Clinics in Surgery

Research Article
Published: 07 Dec, 2016

Endoscopic Radial Artery Harvest Reduces Forearm Complications when Compared to Conventional Methods: A Pooled Analysis

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Abstract

Impetus on total arterial revascularization has led to increased use of the radial artery as a conduit for coronary artery bypass grafting. The radial artery conduit is being increasingly used as alternative to saphenous vein as a conduit. Recent interest has focused on endoscopic harvest using a single small incision in the wrist. However, data comparing this with the earlier open surgical technique is limited.

We have performed aggregate level meta-analysis pooling1340 patients from six studies. The Peto odds ratio (OR) was obtained using fixed effect modeling. Continuous data was pooled as weighted mean difference (WMD). Conduit length was comparable between methods ((WMD 0.6(0.2-1.7) mm; p=0.3)). Endoscopic radial artery harvest led to lower rates of wound hematoma formation ((OR 0.2 (0.08-0.47); p=<0.01)) and wound infection ((OR 0.4(0.1-0.9); p=0.04)) compared to conventional radial artery harvest. However, the incidence of forearm wound exploration was comparable ((OR 0.6(0.2-1.7); p=0.34)) in both cohorts.

Endoscopic radial artery harvest may reduce forearm complications after radial artery harvest.

Keywords: Endoscopic radial artery harvest; Conventional radial artery harvest; Coronary artery bypass grafting; Conduit; Forearm wound

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Received Date: *10 Oct 2016*
Accepted Date: *29 Nov 2016*
Published Date: *07 Dec 2016*

Citation:
Altarabsheh SE, Deo SV, Haddad O. Endoscopic Radial Artery Harvest Reduces Forearm Complications when Compared to Conventional Methods: A Pooled Analysis. Clin Surg. 2016; 1: 1218.

Introduction

Carpentier and colleagues promoted use of the radial artery as a conduit for coronary artery bypass grafting in 1972 [1,2]. While it fell into disrepute for some years due to issues related to vasospasm, since 1989 we have seen a resurgence of this conduit with the widespread application of pedicled harvesting techniques and routine post-operative vasodilator therapy [3].

The traditional way of harvesting the radial artery is by utilizing an incision between the antecubital fossa to the wrist on the radial aspect of the non-dominant forearm. However this leads to a 10-12 cms scar along the length of the forearm. Recently, some centers are focusing on obtaining this conduit endoscopically with only a 2-3 cms incision in the wrist area.

The main local issues related to radial artery harvest are wound hematoma, wound infection and forearm re-exploration related to bleeding. While many studies have compared these techniques of radial artery harvest, they are limited by small sample size and low event rates [1,4]. A recent review discussed the graft patency after these techniques [5]; however they did not compare local harvest related complications. Thus we have conducted a systematic review and meta-analysis to compare adverse local events related to these two methods of radial artery harvest.

Materials and Methods

PUBMED was queried to obtain original articles (Inception-December 2014) comparing the local wound complications in patients who had conventional (CRH) versus endoscopic radial artery harvest (ERH). Editorials, case reports, letters to the editor, and other review articles were excluded. Abstracts were reviewed by two independent authors (SEA, SVD) and disagreements were resolved by consensus. Data was obtained from the included studies using a pre-specified form.

Statistical analysis was performed using Stata 11.0® (StataCorp, TX, USA). Categorical end-points were pooled as Odds ratio (OR) using the Peto method with fixed effect modelling. Continuous

Table 1: A brief overview of the studies included in the systematic review.

Author	Shapira [6]		Bleiziffer [8]		Navia [2]		Patel [1]		Grus [7]		Kim [4]	
Country	USA		Germany		USA		USA		Czech Republic		Korea	
Year of Publication	2006		2008		2011		2004		2011		2007	
Type of Study	Prospective		Prospective		Retrospective		Prospective		Prospective		Prospective	
Total number of patients	228		106		509		200		40		257	
Cohort	CRH	ERH	CRH	ERH	CRH	ERH	CRH	ERH	CRH	ERH	CRH	ERH
Number of patients	120	108	53	53	470	39	100	100	20	20	157	100
Age (years)	62±9	61±9	60.9±9.0	60.8±6.9	60±9.8	60±9.8	68	69	53.3±4.6	55.7±6.8	61.1±8.7	61.1±8.7
Females (N), (%)	28	14	7	7	6(5%)	4(10%)	34(34%)	29(29%)	1(5%)	2(10%)	54(34.4%)	33(33%)
DM (N), (%)	45(38%)	46(43%)	6(11%)	8(15%)	22(19%)	7(18%)	31(31%)	39(39%)	12(60%)	11(55%)	62(39.5%)	48(48%)
HTN (N), (%)	93(77%)	94(87%)	49(92%)	45(85%)	92(79%)	30(77%)	71(71%)	76(76%)	13(65%)	12(60%)	72(45.9%)	48(48%)
PVD (N), (%)	22(18%)	12(11%)	8(15%)	6(11%)	50(43%)	16(41%)	NA	NA	NA	NA	NA	NA

Abbreviations: N: Number, CRH: Conventional Radial Artery Harvest, ERH: Endoscopic Radial artery Harvest, DM: Diabetes Milletes, HTN: Hypertension, PVD: Peripheral Vascular Disease, NA: Not Available.
Patient characteristics included in the meta-analysis.

