Staged Percutaneous Coronary Intervention for Chronic Total Occlusion of Non-Infarct Related Artery: A Meta-Analysis

Noman Lateef, MD¹; M. Junaid Ahsan, MD²; Soban Ahmad, MD³; Muhammad Atif Masood Noori, MD⁴; Azka Latif, MD⁵; Kristen N. Brown, MD¹; Andrew M. Goldsweig, MD, MS¹

- 1. University of Nebraska Medical Center, Omaha, NE
- 2. Iowa Heart Center, Des Moines, IA
- 3. East Carolina University, Greenville, NC
- 4. Rutgers Health/Trinitas Regional Medical Center, Elizabeth, USA
- 5. Creighton University, Omaha, NE

Background

Chronic total occlusion (CTO) of a non-infarct related artery (nIRA) is associated with adverse outcomes following acute myocardial infarction (AMI). The current study aimed to evaluate the impact of successful staged percutaneous coronary intervention (PCI) of nIRA CTO lesions on clinical outcomes.

Methods

PubMed, EMBASE, Google Scholar and Scopus databases were queried for studies comparing outcomes between AMI patients who underwent successful staged PCI of nIRA CTO lesions (CTO PCI group) and AMI patients with medical management of nIRA CTO lesions or failed CTO PCI attempt (No CTO PCI group). The primary meta-analysis outcome was major adverse cardiovascular events (MACE). The main summary estimate was the random effects risk ratio (RR) with 95% confidence intervals (CIs).

Results

Eleven studies (1 randomized, 10 observational) with 2,788 patients were included. Compared with the No CTO PCI group, the CTO PCI group demonstrated a lower incidence of MACE (Figure A, RR 0.55 [0.46, 0.66], p<0.001), all-cause mortality (Figure B, RR 0.47 [0.33, 0.66], p<0.001), cardiac mortality (Figure C, RR 0.4 [0.28, 0.59], p<0.001), stroke (Figure D, RR 0.38 [0.22, 0.66], p=0.0007) and heart failure (HF) hospitalization (Figure E, RR 0.61 [0.41, 0.9], p=0.01). There was no significant difference in rates of any repeat revascularization (Figure F, RR 0.98 [0.69, 1.4], p=0.92) or target vessel revascularization (Figure G, RR 0.81 [0.48, 1.37], p=0.43) between the two groups.

Conclusion

In patients with AMI, staged PCI of nIRA CTO lesions was associated with a significantly lower incidence of MACE, all-cause mortality, cardiac mortality, stroke and HF hospitalization.

Figure A: Major adverse cardiovascular events (MACE)

	CTO P	CI	No-CT	O PCI		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	Year	M-H, Random, 95% CI
Yang et al, 2011	19	87	19	49	8.6%	0.56 [0.33, 0.96]	2011	-
Shi et al, 2014	28	100	24	48	11.8%	0.56 [0.37, 0.85]	2014	
Choi et al, 2016	31	170	67	154	14.1%	0.42 [0.29, 0.60]	2016	
Deng et al, 2017	43	221	54	156	15.1%	0.56 [0.40, 0.79]	2017	
Elias et al, 2018	18	148	18	154	6.9%	1.04 [0.56, 1.92]	2018	
Park et al, 2018	40	321	18	101	9.1%	0.70 [0.42, 1.16]	2018	
Yoshida et al, 2019	11	65	54	107	7.7%	0.34 [0.19, 0.59]	2019	
Cui et al, 2020	20	91	92	196	12.1%	0.47 [0.31, 0.71]	2020	
Qin et al, 2022	38	166	55	164	14.7%	0.68 [0.48, 0.97]	2022	
Total (95% CI)		1369		1129	100.0%	0.55 [0.46, 0.66]		•
Total events	248		401					
Heterogeneity: Tau ² =	0.03; Cl	$ni^2 = 13$	2.08, df =	8 (P = 0)	$(0.15); I^2 =$	34%		0.2 0.5 1 2 5
Test for overall effect	Z = 6.4	L (P < 0	0.00001)					Favours CTO PCI Favours Non-CTO PCI

