Learning objectives

1. Review the pathophysiology of Polyarteritis Nodosa (PAN).

2. Illustrate the common imaging manifestations of Polyarteritis Nodosa.

3. Provide examples of mimics of Polyarteritis Nodosa emphasising the challenge this diagnosis presents to radiologists.

Background

Polyarteritis nodosa (PAN) is one of a spectrum of diseases that belongs to the pathologic category of necrotizing vasculitis. PAN is characterized by the presence of inflammatory reactions of blood vessels of medium or small caliber that lead to necrosis and destruction of the walls of vessels. The diagnosis is ideally made by means of biopsy of involved tissue in a patient with the appropriate clinical symptoms and laboratory data, but an angiogram provides the proof in some cases. Most patients with PAN have positive angiographic evidence of their disease, predominantly in the visceral arteries but also in arteries of the extremities and in small branches of the aorta. The most well-known angiographic feature is the presence of so-called microaneurysms in medium or small arteries. Arterial occlusive lesions are also a feature. In this poster, the epidemiology, pathology, clinical features, and diagnosis of PAN are presented. In addition, some of the commonest imaging features and other pathologies with image findings which mimic PAN are discussed.

PAN occurs twice as frequently in men as in women, and it is found in all age groups but most commonly in the 5th-7th decades. The estimated annual frequency ranges from four to nine per million people in the general population to more than 70 per million people in the population of patients with hepatitis B virus (1). In studies reported from France (2,3), the percentage of cases of PAN attributed to hepatitis B viral infection decreased from 36% to 7% during the past decade after the development of vaccines against viral hepatitis.

The cause of PAN is unknown for most patients. Viruses play a role in the pathogenesis in some cases, most notably hepatitis B virus (4,5) but also human immunodeficiency virus (6,7). PAN is a focal panmural necrotizing vasculitis in small and medium sized arteries.
(and sometimes small veins) that can involve any organ and in varying degrees. The primary abnormal changes of the involved vessel consist of fibrinoid or hyaline necrosis of the media with simultaneous or subsequent involvement of the intima and adventitia. Secondary changes include aneurysm formation, hemorrhage, and thrombosis. The kidneys may be involved in 70%-80% of cases; the gastrointestinal tract, peripheral nerves, and skin in 50%; skeletal muscles and mesentery in 30%; and the central nervous system in 10% (8).

**Imaging findings OR Procedure details**

Recognition of PAN can be a clinical challenge given its varied spectrum of organ involvement, wide range of clinical symptoms, and variations in severity. The clinical course lasts several months to more than a year. Relapse occurs in 40% of treated patients, with a median interval of 33 months (9). The disease may be fulminant; if untreated, the 5-year survival is less than 15%. Survival increases to 80% with steroid treatment, with or without cytotoxic drugs (10,11). Most tests are nonspecific, although the erythrocyte sedimentation rate is usually elevated. Fever, malaise, and weight loss are common. Many of the clinical symptoms are related to organ ischemia secondary to arterial branch occlusions. Aneurysm rupture is a less common cause of pain. Arthralgias are noted in 50% of patients as are peripheral neuropathies (mononeuritis multiplex), which are often symptomatic early. Renal involvement including proteinuria and hypertension are found in 75% (12). Branch vessel occlusions can lead to multiple renal infarcts. Abdominal pain from ischemia or infarction secondary to occlusive lesions is the most common gastrointestinal complaint. Abdominal pain may also be caused by rupture of an aneurysm in one of the viscera: liver, kidney, or mesentery (13). Cutaneous lesions include palpable purpura, infections, and ischemic ulcers. Muscle pain and limb claudication may occur.

