Update on the Talent aortic stent-graft: A preliminary report from United States phase I and II trials

Frank J. Criado, MD,[a] Eric P. Wilson, MD,[a] Ronald M. Fairman, MD,[b] Omran Abul-Khoudoud, MD,[a] and **Eric Wellons, MD,[a]** *Baltimore, Md, and Philadelphia, Pa*

Purpose: **Phase I and phase II trials were conducted to determine the safety and efficacy of the Talent aortic stent-graft (Medtronic World Medical, Sunrise, Fla) in the treatment of infrarenal abdominal aortic aneurysms (AAA). This is a preliminary report of the technical results and 30-day clinical outcome of these trials.**

Methods: **Multicenter prospective trials were conducted to test the Talent stent-graft in high-risk and low-risk patient populations with AAA, including phase I feasibility and phase II clinical trials. The low-risk study included concurrent surgical controls.**

Results: **In the phase I trial, deployment success was achieved in 92% (23/25 patients), and initial technical success was 78% (18/23 implants without endoleak). The 30-day technical success rate was 96%, with six endoleaks that resolved spontaneously (without need for further intervention); and the 30-day mortality rate was 12% (3/25 patients). The phase II high-risk trial demonstrated a deployment success of 94% (119/127 patients) and an initial technical success of 86% (102/119 implants). The 30-day technical success rate was 96%, and the 30-day mortality rate was 1.5% (2/127 patients). The phase II low-risk trial included a first-generation and a second-generation Talent stent-graft. Deployment success rates were 97% and 99%, respectively, and technical success rates at 30 days were 97% and 96%, respectively. The 30-day mortality rate was 2% in the phase II low-risk first-generation device trial, and the adverse-event rate was 20%. Corresponding figures for the second-generation device were 0% and 1.8%, respectively.**

Conclusion: **The Talent stent-graft can be deployed successfully and achieves endovascular exclusion in a large proportion of patients with AAA. Morbidity and mortality rates are acceptable. One-year clinical results and the comparison with concurrent surgical control subjects remain to be evaluated. (J Vasc Surg 2001;33:S146-9.)**

The Talent stent-graft (Medtronic World Medical, Sunrise, Fla) is an endovascular device that is undergoing clinical investigation to test its efficacy in the treatment of thoracic and abdominal aortic aneurysms (AAAs). Approximately 10,000 Talent stent-graft implantations have been performed worldwide since December 1995.

Several studies have been conducted after US Food and Drug Administration approval of the investigational device exemption in April 1997.[1] In this preliminary report, we present the technical and 30-day results obtained in the US phase I and phase II AAA trials. One-year clinical results and comparison with concurrent surgical controls from Phase II will be the subject of a subsequent report.

From the Center for Vascular Intervention, Division of Vascular Surgery, Union Memorial Hospital/MedStar Health,[a] and the Division of Vascular Surgery, Hospital of the University of Pennsylvania.[b]

Competition of interest: FJC is a paid consultant and receives funding for a research assistant from Medtronic World Medical.

Reprint requests: Frank J. Criado, MD, 3333 North Calvert St, Suite 570, Baltimore, MD 21218.

0741-5214/2001/$35.00 + 0 **24/0/111677**
doi:10.1067/mva.2001.111677

METHODS

Endovascular stent-graft device. The Talent device is a self-expanding, modular stent-graft system composed of serpentine-shaped nitinol stents inlaid in woven polyester fabric (Fig 1). The stents are spaced along a full-length nitinol spine. The latter provides longitudinal (column) strength to a graft that is otherwise flexible to accommodate aorto-iliac angulations. The delivery system is composed of a coaxial sheath with an internal pusher rod and a compliant polyurethane balloon that is sequentially inflated to maximize apposition of the graft to the vessel wall target zones and to ensure full expansion of the device along its length. The basic components of the Talent AAA system are a bifurcated main section and a contralateral iliac limb. Available configurations include the Free-Flo graft with a 15-mm long uncovered stent at the proximal end to allow transrenal or suprarenal fixation. Additional modular components include aortic cuffs and iliac extensions. The manufacturer offers customization in a variety of configurations and sizes (length and diameters).[2] Diameter ranges are 16 to 36 mm for the aortic section and 8 to 22 mm for the iliac limbs.