Figure B: All-cause mortality

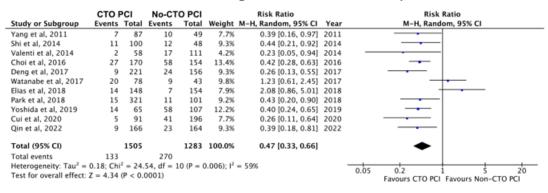


Figure C: Cardiac mortality

		СТО Р	CI	No-CT	O PCI		Risk Ratio		Risk Ratio
Study	or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	Year	M-H, Random, 95% CI
Yang e	et al, 2011	7	87	10	49	9.3%	0.39 [0.16, 0.97]	2011	
Shi et a	al, 2014	9	100	11	48	10.3%	0.39 [0.17, 0.88]	2014	
Valenti	i et al, 2014	1	58	13	111	3.0%	0.15 [0.02, 1.10]	2014	-
Choi et	t al, 2016	13	170	31	154	13.1%	0.38 [0.21, 0.70]	2016	
Watana	abe et al, 2017	16	78	8	43	10.9%	1.10 [0.51, 2.36]	2017	-
Deng e	et al, 2017	8	221	24	156	10.8%	0.24 [0.11, 0.51]	2017	
Elias et	t al, 2018	8	148	1	154	2.8%	8.32 [1.05, 65.74]	2018	
Park et	t al, 2018	13	321	10	101	10.5%	0.41 [0.18, 0.90]	2018	
Yoshid	la et al, 2019	9	65	47	107	12.6%	0.32 [0.17, 0.60]	2019	
Cui et a	al, 2020	4	91	33	196	8.2%	0.26 [0.10, 0.71]	2020	
Qin et	al, 2022	5	166	17	164	8.5%	0.29 [0.11, 0.77]	2022	
Total ((95% CI)		1505		1283	100.0%	0.40 [0.28, 0.59]		◆
Total e	events	93		205					
Hetero	geneity: Tau ² = (0.18; Chi	$^{2} = 19.$	50, df = 3	10 (P = 0).03); I ² =	49%		0.005 0.1 1 10 200
Test fo	or overall effect: 2	Z = 4.75	(P < 0.0)	00001)					
Valenti Choi et Watana Deng e Elias et Park et Yoshid Cui et Qin et Total (Total e	i et al, 2014 t al, 2016 abe et al, 2017 et al, 2017 t al, 2018 t al, 2018 da et al, 2019 al, 2020 al, 2022 (95% CI)	1 13 16 8 8 13 9 4 5	58 170 78 221 148 321 65 91 166 1505	13 31 8 24 1 10 47 33 17 205 50, df = 1	111 154 43 156 154 101 107 196 164	3.0% 13.1% 10.9% 10.8% 2.8% 10.5% 12.6% 8.2% 8.5%	0.15 (0.02, 1.10) 0.38 [0.21, 0.70] 1.10 [0.51, 2.36] 0.24 [0.11, 0.51] 8.32 [1.05, 65.74] 0.41 [0.18, 0.90] 0.32 [0.17, 0.60] 0.26 [0.10, 0.71] 0.29 [0.11, 0.77] 0.40 [0.28, 0.59]	2014 2016 2017 2017 2018 2018 2019 2020	0.005 0.1 10 Favours CTO PCI Favours Non-CTO PCI

Figure D: Stroke

	CTO	PCI	No-CT	O PCI		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	Year	M-H, Random, 95% CI
Valenti et al, 2014	1	58	4	111	6.6%	0.48 [0.05, 4.18]	2014	
Shi et al, 2014	3	100	2	48	10.1%	0.72 [0.12, 4.17]	2014	
Choi et al, 2016	2	170	8	154	13.2%	0.23 [0.05, 1.05]	2016	-
Watanabe et al, 2017	4	78	4	43	17.4%	0.55 [0.15, 2.09]	2017	
Elias et al, 2018	2	148	4	154	11.0%	0.52 [0.10, 2.80]	2018	
Yoshida et al, 2019	2	65	14	107	14.8%	0.24 [0.06, 1.00]	2019	
Cui et al, 2020	2	91	10	196	13.8%	0.43 [0.10, 1.93]	2020	
Qin et al, 2022	2	166	8	164	13.2%	0.25 [0.05, 1.15]	2022	•
Total (95% CI)		876		977	100.0%	0.38 [0.22, 0.66]		•
Total events	18		54					
Heterogeneity: Tau2 =	0.00; Chi	$^{2} = 2.2$	1, df = 7	(P = 0.9)	5); $I^2 = 0$	%		
Test for overall effect:	Z = 3.40	(P = 0.0)	0007)					0.05 0.2 1 5 20 Favours CTO PCI Favours Non-CTO PCI