The diagnostic criteria of PAN have been classified by the American College of Rheumatology (14). Three of the 10 criteria must be present for the diagnosis of PAN. A positive angiogram with typical findings is one of the 10 criteria. A definitive diagnosis may be made in certain clinical settings by performing tissue biopsy from a symptomatic organ site, but sampling errors and lack of disease specificity may be problematic. The role of angiography is to help confirm or support the clinical impression when a suitable biopsy site is lacking or when the biopsy results are inconclusive. In patients with generalized systemic symptoms—especially abdominal complaints, nephropathy, hypertension, or generalized malaise—angiography is a valuable diagnostic tool that can lead to the diagnosis in occult cases. High-spatial-resolution angiographic technique is important for maximizing the diagnostic potential of the procedure. The diagnostic features of PAN, such as minimal luminal irregularity or narrowing, are difficult to detect on suboptimal studies. Aneurysms may be small, difficult to detect, few in number, or isolated
to one organ. A complete angiographic study of the abdomen should be considered to help detect occult aneurysms. Angiographic findings are present in about 40%-90% of patients at the time clinical symptoms appear (15) and include:

- Aneurysms
- Ectasia
- Occlusive disease

The true frequency of PAN is difficult to determine because of the nonspecificity of angiographic findings and sampling bias. Other diseases, including rheumatoid vasculitis, systemic lupus erythematosus, and Churg-Strauss syndrome, may have similar angiographic findings of aneurysms and occlusive lesions (16). Drug abuse is another accepted cause of multiple microaneurysms in various organs. Citron et al. (17) reported that the diverse clinicopathologic syndrome and angiographic findings of necrotizing angiitis associated with drug abuse were strikingly similar to those of polyarteritis nodosa with severe renal, gastrointestinal, cardiac, and neurologic involvement. Other vasculitides, such as Wegener's granulomatosis have also been reported in the literature to have multiple aneurysms similar to those of polyarteritis nodosa (18). Findings of multiple, small-sized aneurysms on angiography are pathognomonic for PAN. The aneurysms are usually multiple (most often 10 or more in any one visceral circulation) and 2-5 mm, commonly affecting the branch points of arteries.

The kidney is the most frequently affected organ. Depending on the vessels involved, renal polyarteritis nodosa may present clinically as acute or chronic renal failure or nephrotic syndrome or may be manifested by perirenal hemorrhage. With renal complications, hypertension often develops rapidly. Two characteristic lesions have been described in polyarteritis nodosa when the kidney is involved: they may occur separately or together (19):

- Arteritis.
- Glomerulitis.

The arteritis primarily involves the arcuate vessels and consists of fibrinoid necrosis and vascular thrombosis. Thus, multiple small renal infarcts are a prominent feature. The aneurysm, forming as a result of focal necrosis of the vessel wall, may undergo necrosis and healing with fibrosis, but occasionally will rupture and produce perirenal and retroperitoneal hemorrhage (19).

Approximately one half to two thirds of patients with polyarteritis nodosa have abdominal pain, nausea, vomiting, or other gastrointestinal symptoms. The gastrointestinal lesions may take the form of ulceration, perforation, hemorrhage, or infarct and produce corresponding symptoms:
• Gastrointestinal hemorrhage occurs in roughly 6% of cases.
• Bowel perforation in 5%.
• Bowel infarction in 1% (20,21).

In the gastrointestinal tract, the jejunum appears to be most commonly involved. Generally, when the aneurysms involve the mesenteric arteries, their number and size are fewer and smaller compared with those of the kidney and liver (22). The infarcted bowel progresses into either bowel perforation or bowel obstruction caused by stricture.

In addition to the genitourinary and gastrointestinal tracts, any organ in the abdomen can be involved -the liver is the most common. The vascular changes in the liver result in:

• Aneurysm formation.
• Rupture of aneurysm.
• Infarction.
• Interstitial hepatitis.
• Liver cirrhosis.

Although the liver is commonly involved, there are few clinical signs or symptoms suggesting hepatic involvement (22). The cystic arteries are also a frequent site of developing arteritis, and subsequent acalculous cholecystitis and intracholecystic hemorrhage have been reported (23).
Fig.: 1. Occlusive disease in PAN. Selective right renal angiogram obtained in the arterial phase shows partial obliteration, or pruning, of the renal arteries distally.

