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Immediate "total" aortic true lumen expansion in type A and B acute aortic dissection after endovascular aortic endografting and GZSD bare stenting

Peter Mossop, MB, BS, FRACR,^a Ian Nixon, MB, BS, FRACS,^b John Oakes, MB, BS,^a Terry J. Devine, MB, BS, FRACS,^c and Craig S. McLachlan, PhD, MPH,^d Melbourne, Victoria, Australia

Use of bare metal stenting is a novel approach for more complete reconstruction of aortic dissection.¹ Treatment advancement with endografting^{2,3} and bare stenting for total aortic reconstruction has been previously reported.¹ In this article we report our results for complete endovascular aortic stenting in acute dissection for both type A and B cases.

From the Vascular Interventional Section, Medical Imaging,^a and the Department of Cardiothoracic Surgery,^b St Vincent's Hospital Melbourne; the Department of Vascular Surgery,^c Monash Medical Centre; and the Department of Medicine,^d University of Melbourne, Melbourne, Victoria, Australia.

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Address for reprints: Peter J Mossop, MB, BS, FRACR, Director of Vascular Interventional Radiology, St Vincent's Hospital Melbourne, 41 Victoria Parade, Fitzroy, Victoria 3065 Australia (E-mail: Peter.MOSSOP@svhm.org.au).

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Deficiencies have persisted with endografts in the treatment of thoracic dissections.⁴ Stent graft closure of the primary entry tear, typically in the proximal descending aorta, results in decompression of the thoracic false lumen with proximal thrombosis and remodeling. However, this technique does not address the need in some cases to more fully remodel the entire aorta and ensure distal branch vessel perfusion.^{2,3} Furthermore, the presence of complex distal re-entries, often related to branch vessels, prohibits extensive treatment with standard tube endografts.

Case reports of Z-stent use for prevention of malperfusion suggest its utility in aortic dissection.⁵ Additionally, we have found bare metal stenting accelerates true lumen remodeling, reduces false lumen volume, and enhances branch vessel perfusion. Our study evaluates quantitatively the postdissection true lumen expansion as a result of Z stenting with or without additional endografting of the primary entry tear.

From 2002 to 2005, 9 patients were treated for acute aortic dissection (3 type A and 6 type B) using Z stenting of the thoracic and abdominal aorta. Patient selection included acute phase false lumen growth (>0.5 cm), malperfusion or mesenteric branch involvement, and true lumen collapse (which did not expand after proximal endograft placement) (Table 1). Initially Gianturco Z stents and subsequently the purpose built Zenith DISSECTION thoracic endovascular

TABLE 1. Procedural and clinical characteristics/outcomes

Patient sex/age (y)	Dissection type	Aortic indication for stenting	Proximal endograft	Stent type	Stent dimensions (mm)
M/60	Acute type B	TLC, high-flow FL	ZTEGA 38–177	GZS	1 × 35–75
M/51	Acute type B	Mesenteric involvement	No endograft	GZS	3 × 35–75
F/54	Acute type B	High-flow FL involving renal artery	ZTEG 42–135	GZS	3 × 35–75
F/48	Acute type B	TLC	ZTEG 30–120	GZS	3 × 35–75
F/48	Acute type B	TLC	ZTEG 30–120	GZSD	46–123, 46–82
M/79	Postop type A repair	Mesenteric involvement	No endograft	GZSD	46–164
M/50	Acute type B	Aorta-infrarenal malperfusion	ZTEG 34–127	GZSD	46–164, 46–123
M/57	Acute type B	Renal malperfusion	ZTEG 34–127	GZSD	46–164, 46–123
M/52	Postop type A repair	Postop type A repair	ZTEG 30–120	GZSD	46–164, 46–82

FL, False lumen; TL, true lumen; SG, stent graft; TLC, symptomatic true lumen collapse; T, total; P, partial; N, no; Y, yes.

stent (Cook Vascular Inc, Bloomington, Ind) were used. The latter consisted of a self-expanding stainless steel Z-stent assembly with an unconstrained diameter of 46 mm (Figure 1, A and B). Zenith TX2 thoracic endovascular grafts (Cook Vascular Inc) were used in conjunction with body and iliac extension pieces to close both primary and secondary entries as required. In type B dissection after endograft closure of the primary entry tear, bare metal Z stents were deployed in the residually delaminated aorta (Figure 1, C and D). The stented segment overlapped the distal endograft and extended to cover the mesenteric vessels. All type A dissections were treated by surgical repair of the ascending aorta followed by immediate endograft and/or bare aortic stenting. Type A repair in 2 patients with no significant proximal descending thoracic entry tear was performed with bare metal stenting alone. Technically successful deployment was achieved in all patients. An average of 1.5 stents was used per patient. Average deployment time for bare stenting was 12 minutes (range 10–16 minutes).

Study analysis included calculating the true lumen index and true lumen expansion.

The true lumen index represents the percentage of true lumen relative to the total aortic cross-sectional area on computed tomography. Expansion indexes were percentage changes in true lumen area compared with the posttreatment area and were derived from the thoracic and abdominal aorta (at thoracic T8 and celiac axis L1 levels, respectively) at 3 time points: before treatment, immediately after treatment, and 3 months after treatment. The thoracic cross-sectional area was below the endograft in all cases. Statistics were performed with a Student *t* test for 2 groups or an analysis of variance followed by a post hoc Tukey test.

Stent deployment in the thoracic aorta resulted in an immediate increase in thoracic true lumen index (true lumen area/total aorta area) from $39\% \pm 15\%$ (standard deviation [SD]) to $71\% \pm 16\%$ (SD) ($P < .001$) and average true lumen expansion was 141%. This was maintained at 3 months' follow-up: $74\% \pm 17\%$ (SD). The mean abdominal aortic true lumen index increased from $41\% \pm 17\%$ (SD) to $75\% \pm 14\%$ (SD) ($P < .001$) after stenting and was maintained at 3 months' follow-up: $79\% \pm 16\%$ (SD). Mean immediate abdominal true lumen expansion was greater than 130%.

