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Carbon dioxide digital subtraction angiography as an option for detection of endoleaks in endovascular abdominal aortic aneurysm repair procedure

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Objective: The purpose of this study was to evaluate carbon dioxide digital subtraction angiography (CO_2-DSA) as an option for the detection of endoleaks (ELs) in the endovascular abdominal aortic aneurysm repair (EVAR) procedure.

Methods: Forty patients with abdominal aortic aneurysm who were scheduled to undergo EVAR were enrolled in the study. There were 35 men and five women (mean age, 77.9 years). All patients had both iodinated contrast conventional DSA (C-DSA) and CO_2-DSA immediately after EVAR. The sensitivity and specificity were calculated for the ability of CO_2-DSA to detect ELs. We also correlated with computed tomography findings 6 months after EVAR.

Results: C-DSA showed that 27 of the 40 patients (68%) had 28 ELs (type I, four; type II, 20; type III, three; type IV, one). CO_2-DSA showed that 16 of the 40 patients (40%) had 17 ELs (type I, four; type II, 10; type III, three; type IV, none). For the prediction of direct ELs (type I and type III) with use of C-DSA as the criterion standard, CO_2-DSA has a sensitivity of 1.0 and a specificity of 1.0. For the detection of persistent type II ELs (n = 11) with use of computed tomography findings 6 months from EVAR as the criterion standard, CO_2-DSA has a sensitivity of 0.87 and a specificity of 0.97. C-DSA has a sensitivity of 0.82 and a specificity of 0.64.

Conclusions: CO_2-DSA is reliable for the detection of direct ELs and persistent type II ELs in EVAR. CO_2-DSA can be an option to detect ELs in the EVAR procedure.

Endovascular balloon occlusion is associated with reduced intraoperative mortality of unstable patients with ruptured abdominal aortic aneurysm but fails to improve other outcomes

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Background: Proximal aortic control by endovascular balloon occlusion (EBO) is an alternative to conventional aortic cross-clamping (CAC) in hemodynamically unstable patients presenting with a ruptured abdominal aortic aneurysm (rAAA). The aim of this study was to evaluate the potential clinical benefit of EBO over CAC.

Methods: Data from 72 patients with rAAA treated at our institution from 2001 to 2013 were retrospectively analyzed. All patients were hemodynamically unstable (mean arterial blood pressure at admission <65 mm Hg or associated unconsciousness, cardiac arrest, or emergency endotracheal intubation). Clinical end points of hemodynamic restoration, mortality rate, and major postoperative complications were assessed for CAC (group 1) and EBO (group 2).

Results: At admission, 72 patients were unstable. CAC was performed in 40 and EBO in 32. Intraoperative mortality was 43% in group 1 vs 19% in group 2 (P = .031). In group 1, the approach for CAC (thoracotomy [n = 23] vs laparotomy [n = 17]) did not influence intraoperative mortality (43% vs 41%). There was no significant difference in 30-day (75% vs 62%) and in-hospital (77% vs 69%) mortality rates between groups. After EBO, the treatment—open vs endovascular repair—did not influence the intraoperative mortality rate (31% vs 43%; P = .5). Eight surgical complications were secondary to CAC (1 vena cava injury, 3 left renal vein injuries, 1 left renal artery injury, 1 pancreaticoduodenal vein injury, and 2 splenectomies), but no EBO-related complication was noted (P = .04). Differences in colon ischemia (15% vs 28%) and renal failure (12% vs 9%) were not statistically significant. Abdominal compartment syndrome occurred in four patients in group 2 and in no patients in group 1.

Conclusions: Compared with CAC, EBO is a feasible and valuable strategy and is associated with reduced intraoperative mortality of unstable rAAA patients, but not in-hospital mortality, in this retrospective study.

Three-dimensional fusion computed tomography decreases radiation exposure, procedure time, and contrast use during fenestrated endovascular aortic repair

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Objective: Endovascular surgery has revolutionized the treatment of aortic aneurysms; however, these improvements have come at the cost of increased radiation and contrast exposure, particularly for more complex procedures. Three-dimensional (3D) fusion computed tomography (CT)

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imaging is a new technology that may facilitate these repairs. The purpose of this analysis was to determine the effect of using intraoperative 3D fusion CT on the performance of fenestrated endovascular aortic repair (FEVAR).

Methods: Our institutional database was reviewed to identify patients undergoing branched or FEVAR. Patients treated using 3D fusion CT were compared with patients treated in the immediate 12-month period before implementation of this technology when procedures were performed in a standard hybrid operating room without CT fusion capabilities. Primary end points included patient radiation exposure (cumulated air kerma: mGy), fluoroscopy time (minutes), contrast usage (mL), and procedure time (minutes). Patients were grouped by the number of aortic graft fenestrations revascularized with a stent graft, and operative outcomes were compared.

