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Case Report

Valsalva maneuvers during computed tomography (CT) can demonstrate seemingly worrisome but ultimately transient aortoiliac narrowing[☆]

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ARTICLE INFO

Article history:

Received 9 May 2022

Accepted 17 May 2022

Keywords:

Abdominal aorta
Aortoiliac disease
CT imaging

ABSTRACT

Computed tomography (CT) being performed with Valsalva is an efficacious and common technique performed to evaluate for abdominal hernias. In certain circumstances, Valsalva can generate sufficient intra-abdominal pressure to cause aortoiliac compression that can raise concerns for possible aortic atresia. Repeat CT without Valsalva generally demonstrates that these changes are transitory, and no further intervention is typically required. Given the ever-growing number of CTs with Valsalva being performed for hernia evaluation, clinicians involved in interpreting abdominal CTs should be aware of this concerning appearing but ultimately benign phenomenon.

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Introduction

Abdominal hernias affect 4% of individuals older than 45 in the United States, with an estimated 1 in 4 men and 1 in 50 women requiring surgery for an inguinal hernia [1,2]. The incidence of the 2 most common abdominal hernias (inguinal and ventral hernias) have steadily increased since 2001 due to increasing surgical volume and hernia recurrence. Although the physical exam is alone diagnostic for abdominal wall hernias, diagnostic tools such as ultrasound and computed to-

mography (CT) with Valsalva are frequently employed in situations such as with obese patients or when they have had prior herniorrhaphy [3]. Valsalva is commonly used to enhance hernia presentation during a CT. With the increasing incidence of abdominal hernias, the number of imaging studies ordered for abdominal hernias is increasing as well [2]. Given the continued growth of CTs with Valsalva, we believe that this case of concerning appearing but ultimately benign aortoiliac compression is important to disseminate to prevent unnecessary follow-up evaluation. Our patient provided written informed consent upon arrival at the teaching institution to share their case details for research purposes.

[☆] Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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<https://doi.org/10.1016/j.radcr.2022.05.048>

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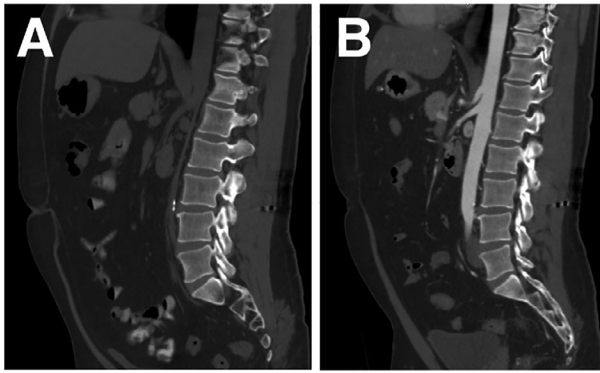


Fig. 1 – Images demonstrating (A) CT with Valsalva from 3/18/21 demonstrating aortic compression, and (B) CT angiogram without Valsalva from 6/14/21 demonstrating a normal aortic caliber.

Case report

The patient presented as a 43-year-old male with a history of left inguinal hernia repair who originally evaluated by general surgery for ventral hernias being considered for possible repair. Although the patient reported feeling discomfort and pain with his ventral hernias, his physical exam revealed only 2 small, non-tender umbilical hernias. The patient has received numerous imaging exams to evaluate for hernia since his initial 2006 intervention. Because of the differences between the patient's clinical presentation and prior imaging, the general surgeon elected to order a CT abdomen pelvis with Valsalva.

The patient subsequently underwent a CT abdomen and pelvis with Valsalva and was instructed to bear down with maximal effort. The study incidentally found a marked de-

crease in the caliber of the aorta (Fig. 1A) and the iliac arteries (Fig. 2) in addition to narrowing of the origin of the superior mesenteric and celiac arteries with minimal atherosclerotic calcification. The degree of compression was sufficient to raise the question of possible aortic atresia, representing a significant change from a prior imaging prompting consultation to vascular surgery.

Upon evaluation by vascular surgery, the patient's symptomatology did not resemble aortoiliac disease. His peripheral lower extremity pulses were palpable bilaterally without lower extremity wounds and had an Ankle Brachial Index (ABI) of 1.35 on the right and 1.34 on the left. Additionally, subsequent CT angiography chest abdomen and pelvis demonstrated an aorta normal in caliber with aortoiliac vessel diameters within normal limits (Fig. 1B).