Clinical studies. Several studies have assessed the safety and efficacy of the Talent stent-graft in the treatment of AAA. The clinical evaluation study designs

Table I. Summary of deployment, technical success, clinically adverse events, and mortality rates associated with the four arms of the Talent stent-graft trials for the treatment of AAA

Clinical trial	*Deployment success rate (%)*	*Technical success rate (%)*	*30-Day (%)*		
			Technical success rate	*Adverse event rate*	*Mortality rate*
Phase I high-risk feasibility	92 (23/25)	78 (18/23)	96 (22/23)	40 (10/25)	12 (3/25)
Phase II high-risk	94 (119/127)	86 (102/119)	96 (114/119)	14.9 (19/127)	1.5 (2/127)
Phase II low-risk (first-generation)	97 (147/151)	88 (130/147)	97 (138/142)	20 (29/142)	2 (3/142)
Phase II low-risk (second-generation)	99 (167/168)	80 (133/167)	96 (68/71)	4 (3/71)	0

included a phase I feasibility study involving six investigational sites to demonstrate device and procedure safety before the expansion to multiple phase II controlled studies (in adherence to the US Food and Drug Administration guidelines) that involve several designs. The phase II studies were conducted at 17 investigational sites. In one arm (low-risk trial), endovascular repair was compared with standard operation as performed concurrently on surgical control patients who were selected on the basis of unsuitable anatomy for endovascular repair or a refusal to undergo the stent-graft procedure. (The control data will appear in a subsequent report.)

Endovascular stent-graft procedure. The Talent stent-graft AAA procedure was performed with general, epidural/spinal, or local anesthesia and involved bilateral groin incisions for exposure of the common femoral arteries. The use of adjunctive brachial artery catheterization was according to individual discretion. Imaging from a fixed or mobile fluoroscopy system and power-injector angiography were used to guide the placement of the stent-graft. Aorto-uniiliac implantations required contralateral iliac artery exclusion by surgical ligation, coil embolization (or a combination of the two), and crossover femorofemoral bypass grafting.

Definitions and criteria. Risk factor stratification adhered to The Society for Vascular Surgery/International Society for Cardiovascular Surgery guidelines,[3,4] with risk-level scores of 0, 1, or 2 being deemed as "low risk" and 3 as "high risk." *Deployment success* was defined as the ability to deliver the stent-graft device into position as intended. *Technical success* was defined as successful deployment without endoleak. *Adverse events* were defined as any complication that required additional procedures and/or prolonged hospitalization (ie, arterial rupture or dissection, renal dysfunction, lower extremity ischemia, significant cardiac or respiratory complications, and conversion to surgery).

Follow-up evaluation. Patients underwent abdominal radiography and contrast/noncontrast spiral computed tomography scans before discharge to evaluate device placement, patency of the graft, aneurysm size, renal artery patency, and presence or absence of endoleak. These studies were reviewed locally at each site and at an independent core laboratory facility. After discharge, the patients were evaluated at 1 month, 6 months, 1 year, and yearly thereafter.

RESULTS

Phase I high-risk. In the phase I feasibility trial, 25 patients with infrarenal AAA were enrolled at six centers. The average aneurysm size was 61 ± 15 mm, with 24 male and one female patients. Nearly one half of the patients (12 patients) had severe coronary artery disease; five patients had a ventricular ejection fraction of less than 30%. Deployment success was achieved in 23 of 25 patients (92%). In two patients, deployment failed because of delivery/access difficulties. These two cases were immediately converted to open aneurysm repair; one of the patients died in the postoperative period. The overall 30-day mortality rate was 12% (3/25 patients). The technical success rate at initial deployment was 78%, with seven of 23 implanted showing evidence of an endoleak at the completion of the stent-graft procedure. Some of these endoleaks were retrospectively attributed to "contrast blush" through the graft. At 30 days, only one patient had a persistent endoleak on computed tomography scan, for a 96% 30-day technical success rate. The other endoleaks closed spontaneously. Adverse events were identified in 10 patients (40%) and included limb ischemia, myocardial infarction, congestive heart failure, renal failure, and groin wound infections (Table I).

