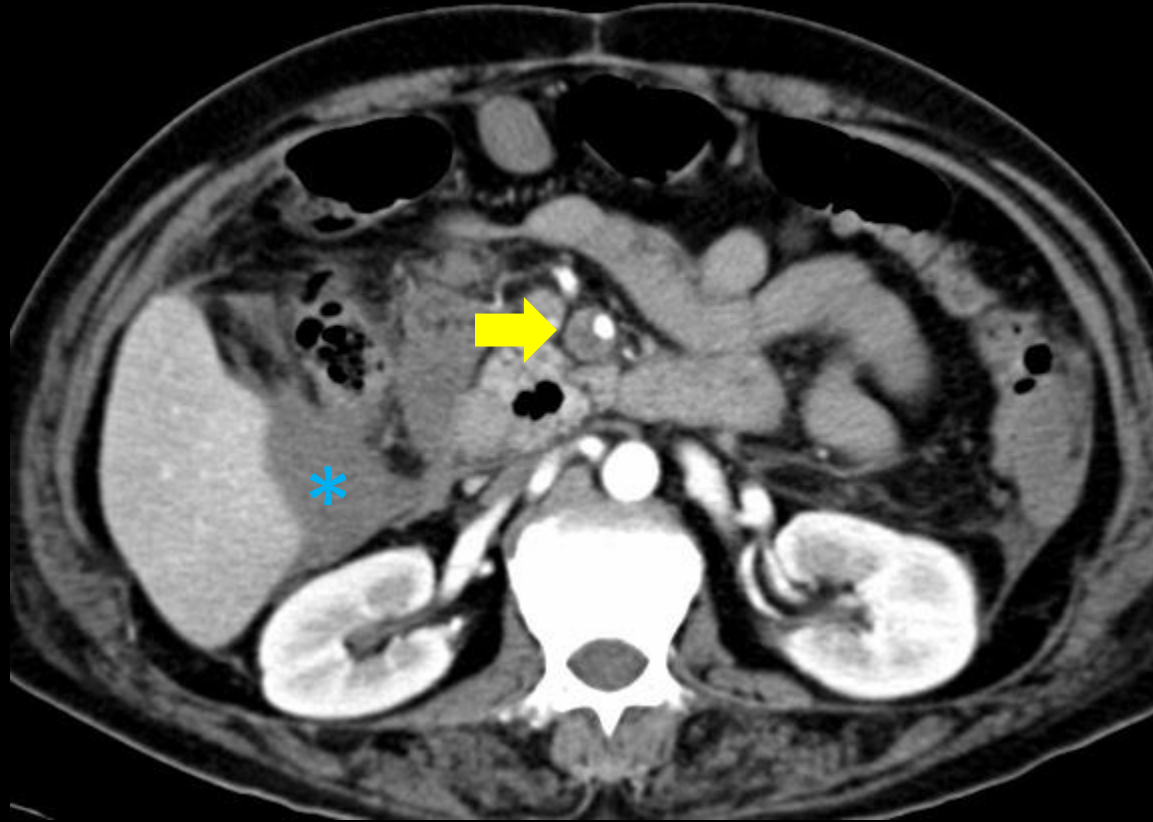
CTA and DSA reveal aneurysms of left hepatic artery

Rupture aneurysm



Axial and coronal CT abdomen demonstrate aneurysm of right gastroepiploic artery (yellow arrow).
Note hemoperitoneum in upper abdomen (*)

Dissecting hematoma



Axial CT abdomen shows dissecting hematoma of SMA (yellow arrow).
Note hemoperitoneum in upper abdomen (*)

Conclusion

- Familiar with abdominal CT and angiography is a crucial clue for diagnosis SAM.
- Differential diagnosis among SAM, FMD, mycotic aneurysm and necrotizing angiitis by clinical presentation, laboratory findings, vascular distribution and imaging findings

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