**Conclusions:** Sn-renals angled more inferiorly than F-renals due to patient selection and stent configuration. Upward respiratory-induced deformation of the celiac artery exceeded that of stented renals, likely related to lack of intravascular stent placement. Sn-renals exhibited significant curvature change during respiration, a finding that may warrant increased surveillance based on known mechanisms of stent-induced renal artery thrombosis. Further investigation is warranted to better optimize anatomic, patient, and branch vessel stent type selection between fenestrated and snorkel strategies and their relationship to long-term patency.

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### Zenith p-Branch Fenestrated Endovascular Graft: How Close "Off-the-Shelf" Repair for Asian Patients with Juxtarenal Aortic Aneurysms?

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**Objective:** The Zenith pivot branch fenestrated endovascular graft (p-branch) is a new "off-the-shelf" device to treat patients with juxtarenal aortic aneurysms (JRA). Two options are currently available based on Caucasian anatomy, differing in the longitudinal distance between the superior mesenteric artery (SMA) and the renal fenestrations. This study investigates the anatomical suitability of the P-branch fenestrated grafts in a cohort of Asian patients with JRA.

**Methods:** Computed tomography images of 51 consecutive patients (43 men; mean age, 76.8 years) with JRA from our hospital database, were analyzed using the TeraRecon Aquarius workstation (San Mateo, Calif). The renal clock positions differed with the variation in graft diameters (range, 26-36 mm). Using the native paravisceral aortic diameter as reference, the artery positions were converted to circumferential locations and then mapped together with the diameters of corresponding arteries. Their geometric locations were then applied to the P-branch option A and B (single SMA and two renal fenestrations, and a scallop). The suitability of these stent graft designs to the aneurysm was evaluated.

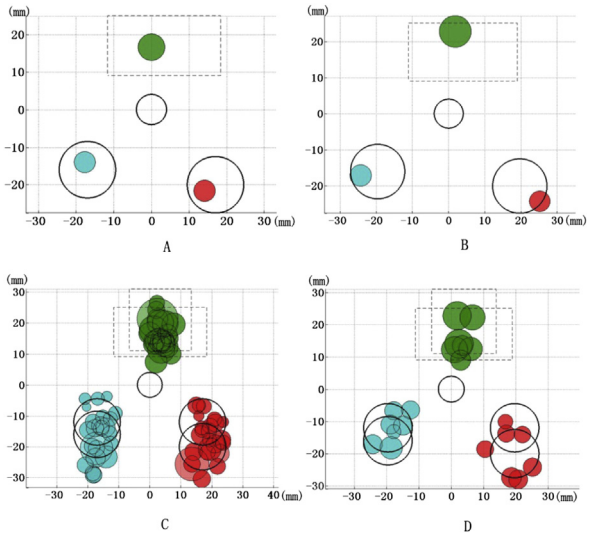


**Fig.** The three *black circles* represent the pivot fenestrations of the superior mesenteric artery and the two renal arteries, and the *rectangle* is the scallop. The *filled circles* stand for the celiac trunk (*green*) and left (*red*) and right (*blue*) renal arteries. The size of the circles represents the actual diameter of the corresponding artery. **A,** Perfectly suitable: all the visceral orifices located inside the fenestrations or scallop. **B,** Marginally suitable: part of the renal orifice (*left*) located outside the fenestration. **C** and **D,** Candidates for the 26-mm and 30-mm graft, respectively.

**Results:** A total of 31 JRA patients (60.8%) were regarded as suitable candidates for one or both p-branch endografts (20 with option A, 22 with option B, and 11 with both options). In 35 patients (68.6%), both renal arteries could be aligned with the fenestrations. Among them, 16 patients (31.4%) were perfectly matched, while 19 patients (37.2%) were only marginally suitable (Fig). The major reason for the exclusion was the misalignment of the renal pivots, mainly due to the longitudinal position of renal arteries rather than the circumferential position, particularly the longer distance of the right renal arteries from the SMA. If the right renal fenestration of option B was adjusted to 20-mm caudal to the SMA fenestration (level with the left fenestration), the match could reach 78.4% (40 of 51). Other reasons were unsuitable scallops for the celiac axis in four patients (7.84%) and insufficient length of the abdominal aorta to accommodate the graft in another four patients.

**Conclusions:** The present designs of the p-branch fenestrated graft are suitable for a good proportion of JRA patients in Asia. Further refinement of design may be necessary to accommodate the anatomical variations, especially a lower right renal artery.