Figure E: Heart failure hospitalization

	CTO	PCI	No-CT	O PCI		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	Year	M-H, Random, 95% CI
Yang et al, 2011	7	87	8	49	17.1%	0.49 [0.19, 1.28]	2011	
Shi et al, 2014	9	100	11	48	23.6%	0.39 [0.17, 0.88]	2014	
Deng et al, 2017	19	221	20	156	44.0%	0.67 [0.37, 1.21]	2017	
Watanabe et al, 2017	10	78	5	43	15.3%	1.10 [0.40, 3.02]	2017	-
Total (95% CI)		486		296	100.0%	0.61 [0.41, 0.90]		•
Total events	45		44					
Heterogeneity: Tau2 =	0.00; Chi	$^{2} = 2.7$	5, df = 3	(P = 0.4)	3); $I^2 = 0$	%		0.1 0.2 0.5 1 2 5 10
Test for overall effect:	Z = 2.50	(P = 0.	01)					Favours CTO PCI Favours Non-CTO PCI

Figure F: Repeat revascularization

	CTO F	CI	No-CT	O PCI		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	Year	r M-H, Random, 95% CI
Yang et al, 2011	8	87	7	49	8.0%	0.64 [0.25, 1.67]	2011	·
Valenti et al, 2014	24	58	15	111	12.9%	3.06 [1.75, 5.37]	2014	·
Deng et al, 2017	21	221	22	156	12.9%	0.67 [0.38, 1.18]	2017	7
Watanabe et al, 2017	38	78	23	43	16.0%	0.91 [0.64, 1.31]	2017	7
Elias et al, 2018	32	148	42	154	15.4%	0.79 [0.53, 1.18]	2018	3 - +
Park et al, 2018	23	321	5	101	8.1%	1.45 [0.56, 3.71]	2018	3 -
Cui et al, 2020	13	91	46	196	12.9%	0.61 [0.35, 1.07]	2020)
Qin et al, 2022	28	166	26	164	14.0%	1.06 [0.65, 1.73]	2022	2
Total (95% CI)		1170		974	100.0%	0.98 [0.69, 1.40]		-
Total events	187		186					
Heterogeneity: Tau ² =	0.17; Chi	$^{2} = 22.$	97, df = 7	(P = 0.	002); $I^2 =$	70%		0,2 0,5 1 2 5
Test for overall effect:	Z = 0.10	(P = 0.9)	92)					Favours CTO PCI Favours Non-CTO PCI

Figure G: Target vessel revascularization

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	CTO P	CI	No-CT	O PCI		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	Year	M-H, Random, 95% CI
Shi et al, 2014	15	100	12	48	17.6%	0.60 [0.31, 1.18]	2014	
Valenti et al, 2014	8	58	8	111	14.0%	1.91 [0.76, 4.84]	2014	
Choi et al, 2016	19	170	35	154	20.0%	0.49 [0.29, 0.82]	2016	
Elias et al, 2018	13	148	36	154	18.9%	0.38 [0.21, 0.68]	2018	
Park et al, 2018	22	321	5	101	13.8%	1.38 [0.54, 3.56]	2018	
Qin et al, 2022	14	166	9	164	15.7%	1.54 [0.68, 3.45]	2022	-
Total (95% CI)		963		732	100.0%	0.81 [0.48, 1.37]		
Total events	91		105					
Heterogeneity: Tau2	= 0.29; Ch	i ² = 16	5.37, df =	5 (P = 0	0.006); I ²	= 69%		0.1 0.2 0.5 1 2 5 10
Test for overall effect	t: Z = 0.79	(P = 0).43)					Favours CTO PCI Favours Non-CTO PCI