Acute aortic dissection following non-structural failure of a prosthetic aortic valve

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Abstract

Malfunction of a prosthetic aortic valve is associated with a spectrum of potentially life threatening complications. In addition, the risk of aortic dissection increases following aortic valve replacement, which relates principally to aortic root pathology rather than prosthetic type or its functional status (Circulation 100 (1999) II-287). We report a case in which a high velocity turbulent jet in the proximal aorta, resulting from prosthetic leaflet entrapment caused intimal injury with subsequent type I dissection. This highlights the desirability for regular surveillance following aortic valve replacement, particularly in those patients with an ‘at-risk’ aorta.

Keywords: Aortic dissection; Valve replacement; Valve dysfunction

1. Clinical summary

A 58-year-old male of normal habitus with congenital bicuspid aortic stenosis underwent aortic valve replacement with a mechanical bileaflet prosthesis (21HP St. Jude Medical, Inc., St. Paul, MN). At operation, the ascending aorta was mildly dilated with maximum diameter at the sinotubular junction of <40 mm. Surgery was uncomplicated; however, 22 months later, he represented with acute central chest pain suggestive of aortic dissection. CT scanning established the diagnosis of type I aortic dissection. Trans-oesophageal echocardiography identified a high velocity eccentric jet arising from the aortic prosthesis directed towards the aortic wall (Fig. 1). At operation, extensive type I dissection was evident, with an entry point distal to the sinotubular junction, and unrelated to the previous aortotomy or cannulation sites. Extensive pannus was encroaching on the ventricular aspect of the prosthetic valve, entrapping one leaflet in a closed position (Fig. 2). This produced a high velocity eccentric jet directed towards the point of intimal injury, corresponding with the echo findings. The aortic prosthesis was excised and replaced with Haemoshield valved conduit (Model 21-CAVG, St. Jude Medical, Inc., St. Paul, MN) with coronary implantation. Post-operative recovery was uncomplicated. Histological examination of the excised aorta identified cystic medial necrosis.

2. Discussion

Aortic valve replacement has been identified as an independent risk factor for type 1 aortic dissection with 0.6% of patients developing dissection following AVR [1]. In a retrospective analysis of 119 patients with Type A dissection following AVR, von Kodolitsch et al. [1] identified the presence of aortic regurgitation combined with fragile and thinned aortic walls in patients with moderate aortic dilation to be predictive of subsequent dissection. This suggests the presumed mechanism(s) relates to the development of an at-risk susceptible aorta as a consequence of either intrinsic aortic wall pathology or turbulent flow in the proximal aorta associated with the native valve lesion or a combination of both. In their report, cystic median necrosis was present in only 37% of patients and not predictive of subsequent dissection.

The current patient’s native aortic valve was congenitally bicuspid, a lesion by itself associated with increased risk of dissection compared with trileaflet valves [2]. There is a high prevalence of aortic root enlargement in such patients,
which occurs irrespective of haemodynamic native valvular dysfunction [3]. This implies that a common developmental defect may exist rather than turbulence as the primary mechanism of root dilation. An autopsy study of patients with bicuspid aortic stenosis compared with acquired disease revealed reduced elastic content, which would explain the predisposition to aortic fragility and dissection [4]. If that is the case, correction of the haemodynamic lesion by aortic valve replacement may not be expected to diminish the subsequent risk.

In general, there appears to be no relationship between prosthetic type (mechanical versus biological or mechanical design) and the risk of subsequent dissection [1]. However, the majority of reported cases in literature are associated with mechanical aortic prostheses, although this may simply reflect more frequent usage of the mechanical type. Pieters et al. identified a high frequency of mono-disc prosthesis (87%) and suggested that the lateral displaced jet is a contributory factor [5]. It is interesting to consider that in the present case, the prosthetic malfunction resulted in a similar laterally displaced jet. The association between prosthetic malfunction and dissection has not been previously reported.

The occurrence of aortic dissection in this situation is associated with high mortality ranging from 20 to 50% [1]. Strategic objectives to avoid this complication may include the use of a stentless bioprosthesis in preference to a mechanical design in those patients highly predictive of future dissection. Such valves by preserving the natural dynamic movement of the aortic root and providing a more physiological flow pattern within the proximal aorta may avoid the shear stresses associated with a rigid prosthetic annulus and reduce the predilection to future dissection. Furthermore, elective replacement of the proximal aorta should be considered either at the time of AVR or in the follow-up period based on regular surveillance. The likelihood of imminent dissection can be predicted by identifying aortic root enlargement (>50 mm) or progressive dilation identified by serial echocardiography.

References