**Author Disclosures: J. Ou:** None; **S. W. Cheng:** None.

### Initial Experience with Endovascular Treatment of Thoracoabdominal Aortic Aneurysm Using Physician-Modified Endografts: B-TEVAR IDE Study

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**Objective:** This study reports an initial single-center experience of patients with physician-modified thoracic endografts for endovascular treatment of thoracoabdominal aortic aneurysm (TAAA).

**Methods:** Patients were included if treated urgently for symptomatic TAAA (n = 2) as well as those treated in a Phase 1 clinical trial (n = 11), an Food and Drug Administration-approved physician sponsored investigational device exemption (B-TEVAR IDE). Patients were included if they had a TAAA and were deemed to be at high risk with open repair and met study inclusion criteria.

**Results:** Thirteen patients (nine men and four women) with TAAA were treated with branched-fenestrated endovascular stent grafts. Demographic and operative details are reported in Tables I and II. Nine patients (69%) had successful treatment: return to preoperative functional state and complete aneurysm exclusion at mean 8 months (range, 1-28 months) of follow-up. Two patients (15%) died. One patient died on the 22nd postoperative day of complications of spinal cord ischemia. Another patient died 4 months after repair of bacterial endocarditis from a foot infection. One other patient had successful aneurysm exclusion but suffered permanent spinal cord injury. One patient is clinically well despite presence of a type III endoleak.

**Conclusions:** Totally endovascular treatment of TAAA using a physician-modified thoracic endograft is feasible. Although it can be done using minimally invasive means, it remains a high-risk procedure. B-TEVAR is highly adaptable to complex anatomy and can be done with current commercially available devices. This treatment may provide a safe and effective means of treatment of TAAA among patients at high risk of open repair. This early experience has provided insights into the safe conduct of these procedures, including staged repair, and methods of case planning.

**Table I.** Demographics

| *Variables* | *Mean (range) or No. (%) (n = 13)* |
|---|---|
| Age, years | 72 (63-88) |
| TAAA extent | |
| 1 | 2 (15) |
| 2 | 3 (23) |
| 3 | 4 (31) |
| 4 | 3 (23) |
| 5 | 1 (8) |
| Diameter, cm | 6.8 (5.5-9.1) |
| Symptomatic | 2 (15) |
| Prior aortic operation | 5 (38) |

*TAAA,* Thoracoabdominal aortic aneurysm.

**Table II.** Operative details

| *Variables* | *No. (%) or mean (range)* |
|---|---|
| Percutaneous access | 13 (100) |
| Branches, No. | 3.8 (2-4) |
| Estimated blood loss, mL | 226 (50-500) |
| Length of aortic coverage, cm | 37 (21-56) |
| Aortic coverage (LSCA to bifurcation) | 77 (46-100) |
| Contrast volume, mL | 176 (60-295) |
| Fluoroscopy time, min | 64 (35-128) |

*LSCA,* Left subclavian artery.

**Author Disclosures: M. P. Sweet:** Honoraria, Company: Endologix Inc. Honoraria, My Role: Proctor for Ventana Trial; **B. W. Starnes:** Consulting Fee, Company: Endologix. Consulting Fee, My Role: Medical Advisory Board; **B. Tatum:** None.

### Physician-Modified Endovascular Grafts: Graft Creation

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**Objective:** The purpose of this video minipresentation is to describe in exquisite detail the process of physician-modified endovascular graft (PMEG) creation in high definition as part of an Food and Drug Administration-sanctioned investigational device exemption clinical trial.

**Methods:** A high-definition 4-minute video was created and edited describing in detail the creation of a PMEG to successfully treat a large juxtarenal aortic aneurysm.

**Results:** The PMEG graft was successfully created and implanted.

**Conclusions:** Three-vessel custom made fenestrated devices can be created in <1 hour with appropriate technique.

**Author Disclosures: B. W. Starnes:** Consulting Fee, Company: Endologix. Consulting Fee, My Role: Ventana Medical Advisory Board; **G. Tang:** None; **B. Tatum:** None.

### The Impact of Endovascular Repair (EVAR) of Abdominal Aortic Aneurysms (AAA) on Resident Training in Elective Open Aneurysm Repair

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**Objective:** The use of endovascular aneurysm repair (EVAR) to treat abdominal aortic aneurysms (AAAs) has resulted in a declining number and increased the complexity of open AAA surgery. Our objective was to analyze trends in open repair of AAA over the last 15 years at our institution and assess its effect on resident training.