Table 2: local neurological complications after radial artery harvest in either method.

Author	Country	Year	Groups (N)	Motor/Sensory Complications	Patient Satisfaction
Shapira [6]	USA	2006	• Open with cautery (18) • Open with harmonic shears (18) • Endo (18)	• No overall motor deficits • Paresthesia and numbness of lateral antebrachial cutaneous and superficial radial nerves (open, no exact number) • Paresthesia and numbness of superficial radial nerve (endo, no exact number)	• No patient satisfaction score recorded
Patel [1]	USA	2004	• Open (100) • Endo (100)	• 10 (open) vs 1 (endo) motor deficits • 31 (open) vs 18 (endo) paresthesia and numbness	• No patient satisfaction score recorded
Casselman	Belgium	2004	• Endo (54)	• 21 patients with paresthesiaof superficial radial nerve • Motor deficits not assessed	• 87% patient satisfaction rate
Bleiziffer [8]	Germany	2007	• Endo (50)	• Not assessed	• No patient satisfaction score recorded
Dimitrova	USA	2010	• Open (90) • Endo (112)	• No overall motor deficits • Damage to superficial radial nerve reported for both open and endo (no exact number)	• No patient satisfaction score recorded

Abbreviations: Endo: Endoscopic radial artery harvest, N: number.
An Overview of the reported neurological complications after radial artery harvest in the included studies.

data were pooled using inverse variance weighted analysis. Results are presented with 95% confidence intervals; p< 0.05 is significant.

Results

From the search results, 6 studies [1,2,4,6-8] reporting local wound complications were selected for analysis. Table 1shows a brief overview of the selected studies. All except Navia et al. [2] were prospective randomized studies. While three studies [1,4,9] included more than 100 patients in the ERH cohort, none reported that these were pilot or initial results of their experience with ERH.

From the pooled analysis, 420 patients had endoscopic radial artery harvest, while 920 had conventional radial artery harvest. The harvest length between ERH and CRH [1,6,7], was comparable. ((WMD 0.6(0.2-1.7) mm; p=0.3)). The incidence of hematoma after harvest was higher with conventional harvest [1,4,6,7] ((OR 0.2 (0.08-0.47); p=< 0.01)). But the need for wound re-exploration was between the two cohorts ((OR 0.6(0.2-1.7); p=0.34)) [1,4,6,8]. The incidence of superficial wound infection was higher after conventional harvest ((OR 0.4(0.1-0.9); p=0.04)) [1,2,4,6,7]. All the included studies [1,2,4,7-9] studied sensory and motor nerve deficit after radial artery harvest. While data could not be pooled together, Table 2 demonstrates that almost all conclude that ERH leads to less neuropathy when compared to open harvest.

Discussion

Our meta-analysis of the 6 studies [1,2,4,7-9] (1340 patients) demonstrates that local problems are less with endoscopic radial artery harvest as compared to the open technique. Importantly, almost all data is obtained from prospective randomized studies. Despite not clearly indicated in the included studies, endoscopic radial artery harvest is usually performed using tourniquet occlusion. This may be the reason that hematoma formation is lower with this technique. Better visualization with magnification may also aid in hemostasis. Other contributing factors could be related to the small size of incision in which better homeostasis can be achieved. While not specifically stated in the studies, conventional practice is to close the radial artery wound prior to the administration of heparin or after heparin reversal. More hematoma formation may be one factor leading to increased wound infection with open harvest. Neuropathy was less observed in the endoscopic radial artery harvest cohort. The lateral antebrachial cutaneous nerve in particular is spared in the endoscopic harvest method because it runs in the brachioradialis muscle sheath, while reported neuropathy related to this nerve in the open harvest cohort could be attributed to excessive traction, suturing or muscle contusions.

However it is also important to acknowledge that these results do not demonstrate pilot or preliminary results. Thus we can conclude

that endoscopic radial artery harvest leads to less forearm problems when performed by trained personnel. With the increased focus on arterial revascularization, we believe that this technique would result in higher arterial conduit use.

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