Results: A total of 72 patients (41 before vs 31 after 3D fusion CT implementation) underwent FEVAR from September 2012 through March 2014. For two-vessel fenestrated endografts, there was a significant decrease in radiation exposure (3400 $\pm$ 1900 vs 1380 $\pm$ 520 mGy; P = .001), fluoroscopy time (63 $\pm$ 29 vs 41 $\pm$ 11 minutes; P = .02), and contrast usage (69 $\pm$ 16 vs 26 $\pm$ 8 mL; P = .0002) with intraoperative 3D fusion CT. Similarly, for combined three-vessel and four-vessel FEVAR, significantly decreased radiation exposure (5400 $\pm$ 2225 vs 2700 $\pm$ 1400 mGy; $P <$ .0001), fluoroscopy time (89 $\pm$ 36 vs 64 $\pm$ 21 minutes; P = .02), contrast usage (90 $\pm$ 25 vs 39 $\pm$ 17 mL; $P <$ .0001), and procedure time (330 $\pm$ 100 vs 230 $\pm$ 50 minutes; P = .002) was noted. Estimated blood loss was significantly less ($P <$ .0001), and length of stay had a trend (P = .07) toward being lower for all patients in the 3D fusion CT group.

Conclusions: These results demonstrate that use of intraoperative 3D fusion CT imaging during FEVAR can significantly decrease radiation exposure, procedure time, and contrast usage, which may also decrease the overall physiologic impact of the repair.

Staged endovascular repair of thoracoabdominal aortic aneurysms limits incidence and severity of spinal cord ischemia

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Objective: Neurologic dysfunction remains a persistent complication of extensive aortic repair owing to disruption of the spinal collateral network. We hypothesized that staged repair might mitigate the incidence and severity of this spinal cord ischemia (SCI).

Methods: We conducted a retrospective cohort study of patients undergoing a Crawford type II repair of a thoracoabdominal aortic aneurysm between January 2008 and July 2013. Baseline demographics, incidence of prior aortic surgery, comorbidities, and outcomes were prospectively recorded. Staged repair was defined as intentional completion of the endovascular repair as two temporally separate procedures, referred to as a two-stage repair. Extent of aortic cover was calculated by three-dimensional imaging and reported as the proportion of the aorta covered between the left subclavian artery and the aortic bifurcation. Primary outcome measures were incidence and severity of SCI and mortality.

Results: The study included 87 patients, divided into the following subgroups: single-stage repair (n = 32; repair in a single procedure, without prior aortic surgery), two-stage repair (n = 27; repair in two separate procedures, without prior aortic surgery), and unintentionally staged repair (n = 28; those with prior aortic surgery, without an intention to stage). Median time between stages was 5 months (range, 1-60 months). All groups were equivalent in terms of demographics and risk factors; however, the staged group had significantly greater proximal aortic cover (P = .001). The overall rates of SCI in the nonstaged and staged groups were 37.5% (12 of 32) and 11.1% (3 of 27), respectively (P = .03). Furthermore, all neurologic injuries in the staged group were temporary. The 30-day survival in the single-stage, two-stage, and unintentionally staged repairs was 18.8%, 0%, and 10.7%, respectively (P = .52).

Conclusions: Staged repair appears both to protect against SCI and to enhance overall survival in extensive aortic repair.

Identification of a potential proinflammatory genetic profile influencing carotid plaque vulnerability

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Objective: Atherosclerosis and vascular remodeling after injury are driven by inflammation and mononuclear cell infiltration. Unstable atherosclerotic plaques are characterized by a large necrotic core. In this study we investigated the distribution and interaction between gene polymorphisms encoding proinflammatory molecules in an Italian population with internal carotid artery stenosis (ICAS). We also evaluated whether reciprocal interaction between these gene polymorphisms increased the risk of plaque vulnerability.

Methods: In this genetic association study, 11 proinflammatory gene polymorphisms were analyzed in 933 individuals comprising 344 patients with ICAS who underwent carotid endarterectomy and 589 controls without ultrasound evidence of atherosclerosis or intimal thickening.

Results: We found that interleukin (IL) 6 (*IL-6*), IL-1β, monocyte chemoattractant protein-1 (*CCL2*) macrophage inflammatory protein-1α (*CCL3*), E-selectin (*SELE*), intercellular adhesion molecule 1 (*ICAM1*), and matrix metalloproteinase-3 (*MMP-3*), and 9 (*MMP-9*) gene variants were independently and significantly associated with ICAS. The association remained significant even after the Bonferroni correction. We also found a genetic profile associated with different risks for ICAS, depending on the number of high-risk genotypes simultaneously present in an individual.