

Gross and microscopic photos courtesy of Melanie Bois, MD and Andrew Layman, MD

1. The decedent is an 80 year old man with a history of prostate cancer (s/p prostatectomy with Gleason 4+3), granulomatosis with polyangiitis (GPA), and coronary artery disease. He was admitted to a tertiary care center for acute renal failure. A renal biopsy showed necrotizing and crescentic glomerulonephritis and serology was positive for anti-neutrophil cytoplasmic antibody (ANCA), consistent with his known diagnosis of GPA. He was discharged home with an alkylating chemotherapeutic drug and steroids.

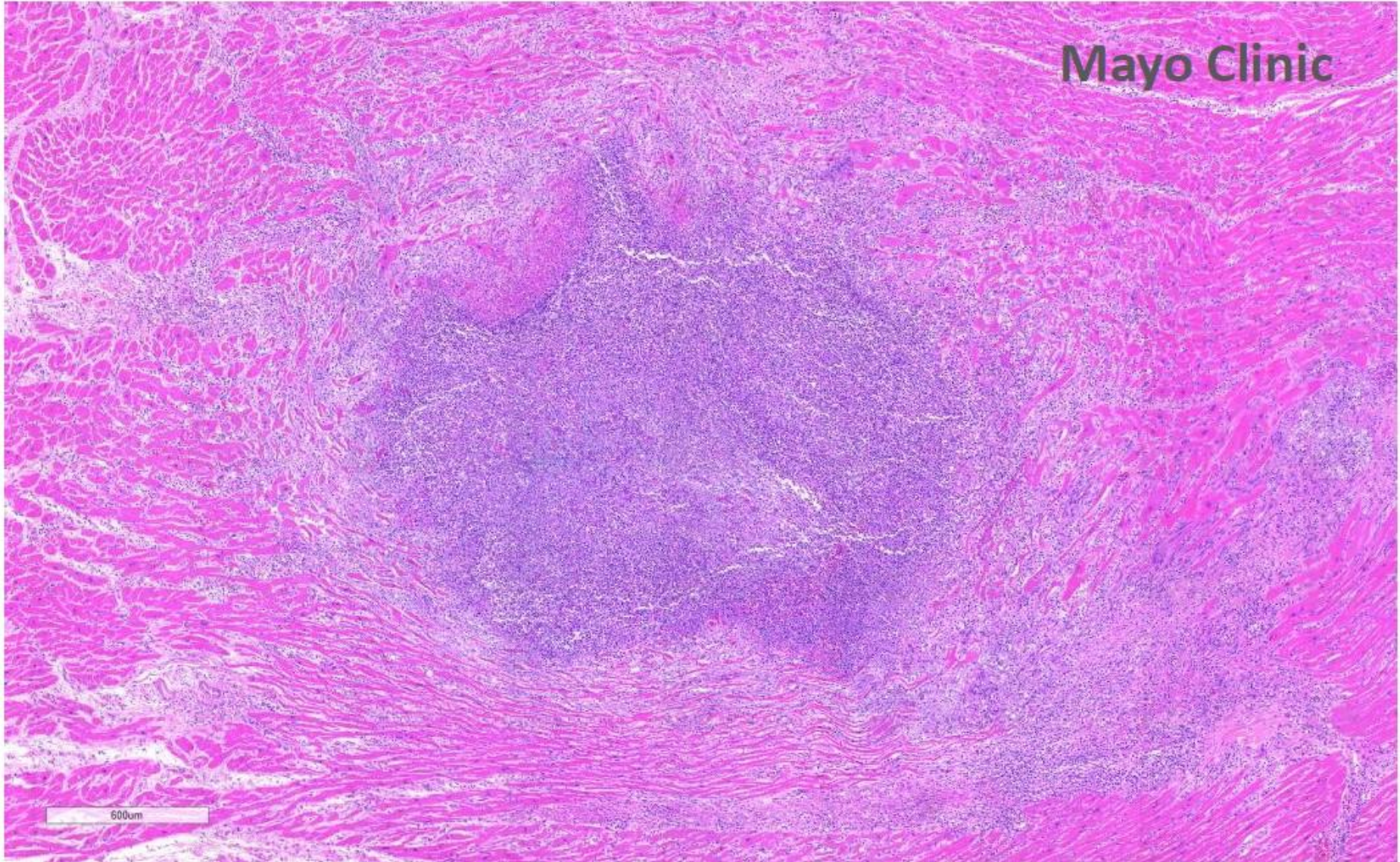
Three months later a chest x-ray showed lung involvement by GPA. During plasma exchange therapy the patient became unresponsive, was intubated and subsequently placed on comfort measures before dying two days later. Autopsy showed a ruptured middle cerebral artery aneurysm, diffuse intraparenchymal hemorrhage with subarachnoid extension, and cavitary pulmonary lesions.

