whose RA conduits were found to have string sign and TIMI 1 flow [3]. In our opinion, if we are discussing study grafts failure/occlusion, RA grafts with angiographic string sign should be included in the category of failed conduits (at least those with TIMI 1 flow, as TIMI 1 flow has been defined as some penetration of contrast material beyond the point of obstruction but without perfusion of the distal coronary bed [4]).

When we compare a total of 11.6% (51/440) of RA conduits that have failed (36 occluded, plus, at least, those 15 with string sign and TIMI flow 1) vs total of 14.1% (62/440) of SV conduits that have failed ([60 grafts occluded, plus 2 with TIMI 1 flow (but without string sign)], p-value is not significant any more (p = 0.38). Although the statistical significance of the difference in angiographic patency rate between compared conduits has gone, this has led us to conclude that the final result of the basic study by Desai and associates [2] did not confirm significantly better angiographic patency for RA conduits compared with SV grafts patency at 1 year after surgery. Collins and co-authors [5] have recently presented the third PRT, which compared angiographic RA conduit patency vs SV conduit patency. They reported an excellent 5-year angiographic patency rate of RA graft — 98.3% (58 out of 59 re-assessed conduits) that has reached significant difference (p = 0.04) compared with 86.4% patency rate of SV graft (38 out of 44 reassessed conduits). However, when we include one RA graft that was reported to have a string sign, the statistical significance (p = 0.16) of the difference in angiographic patency between compared conduits has gone (although there is still an absolute difference of 10% in angiographic patency — 57 out of 59 or 96.6% for RA conduit vs 86.4% for SV conduit).

References


Letter to the Editor

Reply to Nezic et al.

Interpretation of string sign in radial artery patency bypass grafts

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In response to the Letter-to-the-Editor [1] by Nezic et al., we have reviewed problems with definitions and interpretation of graft patencies. Commonly used definitions are anatomic, physiologic or a combination. The use of a simple anatomic definition of patency and complete occlusion in the Radial Artery Patency Study (RAPS) and Radial Artery and Radial Artery Versus Saphenous Vein Patency (RSVP) trials [2] and composite definition of graft failure in the Radial Artery Patency and Clinical Outcomes (RAPCO) trial [3] have lead to conflicting interpretations of similar outcomes of radial artery trials (RAPCO vs RAPS and RSVP) [2—4]. Complete occlusion as used in RAPS and RSVP is a reproducible anatomic observation, supplemented by flow measurements. However, such a dichotomous anatomic definition limits sensitivity and classifies high-grade graft stenoses as patent although the conduit may be dysfunctional.

The string sign is defined as a diffuse longitudinal narrowing less than 1 mm; this may be complete or partial [RAPS]. The string is seen most commonly in arterial grafts and complicates the interpretation of outcome. The assumption that the arterial graft with the string may recover and regain normal physiologic flow has been reported in 17% of LITA in situ grafts [5], but reversible ischaemia in only 2 of 14 patients with a string in a series of 137 after radial artery grafting [6]. Variable TIMI flow in grafts with a string sign adds to further confusion. It appears that about half of those grafts with a string had TIMI 1 and the other half TIMI 2 or 3 flow [7], thus suggesting that there may be several aetiological mechanisms. Diffuse narrowing may be the result of competitive collateral flow or low flow when sutured to a small target artery. In addition, a string sign may be the result of a poor harvesting technique or inherent graft disease.

The answer to Nezic et al.'s question is that a free arterial graft with a string sign is anatomically patent but has a high probability at least 50% chance that it is dysfunctional and that there is little prospect of any improvement. Most surgeons would interpret such a conduit as a failure. In an attempt to circumvent any potential problem with the definition and to use one that most surgeons would accept in the RAPCO Trial, graft failure was defined as total occlusion, a stenosis greater than 80% and those conduits with a string sign. The argument for including grafts with stenoses between 70% and 100% in the failure group is that this level of narrowing is thought to be related to flow restriction and myocardial ischaemia and is the trigger for re-vascularisation used by many surgeons.
References


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