

Long-term consequences of trans-radial catheterization on the radial artery

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Abstract

Background: The radial artery (RA) is often utilized for diagnostic coronary angiography and percutaneous intervention. Recent high-level evidence supports RA use in preference to saphenous vein as a conduit for coronary revascularization. **Aim:** To demonstrate gross and histologic changes of the RA following transradial access. **Methods:** We present two patients who had open RA harvest for coronary bypass surgery after transradial catheterization. **Results:** Examination 8 years after transradial catheterization demonstrated thickened intima and dissection, and examination 12 years following transradial catheterization with percutaneous coronary intervention demonstrated chronic dissection with thickened intima and near occlusion of the lumen. **Conclusion:** Transradial access via the RA, even after several years, is associated significant injury, making it unusable as a conduit for surgical coronary revascularization. A RA that has been utilized for catheterization should not be considered for coronary revascularization.

Long-term consequences of trans-radial catheterization on the radial artery

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Short title: Transcatheter radial artery injury.

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Abstract

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INTRODUCTION

The radial artery (RA) is often used for coronary angiography and percutaneous intervention. With the increased use of total arterial revascularization in accordance with recent guidelines, the RA is more commonly used in coronary artery bypass grafting (CABG).¹ Studies have shown superior long-term patency rates of the RA compared to the saphenous vein.² Questions have been raised as to whether the RA should be used as an arterial graft after transradial (TR) catheterization as it may affect graft patency. Here we discuss two patients with prior TR interventions who after 8-17years, still show structural and histologic changes.

Patient 1

53-year-old male with a history of kidney (8 yrs prior) and liver (17 yrs prior) transplantation and diabetes mellitus complained of chest pain at rest and workup revealed multivessel coronary artery disease (CAD). During left RA dissection, the distal portion was thickened, and a chronic dissection flap was noted (**Figure 1**).

Patient 2

48-year-old female with a history of CAD (PCI and stents 12 yrs prior), diabetes mellitus, hyperlipidemia, and statin intolerance presented with dyspnea and chest pain. Nuclear stress test was positive and cardiac catheterization demonstrated multivessel CAD. The entire the RA was noted to have a chronic dissection (**Figure 2**). And it was sent to pathology for histologic examination. Findings were significant for a portion of the lumen occluded by fibrosis and recanalization (**Figure 3**).

DISCUSSION

Here we present two patients with more than 8 years after TR arterial line or catheterization with chronic injury in the form of dissection and obstruction of the lumen due to fibrosis. Current evidence supports that TR procedures cause chronic and irreparable injury to the RA, making them unusable as bypass conduit for CABG.

Sousa-Uva and colleagues recommend that the RA should *de facto* be considered in every CABG.³ The group cites the superior late graft patency compared with traditionally harvested saphenous vein, as well as, stronger evidence of clinical benefit when compared to the right internal thoracic artery.

Gaudino summarized the benefits of using the TR approach for percutaneous procedures and the RA as a conduit for CABG.⁴ The writing panel comprised of clinical cardiologists, cardiothoracic surgeons, and

interventional cardiologists recommended reserving one RA for TR access and the other as a conduit for CABG. They also recommended adoption of strategies to minimize RA damage during TR access.

To date there are only two studies that specifically examine the impact of previous TR procedures on the function of RA used as conduit in CABG. Kamiya reported a stenosis-free patency rate of 77% in those with prior RA catheterization versus 98% in the control group (no prior RA catheterizations) at 30 days.⁵ The authors also performed a subanalysis on the relationship between occurrence of graft stenosis and TR catheterization, which indicated that the number of previous TR catheterizations was the most likely factor affecting graft patency ($P=0.07$). In a similar study, Ruzieh reported a 6- to 18-month patency of 59% in the TR access group compared to 78% in the control group (RA not used for angiography) ($p=0.03$).⁶

TR access is associated with endothelial injury and intimal hyperplasia.

Kamiya noted intimal hyperplasia (the primary method of long-term saphenous vein graft failure) in 68% of RAs in the prior RA catheterization group and 39% in those from the control group ($P=0.046$). Gaudino⁷

examined 50 patients who underwent TR coronary angiography before CABG and split the patients into 3 groups depending on the time interval. Immunohistochemical analysis demonstrated extensive endothelial injury in all examined RAs, with a trend toward a reduction in damage over time.

Nitroglycerin-mediated dilation (NMD) and flow-mediated dilation (FMD) are frequently used to study vasomotor function of the RA. Burstein found that, although the NMD response showed some trend for recovery over time, the FMD response was almost completely abolished after 9 weeks.⁸ Yan demonstrated that TR procedures decreased RA NMD and FMD resulting in immediate and persistent blunting of vasodilatory function.⁹

Using ultrasound imaging, studies have shown that the diameter of the RA following TR intervention never completely returns to baseline.¹⁰ A meta-analysis by Rashid found that, following TR intervention, the incidence of RA occlusion within 24 hours was 7.7%, which decreased to 5.5% at >1 week follow-up.¹¹ The only intervention that significantly reduced the risk of occlusion was use of a higher dose of heparin (5,000 IU vs < 5,000).

Conclusion

Studies evaluating the durability of the RA as a conduit after TR intervention are very limited, and few have demonstrated that injury remains after many years. We demonstrate that after multiple years following TR intervention, the RA shows persistent injury and should not be utilized as a conduit for CABG. Unfortunately, chronic injury to the RA prevents future use as a surgical revascularization conduit, thereby depriving the patient of its well documented benefits of improved patency and prolonged survival.

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Figure 1.eps available at <https://authorea.com/users/437432/articles/539073-long-term-consequences-of-trans-radial-catheterization-on-the-radial-artery>

figures/Figure-2/Figure-2-eps-converted-to.pdf

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