**Methods:** A retrospective review of 867 consecutive AAA done over the last 15 years at our institution was performed, recording type of repair, level of aortic clamping, and associated bypasses. A survey of all vascular surgery program directors was used to assess their willingness to assist vascular surgery residents in variously complex open AAA repairs.

**Results:** The number of open repairs of AAA has declined by 80% over 15 years (Table). The complexity of open AAA repair has resulted in more suprarenal and supraceliac clamping ($P < .001$) and more renal and visceral artery revascularization and bypass ($P < .001$). The willingness of attendings (67) to assist vascular surgical residents varied significantly between trainees in fellowship and integrated programs ($P < .05$). Attendings are significantly less willing to assist a postgraduate year 4/5 in an integrated vascular residency with complex open operations compared with a first-year or second-year vascular fellow ($P < .05$).

**Conclusions:** Our experience documents that vascular surgical residents are exposed to progressively fewer open aneurysm cases. AAA cases are increasingly complex and often considered too difficult, thus decreasing resident involvement. Vascular surgery programs will need to consider supplemental open AAA training, such as simulation or traveling to high-volume centers, or both, for trainees to achieve competency in open AAA surgery.

**Table.** Trends in abdominal aortic aneurysm repair from 1999 to 2013

| *Variable* | *1999-2003, No. (%)* | *2004-2008, No. (%)* | *2009-2013, No. (%)* |
|---|---|---|---|
| Procedure type | | | |
| Open | 254 (70) | 89 (33) | 46 (20) |
| Endovascular aneurysm repair | 107 (30) | 182 (67) | 189 (80) |
| Clamp location | | | |
| Supraceliac | 17 (7) | 10 (11) | 9 (20) |
| Suprarenal | 6 (2) | 19 (21) | 17 (37) |
| Between renal arteries | 7 (3) | 4 (4) | 4 (9) |
| Infrarenal (<2 cm neck) | 132 (52) | 39 (44) | 13 (28) |
| Infrarenal (>2 cm neck) | 92 (36) | 17 (19) | 3 (7) |
| Concomitant repairs | | | |
| Reimplanation of renal and/or visceral vessels | 9 (4) | 13 (15) | 22 (48) |
| Renal artery bypass | 8 (3) | 7 (8) | 15 (33) |

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### Brachial Artery Volume Flow by Duplex Predicts Dialysis Access Maturation

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**Objective:** To validate use of our previously described Fast Five-Minute Duplex Scan, which measures brachial artery volume flow (VF), to confirm the adequacy of dialysis access maturation and predict successful hemodialysis usage.

**Methods:** Duplex ultrasound imaging was used to directly measure brachial artery and dialysis access VF in 75 patients with upper extremity accesses. Scatterplot analysis was used to determine the correlation between brachial artery VF and dialysis access VF. Brachial artery velocity spectra criteria were developed to estimate VF in three categories - low 800 mL/min. An additional 121 patients having a primary (n = 73) or revised (n = 48) dialysis access had measurement of brachial VF, and this was correlated with conduit maturation and hemodialysis usage. Duplex testing was performed in the outpatient clinic within 2 to 3 weeks of the access procedure.

**Results:** Duplex measurements of VF from the brachial artery demonstrated a high degree of correlation ($R^2 = 0.87$) with access conduit VF for autogenous vein (n = 45; $R^2 = 0.88$) and bridge grafts (n = 30; $R^2 = 0.85$). Access VF >800 mL/min is predicted when duplex testing indicates a brachial artery diameter >4 mm, PSV >150 cm/s, and diastolic/systolic velocity ratio >0.3. Brachial artery VF <800 mL/min was associated with failure of access maturation. Revision was required in 13 of 16 accesses with VF <600 mL/min and in three of 11 with VF in the 600 to 800 mL/min range. Only one of 94 with VF >800 mL/min required revision (for conduit depth), and all were successfully used for hemodialysis.

**Conclusions:** The Fast Five-Minute Duplex Scan is an accurate technique to predict upper extremity dialysis access maturation and successful hemodialysis usage. Brachial artery VF is easy to measure, applicable to forearm and arm accesses, and is highly correlated to AV access VF. VF >800 mL/min predicts a functional access suitable for cannulation if conduit anatomy criteria are also verified.

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### Migration Towards Proximal Location Improves Maturation Rate of Arteriovenous Fistula

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**Objective:** In recent years, vascular surgeons have noted that a major drawback to the Fistula First initiative has been the failure of arteriovenous fistulas (AVFs) to reach maturation. In May 2012, we adopted a protocol and hypothesized that such a protocol would lead to a decrease in fistula failures.