Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Correspondence

Chronic total occlusion percutaneous coronary intervention during the COVID-19 pandemic: Insights from the PROGRESS-CTO registry

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The coronavirus disease 2019 (COVID-19) pandemic resulted in a significant decrease in percutaneous coronary interventions (PCIs) for both acute and chronic coronary syndromes.[1,2] We analyzed the clinical, angiographic, and procedural characteristics of 2,794 chronic total occlusion (CTO) PCIs performed on 2,725 patients enrolled in the PROGRESS-CTO (Prospective Global Registry for the Study of Chronic Total Occlusion Intervention, (clinicaltrials.gov Identifier: NCT02061436) registry and compared procedural volume and outcomes for procedures performed in 2020 vs. 2019 at 21 US and international centers. Only cases from centers that enrolled patients during both years were included in the study. The study was approved by the institutional review board of each site, and a waiver of informed consent was obtained.

Categorical variables were expressed as percentages and were compared using Pearson's chi-square test. Continuous variables are presented as mean ± SD or as median (interquartile range [IQR]) and were compared using Student's t-test and one-way analysis of variance for normally distributed variables; the Wilcoxon rank-sum test applied for nonparametric continuous variables as appropriate. All statistical analyses were performed using JMP version 13.0 (SAS Institute, Cary, North Carolina).

A total of 1,079 procedures were performed in 2020 at 22 centers as compared to 1,715 in 2019 (37.1% decrease). The majority of participating centers observed a decline in procedural volume (18 centers of 22, 81%). The mean J-CTO score was slightly higher in 2020 (2.5 ± 1.2 vs. 2.4 ± 1.2, p = 0.0016). Technical and procedural success rates were similar, but the incidence of in-hospital major adverse cardiovascular events (MACE) was higher in 2020 (3.2% vs. 1.7%, p = 0.01) (Table), driven by higher incidence of acute myocardial infarction (1.1% vs. 0.3% p = 0.007), emergent PCI (0.5% vs. 0%, p = .005), and emergent coronary artery bypass graft surgery (0.3% vs. 0%, p = 0.029).

To the best of our knowledge, this is the first study of CTO PCI volumes and outcomes during the COVID-19 pandemic and showed a significant decrease in procedural volumes. Technical and procedural success rates remained similar, but in-hospital MACE rates were higher in 2020, possibly because of higher angiographic complexity of CTOs treated during that year.

Our study has some limitations. First, it was an observational, retrospective study. Second, our study reported only in-hospital outcomes. Third, there was no clinical event adjudication by a clinical events committee. Fourth, all procedures were performed at high-volume, experienced PCI centers, thus limiting the generalizability of our findings to centers with limited CTO PCI experience.

In conclusion, the volume of CTO PCIs significantly decreased during the COVID-19 pandemic. Technical and procedural success rates remained stable, whereas in-hospital MACE rates increased.

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Table
Baseline characteristics and procedural outcomes of the study patients and lesions

Variable	CTO PCIs in 2020 n = 1,054	CTO PCIs in 2019 n = 1,671	p-value
Baseline characteristics of the study patients			
Age (years)*	64.5 ± 11	64.5 ± 10	0.95
Men (%)	813 (78)	1313 (79)	0.56
Diabetes mellitus (%)	441 (44)	697 (43)	0.67
Dyslipidemia (%)	941 (94)	1399 (86)	*<0.001*
Hypertension (%)	939 (93)	1468 (91)	0.013
Heart failure (%)	304 (31)	426 (27)	*0.019*
Prior CABG (%)	292 (29)	447 (28)	0.36
Dialysis (%)	33 (3.3)	91 (1.9)	0.034
CTO Indication			<0.001
-Symptom relief (%)	628 (63)	1124 (69)	
-Ischemia reduction (%)	130 (13)	188 (12)	
-Staged for complete revascularization stable angina (%)	94 (9.5)	80 (4.9)	
-Acute coronary syndrome (%)	71 (7.2)	107 (6.6)	
-Other (%)	69 (7)	1287(7.8)	
Baseline angiographic and technical characteristics of the study lesions			
	N = 1,079	N = 1,715	
J-CTO score*	2.5 ± 1.2	2.4 ± 1.2	*0.002*
Moderate/severe calcification (%)	444 (45)	661 (43)	0.47
Dual Injection (%)	698 (72)	1028 (68)	*0.035*
Crossing strategies used			
-AWE (%)	946 (88)	1522 (89)	0.38
-ADR (%)	214 (20)	291 (17)	0.06
-Retrograde (%)	345 (32)	532 (31)	0.59
OCT use (%)	18 (2.1)	49 (3.6)	*0.041*
IVUS use (%)	624 (67)	818 (55)	*<0.001*
Procedural outcomes			
	N = 1,054	N = 1,671	
Technical success (%)	932 (86.4)	1476 (86.1)	0.81
Procedural success (%)	986 (84.1)	1420 (85)	0.52
In-hospital MACE (%)	34 (3.2)	29 (1.7)	0.01
Perforation (%)	75 (7.1)	89 (5.3)	0.06
Contrast volume (ml)**	190 [139,260]	200 [140,270]	0.10
Fluoroscopy Time (min)**	46 [27,73]	42 [26,67]	*0.009*
AK Fluoroscopy Dose (Gy)**	1.7 [1,3]	1.9 [1.1,2.9]	0.18
Procedure time (min)**	123 [79,180]	118 [78,171]	0.19

Abbreviations: CTO = chronic total occlusion; PCI = percutaneous coronary intervention; CABG = coronary artery bypass grafts; AWE = antegrade wire escalation; ADR = antegrade dissection/re-entry; OCT = optical coherence tomography; IVUS = intravascular ultrasound; MACE = major adverse cardiovascular events; AK = air kerma.
* mean±SD.
** median [IQR].

References

1. Kwok CS, Gale CP, Curzen N, et al. Impact of the COVID-19 Pandemic on Percutaneous Coronary Intervention in England: Insights From the British Cardiovascular Intervention Society PCI Database Cohort. *Circ Cardiovasc Interv*. 2020;13, e009654.
2. Garcia S, Albaghdadi MS, Meraj PM, et al. Reduction in ST-Segment Elevation Cardiac Catheterization Laboratory Activations in the United States During COVID-19 Pandemic. *J Am Coll Cardiol*. 2020;75:2871–2872.

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