Given the clinical history and gross findings, what is the most likely etiology of these cardiac lesions?

- ☐ Metastatic prostate cancer
- ☐ Resolving myocardial ischemic injury
- ☐ Vascular fibrosis associated with GPA
- ☐ Septic abscesses
- ☐ Drug-induced cardiotoxicity



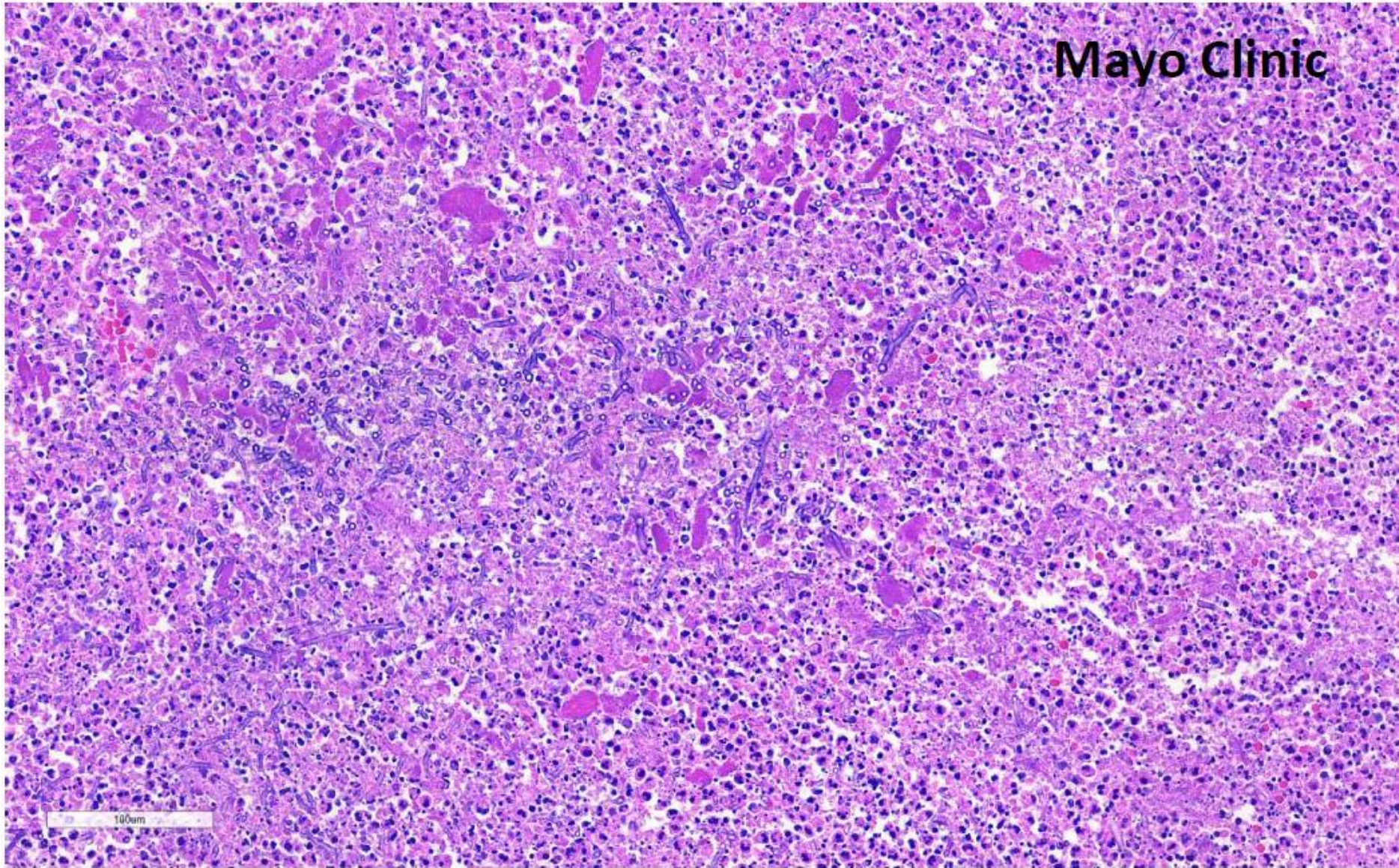
Mayo Clinic



Heart



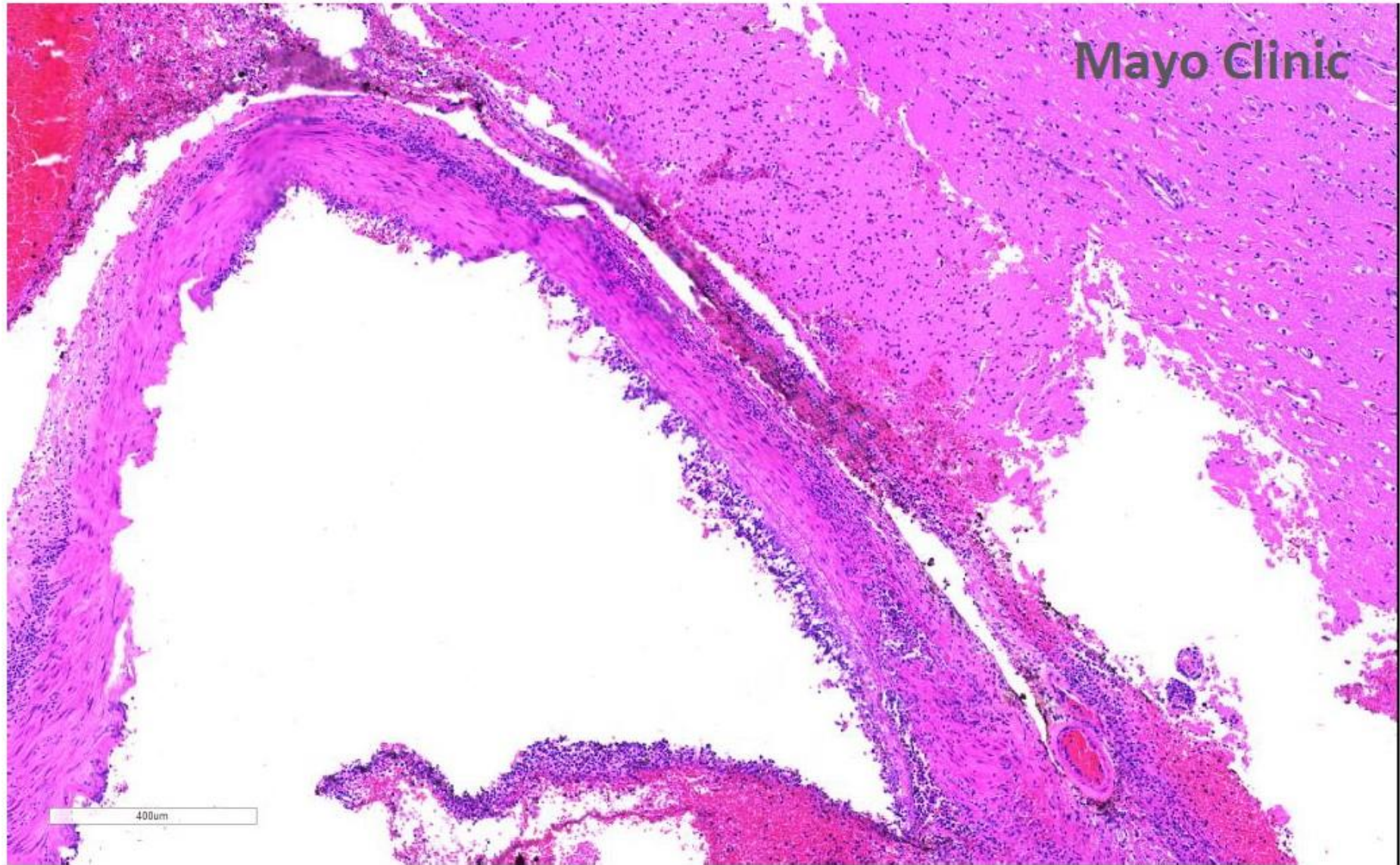
Mayo Clinic



Heart

