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rate ranges from 1.51% to 12%,^{4,5} which also varies within a relatively large range. In our study, bilateral tumor lesions and preoperative symptoms are found to be associated with malignancy. The risk of a new event is also high in patients with those characteristics. Hence, a particular cohort study may provide more information for individualized follow-up strategies in future studies.

Malignant paraganglioma is more likely diagnosed in genetic mutations carriers, especially in SDHB mutation carriers.⁶ In addition, SDH mutations may serve to guide the follow-up strategy as it is associated with increased risk of recurrence and development of metachronous tumors.⁷ Unfortunately, we did not regularly perform genetic testing as mentioned before. Lacking data makes it unavailable to analyze the correlation between genetic mutations and malignancy. We will perform more genetic testing and provide evidence on the roles of genetic mutations in CBT management in future studies.

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COVID-19 patients with abdominal aortic aneurysm may be at higher risk for sudden enlargement and rupture



The American College of Surgeons recommends limitation of elective abdominal aortic aneurysm (AAA) repair during the COVID-19 pandemic to reduce contamination rates for patients and health workers.¹

In a recent article, Xu et al² described the mechanisms through which COVID-19 infection might determine AAA degeneration. Several mechanisms related with COVID-19 infection have the potential to activate metalloproteinases able to digest collagen and elastin, favoring AAA wall degeneration, including the increased levels of inflammatory cytokines.³⁻⁴ During the pandemic, many patients died at home and epidemiologic studies were inaccurate, making difficult to confirm the hypothesis by Xu et al.

We report our experience at the hospital San Matteo (Lombardy), which seems to support the hypothesis by Xu et al. We have observed four COVID-19-positive patients with a ruptured AAA; in all four patients the aneurysm showed a sudden enlargement during the infection, with local and systemic signs of severe inflammation. COVID-19 infection was diagnosed with serological tests before surgery; steroid therapy was not started before surgery.

Two patients underwent open surgery and two endovascular treatment. There was no mortality or major morbidity. After surgery, steroid therapy could be started without the fear of promoting aneurysm degeneration. Local and systemic inflammatory parameters decreased significantly after both open and endovascular surgery, supporting the hypothesis that the enlarging/ruptured AAA might have contributed to worsening the cytokine storm. Few patients with ruptured AAA have been reported in the literature; we were able to find another four patients who had sudden enlargement of an AAA during COVID-19 infection.⁵⁻⁸ As suggested by Xu et al,² in patients with AAA suffering from moderate-severe COVID-19 infection, attention should be paid to the possibility of sudden enlargement and rupture of the aneurysm; the therapeutic importance of steroid therapy in COVID-19 hospitalized patients should be also considered; steroid therapy might favor collagen digestion with consequent risk for AAA degeneration.⁹

Endovascular aneurysm repair seems to be a valid compromise in hospitalized patients with moderate to severe COVID-19 infection and an enlarging AAA. The operation may also ameliorate the inflammatory storm that accompanies moderate to severe COVID-19 infection, with an improvement in the general clinical condition of the patient.

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