Phase II high-risk. One hundred twenty-seven patients at 17 centers qualified for the phase II high-risk trial that used either the bifurcated Talent stent-graft design or the aorto-uniiliac configuration with a femorofemoral bypass. The mean aneurysm diameter was 57 ± 10 mm. All patients were found to be high risk, with 15% of the patients having an ejection fraction of less than 20, and 10% of the patients being over the age of 90 years. Ninety-nine patients received the bifurcated device; 28 patients received an aorto-uniiliac stent-graft. Deployment success was achieved in 94% of the patients (119/127 patients), with deployment failure in eight patients. Initial technical success (absence of endoleak) was documented in 102 patients (86%). Success at 30 days was found to be 96% (114/119 patients). The adverse-event rate was 14.9% (19/127 patients), the most common complications

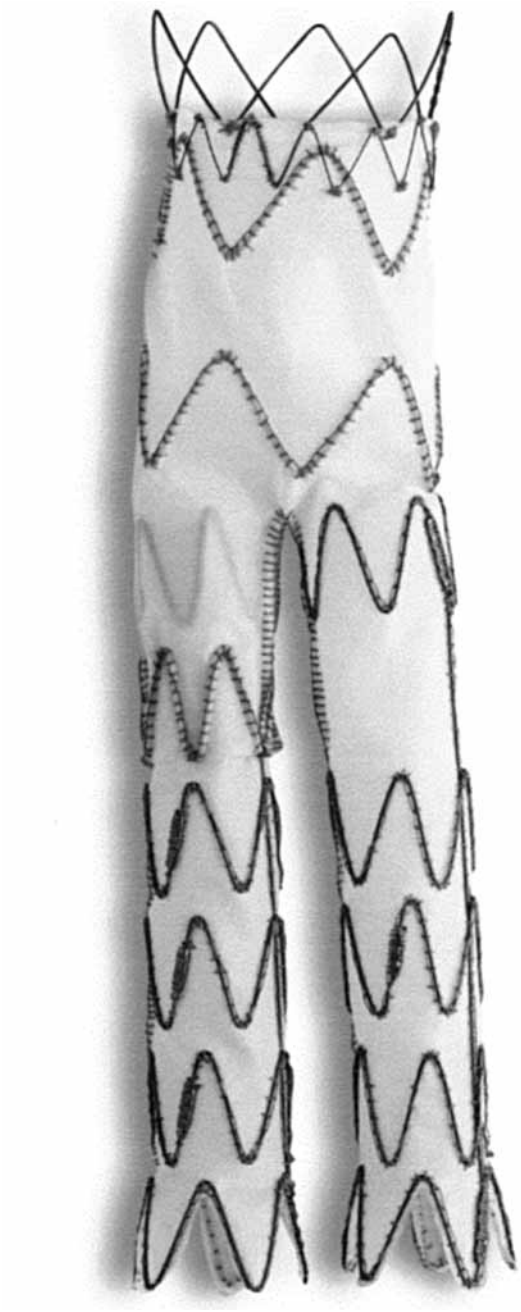

Fig 1. The modular bifurcated Talent aortic stent-graft. Note the "bare spring" proximal nitinol stent configuration for trans- and suprarenal fixation.

being renal failure, congestive heart failure, and graft limb thrombosis. Two of the 127 patients (1.5%) died; one patient had overwhelming disseminated intravascular coagulopathy, and the other patient experienced a fatal myocardial infarction on day 30 (Table I).

Phase II low-risk (first-generation device). This phase II trial used the first generation Talent stent-graft and delivery system, both of which were later modified and resubmitted under an additional investigational device exemption. One hundred fifty-one patients were selected under the low-risk inclusion criteria. Successful deployment was realized in 147 patients (97%), with initial technical success in 130 patients (88%). Ninety-seven percent of patients (138/142 evaluated) were free of endoleaks at 30 days. Adverse events were seen in 29 of 142 patients (20%) and included arterial dissection or rupture in seven patients, renal failure in six patients, ischemia of the lower extremities in two patients, myocardial infarction in five patients, respiratory complications in three patients, arrhythmias in three patients, and conversion to open surgery in four patients. The 30-day mortality rate was 2% (three patients). Causes of death included respiratory failure in two patients and myocardial infarction in one patient (Table I).

Phase II low-risk (second-generation device). The original Talent stent-graft and delivery system evolved into the low-profile system and was evaluated in a separate clinical study. Low-risk criteria were observed in 168 patients who were enrolled in this arm of the trial. A concurrent surgical control population was also evaluated, the results of which will be reported subsequently with the 1-year data. Deployment was successful in 99% of the patients (167/168 patients), and initial technical success was achieved in 80% of the patients (133 patients). Thirty-day success (no endoleak) was seen in 68 of 71 patients (96%) who were available for evaluation. Procedure-related complications included one patient with a thrombosed stent-graft limb, another patient with respiratory failure, and an additional patient with postoperative paraplegia from spinal cord ischemia. No patients died during the procedure or the initial 30-day follow-up (zero mortality rate; Table I).