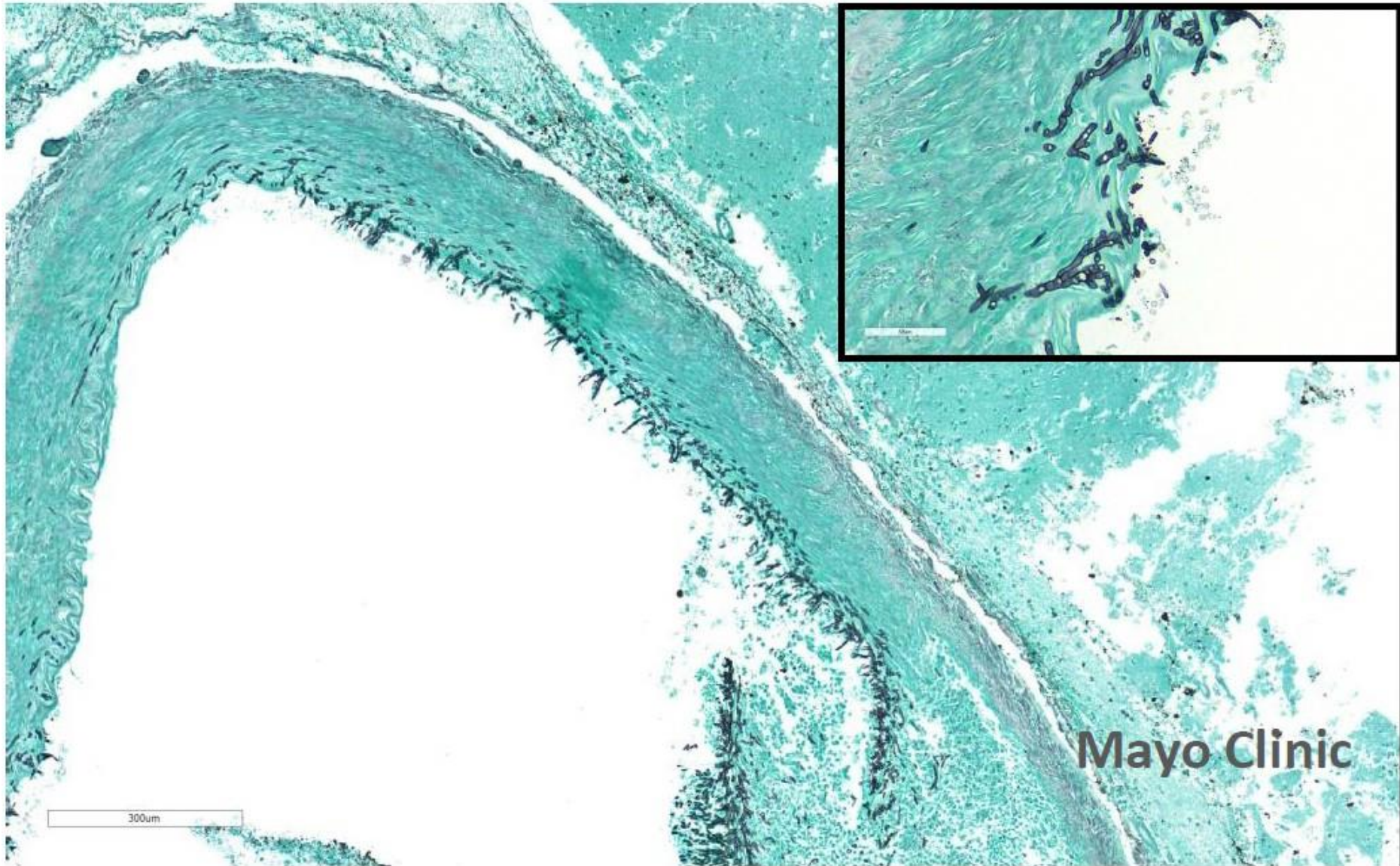


Mayo Clinic



Brain





Brain



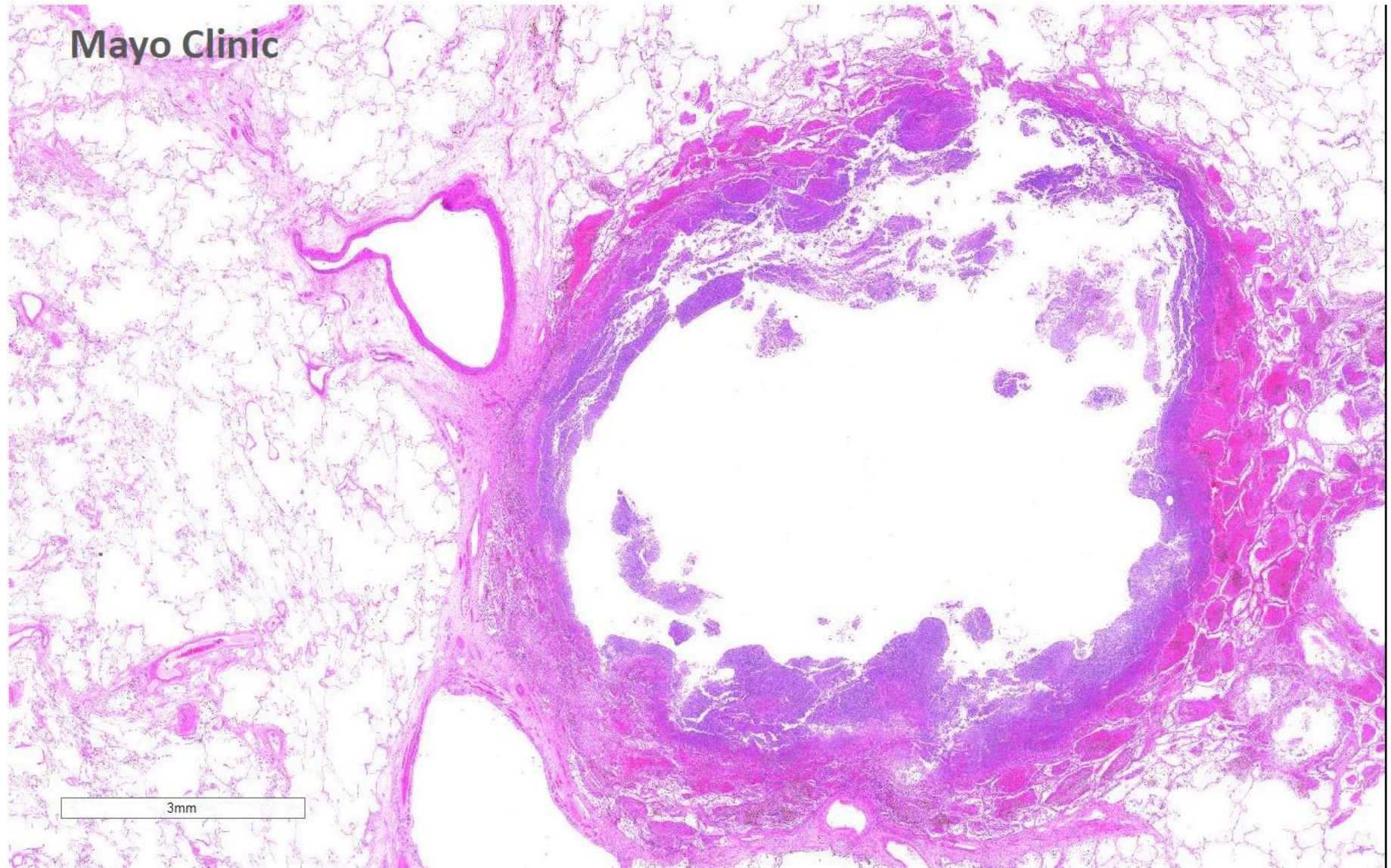
Mayo Clinic



Lung



Mayo Clinic



3mm

Lung



The lesions in his myocardium turned out to be septic abscesses that contained *Aspergillus* (see full description below). Additional images of the heart, brain, and lung are attached. Thanks again to Dr. Andrew Layman and Dr. Melanie Bois for submitting this question.