Follow-up over a mean of 18 months revealed no mortality. One patient with type A dissection (Table 1) had a perioperative cerebrovascular accident but recovered fully.

No long-term adverse events related to Z-stent implantation, including stent migration, fracture, intimal flap erosion, or redissection, was seen.

Figure 1. A, The Zenith DISSECTION thoracic endovascular stent is a one-piece cylindrical device constructed from self-expanding stainless steel Cook-Z stent segments sewn together with polyester suture in multiple lengths (4, 6, or 8 stent segments) and preloaded in a 16F introducer sheath. The stent seen deployed in glass model with proximal overlap into a Zenith TX2 thoracic endovascular graft has a single diameter (46 mm), which can be deployed in aortic diameters ranging from 24 to 38 mm. B, An example of a postprocedure maximum intensity projection computed tomographic angiogram showing endograft and Z-stent reconstructed thoracoabdominal aorta with complete obliteration of the dissection at 1 month. C, Preprocedure computed tomographic scan showing acute type B dissection with false lumen compression of the true lumen. D, Computed tomographic scan 6 month after the procedure showing position of bare metal stents with reexpansion of the true lumen and obliteration of the false lumen.

TABLE 1. Continued

FL thrombosis		Branch compromise	TL expansion	Procedural success	Complication (30-d)
Thoracic	Abdominal				
T	T	N	Y	Y	None
T	P	N	Y	Y	CVA
T	T	N	Y	Y	Left arm claudication; resolved by 6 mo
T	T	N	Y	Y	None
P	T	N	Y	Y	None
T	T	N	Y	Y	None
P	P	N	Y	Y	None
T	T	N	Y	Y	None
T	P	N	Y	Y	None

Z stenting is a safe ancillary endovascular technique in the treatment of acute aortic dissection. Z stenting allows rapid support and immediate expansion of the aortic true lumen without the necessity to resort to extensive endograft implantation, while facilitation of thrombosis and obliteration of the false lumen often effectively eliminates residual aortic dissection.

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Fracture of silicone tracheal T-tube: A rare complication

Iwao Takanami, MD, Tomohiro Abiko, MD, and Hideko Kurihara, MD, Tokyo, Japan

Silicone tracheal T-tubes can be used as satisfactory stents, with little or no tissue reaction and providing sufficient support to the stenotic segment of the trachea. Fractures in silicone T-tube are uncommon. Here, we describe a silicone tracheal T-tube fracture as a very uncommon complication in a patient with tracheal stenosis after a tracheostomy.

Clinical Summary

A 70-year-old man underwent a pancreaticoduodenectomy and an anterior resection of the rectum for the simultaneous treatment of an intraductal papillary neoplasm of the pancreas and a rectal carcinoma. After the operation, the patient had respiratory failure requiring a tracheostomy followed by 3 months of mechanical ventilation. The patient was referred to our department because of difficulty in removing the tracheostomy tube. Examination with a flexible bronchoscope showed a tracheostomal stenosis of the anterior wall above the tracheostomy with granulation at the site. The tracheal stenosis was located 0.7 cm below the vocal cords and its length was 2.1 cm. The patient underwent fiberoptic bronchoscopic dilation. A 10-mm T-tube (Koken Laboratories, Tokyo, Japan; proximal portion of the vertical limb, 2 cm; distal portion

of the vertical limb, 4 cm; horizontal limb, 5.5 cm) was inserted with difficulty via the tracheal stoma according to a previously described method¹ and with the help of the bronchofiberscope. The proximal portion of the vertical limb of the silicone T-tube was positioned across the stenotic segment, and only a slight kink (less than 90°) between the proximal portion of the vertical limb and the horizontal limb was observed using the bronchofiberscope. The tracheal T-tube was straightened after several insertions of the bronchofiberscope into the endotracheal T-tube to remove the kink. The patient had no further respiratory symptoms and was discharged. A bronchoscopic examination was performed once a month for 3 months to check the stent airway and to confirm the absence of new granulation tissue at the T-tube.

Nine months after the insertion of the silicone T-tube, the patient came to our hospital after vomiting a piece of the broken T-tube and coughing. On examination, his vital signs were stable and no evidence of cyanosis was seen. An emergency bronchofiberscopic examination was performed via his mouth, and the fracture and loss of the proximal portion of the vertical limb of the silicone T-tube was confirmed. No abnormalities were found in the remaining part of the silicone T-tube, and the remainder of the T-tube was removed through a tracheostome; a new tracheostomy tube (Portex; Smith's Medical, London, United Kingdom) was then inserted. The tracheal T-tube was fractured at the junction of the proximal portion of the vertical limb and the horizontal limb (Figure 1). We ordered the T-tube company to modify a new 12-mm T-tube with the same long vertical and horizontal limbs but with a 60° angle between the horizontal limb and the proximal portion of the vertical limb (Figure 2). A month later, the customized silicone T-tube was inserted through the tracheostome. This time, kinking between the horizontal and vertical limbs was not observed by bronchofiberscopy. The patient remains well and continues to be followed up 6 months after the insertion of the new silicone tracheal T-tube.

From the Department of Surgery, Teikyo School of Medicine, Tokyo, Japan.

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Address for reprints: Iwao Takanami, MD, Department of Surgery, Teikyo School of Medicine, 2-11 Kaga 2-Chome, Itabashi-Ku, Tokyo, 173 Japan (E-mail: takanami@med.teikyo-u.ac.jp).

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