References: D. T. O Driscoll; St. James Radiology Department, St. James Hospital, Dublin, IRELAND
**Fig.**: 2. Occlusive disease in PAN. Selective right renal angiogram obtained in the parenchymal phase showing multiple microaneurysms and a right lower pole infarct.  
**References**: D. T. O Driscoll; St. James Radiology Department, St. James Hospital, Dublin, IRELAND
Fig.: 3. Diffuse involvement of the abdominal visceral arteries with PAN. Angiogram shows multiple aneurysms of the coeliac trunk and its peripheral branches.  

References: D. T. O Driscoll; St. James Radiology Department, St. James Hospital, Dublin, IRELAND
**Fig.**: 4. Diffuse involvement of the abdominal visceral arteries with PAN. Angiogram depicts extensive fusiform aneurysms of the superior mesenteric artery and one large saccular aneurysm of the accessory right hepatic artery.

**References**: D. T. O Driscoll; St. James Radiology Department, St. James Hospital, Dublin, IRELAND
**Fig.** 5. Diffuse involvement of the abdominal visceral arteries with PAN. Angiogram depicts the coeliac trunk and pancreaticoduodenal arcade with extensive small fusiform microaneurysms.

**References:** D. T. O Driscoll; St. James Radiology Department, St. James Hospital, Dublin, IRELAND
**Fig.** 6. Superior mesenteric artery involvement in PAN. Superior mesenteric artery angiogram shows multiple microaneurysms in peripheral branches of the superior mesenteric artery.

**References:** D. T. O Driscoll; St. James Radiology Department, St. James Hospital, Dublin, IRELAND
Fig.: 7. Superior mesenteric artery involvement in PAN. Superior mesenteric arteriogram shows multiple microaneurysms in a jejunal branch of the superior mesenteric artery.

References: D. T. O Driscoll; St. James Radiology Department, St. James Hospital, Dublin, IRELAND
Fig.: 8. Segmental arteriolar mediolysis. Multiple microaneurysms in the superior mesenteric artery (biopsy proven to be SAM) mimicking PAN.

References: D. T. O Driscoll; St. James Radiology Department, St. James Hospital, Dublin, IRELAND
Fig.: 9. Fibromuscular Dysplasia (a,b). Nonselective renal angiogram depicting classical FMD (a,b).

References: D. T. O Driscoll; St. James Radiology Department, St. James Hospital, Dublin, IRELAND
Fig.: 9. Fibromuscular Dysplasia (a,b). Nonselective renal angiogram depicting classical FMD (a,b).

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Conclusion

As seen in this review of the spectrum of imaging findings in PAN, a variety of arterial beds may be affected and a variety of lesions may be seen. The clinical diagnosis of polyarteritis nodosa is usually made on the basis of various symptoms and signs of:

- abdominal pain.
- hypertension.
- arthralgia or arthritis.
- peripheral and central nervous system dysfunction.
- retinopathy.
• cardiac involvement.
• respiratory involvement.
• hepatic involvement (24).

Such protean clinical manifestations frequently present a diagnostic challenge. Findings of multiple, small-sized aneurysms on angiography are virtually pathognomonic for PAN. While the presence of aneurysms increases the specificity of the diagnosis of PAN, in their absence other arterial lesions such as luminal irregularities, stenoses, and occlusions can suggest the diagnosis. In a patient without fulminant disease but in whom clinical suspicion is firm, comprehensive angiography may lead to the diagnosis of PAN on the basis of the constellation of angiographic findings.

Without angiography, the correct diagnosis is established only by obtaining a biopsy of subcutaneous nodules or skeletal muscle; however, the diagnostic success rate of the biopsy has been disappointing (20-35%) (25). Therefore, a negative biopsy does not rule out the condition.

In summary, the possibility of vasculitis should be considered when multiple abdominal organs have abnormal radiologic findings; however, angiography is necessary (in the absence of a positive biopsy) for establishing a specific diagnosis of polyarteritis nodosa.

Personal Information

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References