Responses:

A. Metastatic prostate cancer (8.92% of responses)

Metastases normally appear as firm solid nodules. While tumor necrosis can cause cavitary lesions, the clinical scenario makes infectious etiology more likely.

B. Resolving myocardial ischemic injury (1.88% of responses)

The appearance and distribution of the lesions in this instance are not suggestive of an ischemic injury. Ischemic events can normally be attributed to a coronary artery distribution and do not generally form punctate lesions. Fibrinoid necrosis from a myocardial infarction leads to myocardial fibrosis. Cavitation is not seen.

C. Vascular fibrosis associated with GPA (30.52% of responses)

The treatment for GPA often consists of chemotherapeutic agents and steroids. While this treatment regimen certainly placed this patient at risk for infection it is not the underlying etiology of the myocardial lesions. GPA involvement of the myocardium is rare, but has been shown to be associated with pericarditis, arteritis, and myocarditis as well as arrhythmias and valvular disease.



D. Septic abscesses (Correct Answer, 50.23% of responses)

Gross findings show short axis myocardial sections with multiple punctate gray-white, granular and cavitory lesions. These lesions are consistent with disseminated infection and multiple septic abscesses. Subsequent histology and GMS stain showed acute inflammation with numerous fungal forms including hyphae with acute angle branching, consistent with *Aspergillus* sp. Fungal myocarditis happens almost exclusively in the setting of an immunocompromised patient, although nosocomial infections during heart surgery have also been reported in the literature. In this case the use of chemotherapeutic agents and steroids placed this patient at an increased risk of developing an infection. Further autopsy findings showed the brain findings were due to a mycotic aneurysm and the cavitory lesions of the lung were also of an infectious etiology.

E. Drug induced cardiotoxicity (8.45% of responses)

Cardiotoxicity is not associated with any specific gross findings, but may be the cause of a dilated cardiomyopathy. In the acute setting the patient may present clinically with arrhythmias and histologically may show acute inflammation of the myocardium and microvasculature with contraction band necrosis. Commonly implicated therapeutic agents include doxorubicin, 5-fluorouracil, trastuzumab, and paclitaxel. Recently cardiotoxicity associated with chronic hydroxychloroquine use has been discussed in the media due to its use in COVID-19 patients. Histologically it is associated with myocyte vacuolization due to myofibrillar degeneration. Myelin bodies and curvilinear bodies may be seen on electron microscopy.



D. History of abdominal surgery (Correct Answer, 62.44% responses)

Volvulus is a well-recognized cause of acute intestinal obstruction, occurring most often in the sigmoid colon and cecum, with volvulus of the small bowel rarely being encountered in the adult population of the United States. Volvulus can be primary, without any predisposing anatomic abnormalities or risk factors, or secondary to congenital or acquired lesions. Postoperative adhesions are the most common cause of secondary volvulus in adults. The volvulus rotation (torsion) causes vascular insufficiency, resulting in ischemia and tissue hypoxia. Substantial increases in intraluminal pressure and dilation of the bowel segment further compromise vascular supply to the intestinal wall, ultimately leading to hemorrhagic infarction and perforation, which is associated with high morbidity and mortality. CT scans may reveal torsion of loops of small bowel around the mesenteric vessels and mesentery known as the “whirl sign”. Other radiographic signs, such as the “spoke wheel,” “beak,” and “barber pole” signs, have been described in the literature as well. Of note, although this pathology represents a rare cause of small bowel obstruction in Western countries, in Asia and Africa, it can represent between 20 and 50% of the cases. Possible related factors have been proposed such as uptake of large quantities of fiber after prolonged fasting, as occurs with Muslims during The Ramadan festival.

E. Adenocarcinoma of the sigmoid colon (2.26% responses)

Colon cancer is one of the most common causes of intestinal obstruction, accounting for approximately 60% of cases. Although the burden of tumor can cause elongation and dilation within the sigmoid colon, becoming a leading source of volvulus torsion, this etiology is a less prevalent source of volvulus than the ones previously mentioned, only resulting in colonic volvulus 5% of the time.