DISCUSSION

Despite ongoing doubt[5] and recent concerns surrounding clinical efficacy and durability,[6] stent-graft repair of AAA is by far the most exciting development in vascular surgery in many years. All clinical investigators recognize the somewhat "unfinished" nature of endoluminal graft technology that, by all accounts, is still in its "infancy." Future developments will likely address the major unresolved issues, mainly deliverability to the aortic lumen, reliable fixation in challenging proximal necks and, foremost, the ability to adjust to evolving morphologic changes (as the excluded aneurysm shrinks) without disconnections, dislocations, or migration. The occurrence of endoleaks and the potential for late aneurysm rupture after stent-graft repair continue to be causes for concern.

The Talent stent-graft has proved versatile in the treatment of a wide range of aortic aneurysms of various morphologic conditions. It is the only currently available commercially produced device that is capable of addressing AAA necks larger than 28 mm in diameter.[7] Customization

capabilities (as offered by the manufacturer) have provided a niche for the Talent technology and made it distinct in the stent-graft field. Interestingly, such characteristics (and the fact that initial investigational device exemption approval in the United States was for high-risk patients only) have resulted in the application of the Talent device in a disproportionately large percentage of surgically unfit patients. Morbidity and mortality rates in some of the studies clearly reflect its use in such anatomically and medically disadvantaged patient population. It would be fair to state that the Talent stent-graft is the one device that many, if not most, investigators around the world resort to for large aortic necks and "difficult AAA anatomy."

The data reflect the technical performance of the device and 30-day clinical outcome obtained at 17 investigational centers in the United States. The Talent aortic stent-graft appears to be an effective device for the endovascular exclusion of AAA. The thinner-graft low-profile system (Talent low profile system) has been a particularly welcome evolution, which has resulted in a decrease of procedure-related adverse events from 20% to just under 5%. The 1-year clinical results (currently undergoing auditing and tabulation) and a comparison with concurrent surgical controls will be published at a later time.

The principal investigators at the 17 investigational sites for the US Talent AAA trials: Frank J. Criado, MD; Gary Becker, MD; Barry T. Katzen, MD; Frank J. Veith, MD; Renan Uflacker, MD; Edward B. Diethrich, MD; Michael Belkin, MD; Michael Hallisey, MD; Michael Khoury, MD; Paul Bove, MD; Alexander Balko, MD; Ronald M. Fairman, MD; Richard Green, MD; Robert Allen, MD; Rodney A. White, MD; Patricia Cole, MD; Roy K. Greenberg, MD; Richard Heuser, MD; and Thomas J. Fogarty, MD.

REFERENCES

1. Criado FJ, Fry PD, Machan LS, et al. The Talent endoluminal AAA stent-graft system: report of the phase I USA trial, and summary of worldwide experience. J Mal Vasc 1998;23:371-3.
2. Criado FJ, Wilson EP, Martin JA, et al. Custom manufacturing of aortic stent-grafts to expand applicability of endovascular repair: In: Greenhalgh RM, Powell JT, Mitchell AW, editors. Vascular and endovascular opportunities. London: Saunders; 2000. p. 287-96.
3. Zarins CK, Harris EJ Jr. Operative repair for aortic aneurysms: the gold standard. J Endovasc Surg 1997;4:232-41.
4. Hollier LH, Taylor LM, Ochsner J, et al. Recommended indications for operative treatment of abdominal aortic aneurysm. J Vasc Surg 1992;15:1046-56.
5. Porter JM, Abou-Zamzan AM Jr. Endovascular aortic grafting: current status. Cardiovasc Surg 1999;7:684-91.
6. Zarins CK, White RA, Fogarty TJ. Aneurysm rupture after endovascular repair using the AneuRx stent graft. J Vasc Surg 2000;31:960-70.
7. Criado FJ, Abul-Khoudoud O, Wellons E, et al. The Talent abdominal aortic aneurysm stent-graft: technical approaches and results of aneurysm exclusion. In: Greenhalgh RM, editor. The durability of vascular and endovascular surgery. London: Saunders; 1999. p. 433-48.

Submitted Jun 21, 2000; accepted Aug 18, 2000.