Discussion

This case presented a unique but ultimately benign etiology of marked aortic change caused by a Valsalva maneuver. Valsalva is efficacious in enhancing hernia detection on imaging, with 50% of hernias becoming more apparent with Valsalva and 10% of hernias only detectable with Valsalva [4]. Although ultrasound is the preferred imaging modality in these situations, CT has superior sensitivity and can overcome ultrasound limitations from body habitus or overlying bowel gas [3]. Imaging's efficacy in hernia detection has led to overuse, with studies suggesting nearly 50% of all images prior to abdominal hernia surgery are unnecessary [2]. The percentage of patients with imaging before hernia repair varies widely by institution from 16% to 68.3%. The growth of these exams is driven largely by primary care, emergency, and urgent care providers [2,3]. In one study, CT with Valsalva encompassed 33.1% of unnecessary imaging representing tens of thousands of unnecessary imaging exams annually [2]. With the increasing frequency of CT with Valsalva being performed, we expect the radiographic

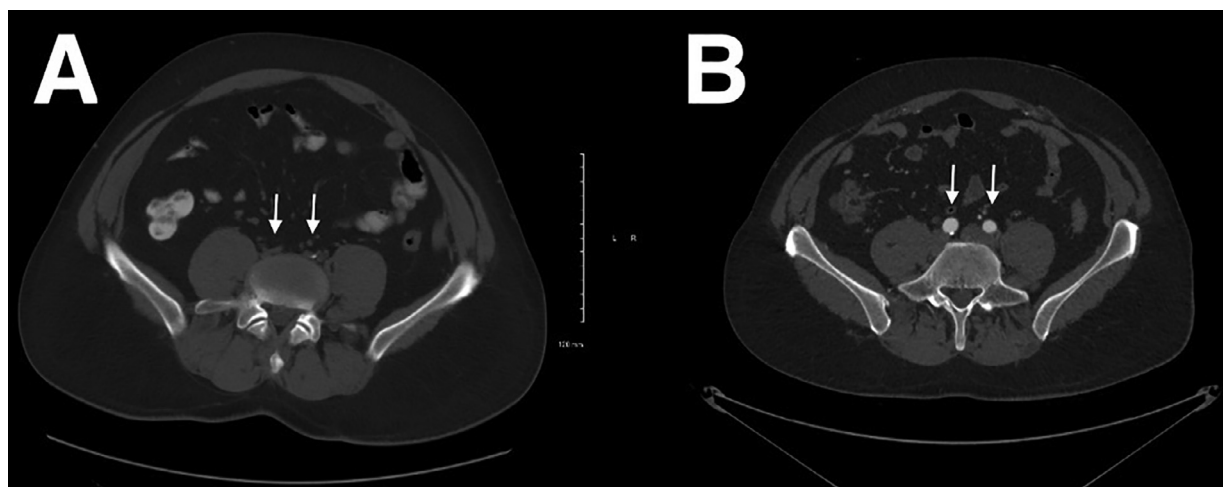


Fig. 2 – Image demonstrating compressed (A) iliac arteries with Valsalva and (B) iliac arteries of normal caliber.

findings of aortoiliac compression to increase during the coming years.

Aortic compression occurs when the intra-abdominal pressure exceeds the combined force of the diastolic blood pressure and arterial wall compliance. Because the aortic wall is elastic, whose role is largely to absorb the kinetic energy of cardiac systole, the primary force intraabdominal pressure needs to overcome for aortic collapse is the diastolic blood pressure [5]. The patient's blood pressure at presentation was 140/90, suggesting a minimum of 90 mm Hg of intra-abdominal pressure for aortic compression. While activities of daily living rarely generate enough force to overcome diastolic pressure, exceptions can occur. A study evaluating intra-abdominal pressure during coughing and vomiting showed pressures on average of 35 mm Hg and 82 mm Hg, respectively. However, maximum pressures during coughing and vomiting were 233 mm Hg and 290 mm Hg, enough to well exceed this patient's diastolic blood pressure [6]. In another study, both control and trained judo athletes were capable of exerting 140 mm Hg and 204 mm Hg of intra-abdominal pressure respectively during an isometric lifting effort [7].

Because aortic compression/narrowing has numerous worrisome etiologies including aortoiliac disease, intra-abdominal mass compression, vasculitis, and stenosis, vascular surgery can expect an increasing number of referrals for these cases. Visualizing the transitory nature of this phenomenon can be complicated by many CT with Valsalva protocols only capturing images under Valsalva and not at rest, necessitating repeat imaging [4]. Differentiating this phenomenon from true vascular pathology is further complicated by the demographics for aortoiliac occlusive disease and abdominal hernias sharing multiple co-morbidities including older age, diabetes, hypertension, and male sex [8,9].

Given the increasing incidence of CT with Valsalva for abdominal hernia evaluation, recognition of this worrisome appearing but ultimately benign physiologic finding will become increasingly important for vascular surgeons to differentiate from similar appearing aortic pathology.

Patient consent

Our patient provided written informed consent upon arrival at the teaching institution to share their case details for research purposes.

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