



Technical Success Rates of Endovascular Treatment of Femoropopliteal Chronic Total Occlusions

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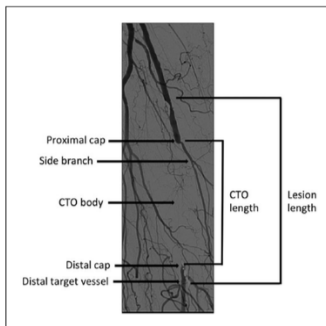
Excellence in Peripheral Arterial Disease

Background

Chronic total occlusions (CTOs) of femoropopliteal (FP) arteries exist in nearly 50% of all patients with peripheral arterial disease (PAD). Crossing CTOs presents a significant challenge to successful percutaneous revascularization, and is oftentimes a determinant of procedural and technical failure. However, limited data exists on the risk of procedural failure in crossing FP CTOs, as well as the immediate and longer term outcomes of procedural success and failure in crossing. Additionally, it is unknown which patient and lesion characteristics contribute to increased risk of procedural failure. This study aims to explore the independent predictors of procedural failure in crossing CTOs, as well as compare the outcomes following procedural failures and successes.

Methods

Consecutive patients between January 2006 and March 2015 undergoing endovascular revascularization for symptomatic peripheral artery disease with FP CTO were analyzed as part of the Excellence in Peripheral Artery Disease (XLPAD) registry (NCT01904851). A single CTO is defined as angiographic 100% occlusion or sequential occlusion separated by ≤ 2 cm. Procedural success was defined as restoration of flow through the lesion with $\leq 30\%$ residual stenosis. Procedural failures included technical failures (defined as failure to cross the CTO or failure to enter the true lumen from the subintimal space) and treatment failures (defined as $\geq 30\%$ residual stenosis after successful crossing). One year outcomes for surgical revascularization, endovascular revascularization, and major amputation were analyzed. Pearson's chi-squared tests for independence were used amongst the categorical variables with greater than five occurrences, and Fischer's exact test was used for categorical variables with less than five occurrences. Univariate and Multivariate analysis were conducted for predictors of procedural failure. All statistical tests conducted in Microsoft JMP.



Angiographic depiction of a superficial femoral artery CTO

Results

A total of 1100 CTO lesions from 948 patients were included in the analysis. Procedural success was achieved in 989 (89.9%) CTO, while procedural failure occurred in 111 (10.1%). Treatment failures comprised 23 (2.1%) and technical failures 88 (8.0%), with 59 (5.4%) intraluminal failures to cross and 29 (2.6%) failures to re-enter from subintimal space. A CTO crossing device was used in 390 lesions (35.5%). There were significantly more surgical revascularizations following failed procedures compared to successful, although with a lower need for repeat revascularization procedures. Need for amputations were similar for patients with failed or successful procedures. Univariate analysis indicated age, lesion length, heavy calcification, and multilevel FP disease to be predictors of procedural failure; lesion calcification and multilevel FP disease were independent predictors in multivariable analysis.

Figure 1: Procedural Successes and Failures in FP CTO Intervention

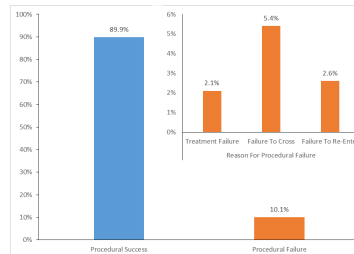


Table 1: Predictors of Procedural Failure

Univariate	Odds Ratio	95% Confidence Interval
Age	0.9	0.92-0.97
Smoking	0.33	0.11-0.8
CAD	0.56	0.3-1.0
BTK	5.6	1.23-40.6
Length	0.9	0.9-0.99
Calcification	0.13	0.02-0.3
Multilevel	1.9	1.22-3.46
Tapered Stump	0.19	0.06-0.52
Blunt Stump	5.13	1.9-15.37
True Lumen	14.29	3.4-106.3
Subintimal	8.41	2.01-57.44

Multivariate	Odds Ratio	95% Confidence Interval
Multilevel	1.006	0-0.81
Calcification	0.32	0.012-3.4

Figure 2: Incidence of Adverse Outcomes following Procedural Successes and Failures

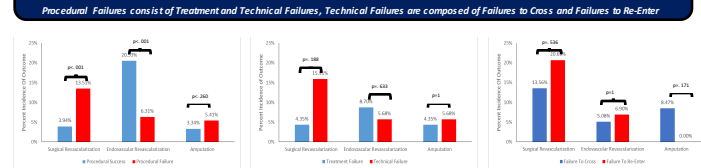


Table 2: Baseline and Lesion Characteristics in XLPAD

	Baseline Characteristics		
	Total (n=2148)	CTO (n=1100)	Non-CTO (n=1048)
Age	65.8 ± 9.7	65.1 ± 9.6	66.5 ± 9.7
Male	1702 (79.2%)	924 (84.0%)	778 (74.2%)
Caucasian	1466 (68.2%)	727 (66.1%)	739 (70.5%)
Black	417 (19.4%)	237 (21.5%)	180 (17.2%)
Hispanic	215 (10.0%)	102 (9.3%)	113 (10.8%)
Rutherford Category	3.5 ± 0.9	3.6 ± 0.9	3.5 ± 0.9
Ankle Brachial Index	.68 ± 0.2	.65 ± 0.2	.72 ± 0.2
Current Smoker	1077 (50.1%)	619 (56.3%)	458 (43.7%)
Past Smoker	742 (34.5%)	337 (30.6%)	405 (38.6%)
Never Smoked	292 (13.6%)	131 (11.9%)	161 (15.4%)
Diabetes Mellitus	1217 (56.7%)	603 (54.8%)	614 (58.6%)
Dyslipidemia	1876 (87.3%)	946 (86.0%)	930 (88.7%)
Hypertension	1974 (91.9%)	1013 (92.1%)	961 (91.7%)
Coronary Artery Disease	1448 (67.4%)	743 (67.5%)	705 (67.3%)
Prior Myocardial Infarction	567 (26.4%)	313 (28.5%)	254 (24.2%)
Congestive Heart Failure	396 (18.4%)	225 (20.5%)	171 (16.3%)
Chronic Kidney Disease	409 (19.0%)	208 (18.9%)	202 (19.3%)

Lesion Characteristics			
Lesion Length	139.6 ± 100.7	168.7 ± 102.7	108.0 ± 88.6
Vessel Diameter	5.0 ± 1.1	4.9 ± 1.1	5.0 ± 1.1
Heavily Calcified	1054 (49.1%)	474 (43.1%)	580 (55.3%)
Multilevel Disease	1426 (66.4%)	752 (68.4%)	674 (64.3%)
In-stent Restenosis	358 (16.7%)	172 (15.6%)	186 (17.7%)

Conclusion

Advanced patient age, lesion length, heavy calcification, and multilevel FP disease are associated with higher procedural failure rates of crossing FP CTO. Patients experiencing procedural failures undergo significantly higher rates of surgical revascularization, albeit with lower need for repeat revascularization.



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