

# Quantitative digital subtraction angiography to localize intercostal arteries during thoracic endovascular aortic repair

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The accurate identification and preservation of critical intercostal arteries are important technical issues during thoracic endovascular aortic repair (TEVAR) to reduce the risk of postoperative paraparesis, especially in a setting of extensive thoracic aortic coverage and previous abdominal aortic surgery.<sup>1,2</sup>

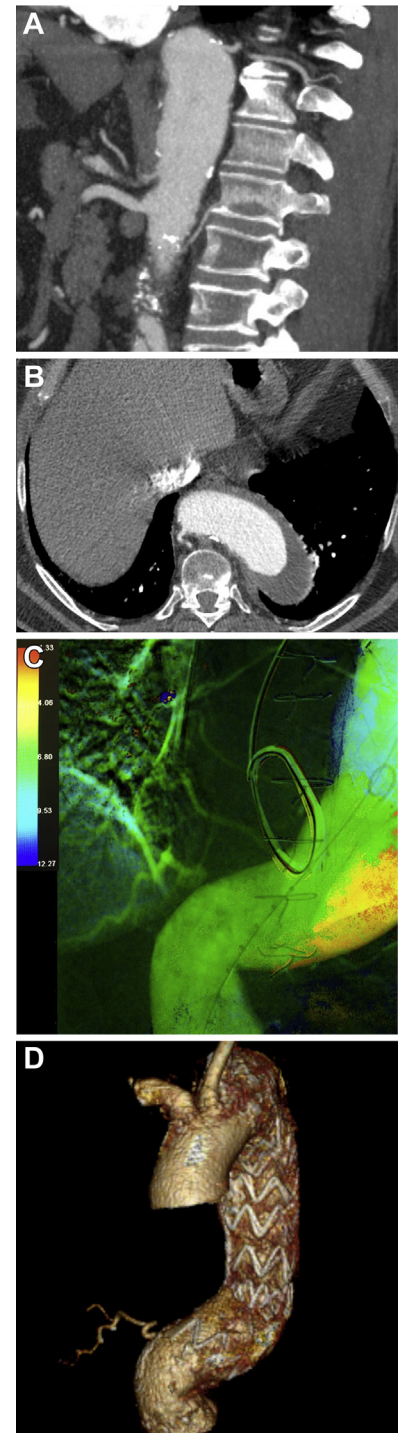
The localization of intercostal arteries by digital subtraction angiography (DSA) before deployment of a stent graft is often difficult because of their small caliber and posterior orientation.<sup>3</sup> Parametric color coding is an imaging software that measures flow dynamics in a DSA series and provides quantitative information without the additional cost of an X ray dose and contrast medium. In a single image, quantitative DSA (Q-DSA; syngo iFlow software; Siemens, Forchheim, Germany) provides information on the transit of contrast medium through vessels.<sup>4,5</sup>

We describe the use of Q-DSA to localize and preserve the intercostal arteries in the distal descending aorta during TEVAR. The patient's consent for publication was obtained.

In a 76-year-old man with a descending thoracic aortic aneurysm, previously treated by abdominal aortic surgery, preoperative computed tomography planning showed an important intercostal artery (T9) tributary of the Adamkiewicz artery (A). The distal neck as a safe landing zone (3 cm) ended just before the origin of this important intercostal artery (B). The patient accepted the TEVAR treatment, refusing cerebrospinal fluid drainage. Thus, a critical technical point to reduce the paraplegia risk was a correct stent graft deployment, preserving the patency of this intercostal artery.

Intraoperative DSA (4 frames/s rate, 20 mL of 350 iomeprol contrast agent with flow rate of 10 mL/s) with stiff guides in place was performed before stent graft deployment. This series was immediately postprocessed (approximately 3 seconds) using the syngo iFlow. The parametric color coding image clearly showed the critical intercostal artery at the end of the distal aortic neck (C). Stent graft deployment (Relay NBS; Bolton Medical, Sunrise, Fla) was performed considering this reference image and sparing the intercostal artery. In the absence of paraplegia, postoperative computed tomography confirmed the patency of the intercostal artery and adequate aortic sealing (D).

Q-DSA intraoperative evaluation during TEVAR can provide useful support for angiographic comprehension and the detection of small arteries without increasing the doses of radiation and contrast material.



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**REFERENCES**

1. Ullery BW, Quatromoni J, Jackson BM, Woo EY, Fairman RM, Desai ND, et al. Impact of intercostal artery occlusion on spinal cord ischemia following thoracic endovascular aortic repair. *Vasc Endovascular Surg* 2011;45:519-23.
2. Matsuda H, Ogino H, Fukuda T, Iritani O, Sato S, Iba Y, et al. Multidisciplinary approach to prevent spinal cord ischemia after thoracic endovascular aneurysm repair for distal descending aorta. *Ann Thorac Surg* 2010;90:561-5.
3. Koutouzi G, Sandstorm C, Skoog P, Ross H, Falkenberg M. 3D image fusion to localise intercostal arteries during TEVAR. *EJVES Short Rep* 2017;35:7-10.
4. Strother CM, Bender F, Deuerling-Zheng Y, Royalty K, Pulfer KA, Baumgart J, et al. Parametric color coding of digital subtraction angiography. *AJNR Am J Neuroradiol* 2010;31:919-24.
5. Yamamoto K, Nakai G, Azuma H, Narumi Y. Novel software-assisted hemodynamic evaluation of pelvic flow during chemo-perfusion of pelvic arteries for bladder cancer: double- versus single-balloon technique. *Cardiovasc Intervent Radiol* 2016;39:824-30.

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