



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.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

CASE REPORT

INTERMEDIATE

CLINICAL CASE

Exploring Personal Protection During High-Risk PCI in a COVID-19 Patient

Q1 Impella CP Mechanical Support During ULMCA Q4 Bifurcation Stenting

Q11 Luca Bettari, MD,^a Gaetano Pero, MD,^a Cristian Maiandi, MD,^a Antonio Messina, MD,^b Matteo Saccocci, MD,^b Marco Cirillo, MD,^{b,c} Giovanni Troise, MD,^b Elena Conti, MD,^c Claudio Cuccia, MD,^d Diego Maffeo, MD^a

ABSTRACT

The correct management of patients with coronavirus disease 2019 and acute coronary syndrome is still uncertain. We describe the percutaneous treatment of an unprotected left main coronary artery in a patient who is positive for coronavirus disease 2019 with unstable angina, dyspnea and fever. Particular attention will be dedicated to the measures adopted in the catheterization laboratory to protect the staff and to avoid further spread of the infection. **(Level of Difficulty: Intermediate.)** (J Am Coll Cardiol Case Rep 2020;■:■-■) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

HISTORY OF PRESENTATION

A 70-years-old gentleman with unstable angina was transferred to our center with persistent chest pain despite maximum antianginals. On admission, his

blood pressure was 100/65 mm Hg, heart rate 72 beats/min and respiratory rate 14 breaths/min. Physical examination revealed normal vital signs, regular heart rhythm with no significant murmurs, and some bibasilar lung rales.

LEARNING OBJECTIVES

- Cardiovascular diseases significantly increase mortality in infected patients.
- Heart team discussion is key in decision making in this subset of patient.
- Personal protection protocols are fundamental to reduce the risk of infection in health care workers.

He was referred to our hospital after presenting to a hospital in Bergamo and having angiographic evidence of chronic total occlusion of the right coronary artery (**Video 1**) and critical stenosis of distal left main coronary artery (LMCA) involving the ostia of both left anterior descending and left circumflex arteries (**Videos 2** and **3**). After the diagnostic angiogram, he was started on aspirin 100 mg and atorvastatin 80 mg once a day. From his blood tests, initial high-sensitivity troponin I was 11 ng/l (normal

From the ^aInterventional Cardiology Unit, Cardiovascular Department, Fondazione Poliambulanza Istituto Ospedaliero, Brescia, Italy; ^bCardiac Surgery Unit, Cardiovascular Department, Fondazione Poliambulanza Istituto Ospedaliero, Brescia, Italy; ^cHeart Failure Surgery Unit, Cardiovascular Department, Fondazione Poliambulanza Istituto Ospedaliero, Brescia, Italy; ^dCardiology Unit, Cardiovascular Department, Fondazione Poliambulanza Istituto Ospedaliero, Brescia, Italy; and the ^eCardiovascular Intensive Care Unit, Cardiovascular Department, Fondazione Poliambulanza Istituto Ospedaliero, Brescia, Italy. The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, or patient consent where appropriate. For more information, visit the *JACC: Case Reports* [author instructions page](#).

Manuscript received March 11, 2020; revised manuscript received March 20, 2020, accepted March 23, 2020.

ABBREVIATIONS AND ACRONYMS

COVID-19 = coronavirus
disease 2019

LMCA = left main coronary
artery

range <34 ng/l) and B-type natriuretic peptide was 719 pg/ml (normal range <300 pg/ml).

The patient had an electrocardiogram (Figure 1) that demonstrated sinus rhythm, left anterior fascicular block, and left axis deviation. A bedside echocardiogram on admission demonstrated a left ventricular ejection fraction of 45% with left anterior descending territory severe hypokinesis.

PAST MEDICAL HISTORY

Aside from previous bladder cancer, the patient denied any past cardiac events or cardiac risk factors. He was not on any medication prior to the diagnostic angiogram.

MANAGEMENT

After the heart team's discussion, it was decided to refer the patient to surgical revascularization within the 2 following days. However, after a few hours, the patient developed cough and fever (>39°C). Urgent chest x-rays demonstrated interstitial involvement of the lungs, which is suggestive for severe acute respiratory syndrome coronavirus 2 infection (Figure 2). The diagnosis of coronavirus disease 2019 (COVID-19) was then confirmed by the reverse transcriptase polymerase chain reaction test, and so the patient was transferred to a negative pressure airflow room. In the next days, due to the recurrence of chest pain and hyperthermia, accompanied by thrombocytopenia, leukopenia, and mild hypoxia, we decided to have a second, urgent heart team discussion after the evaluation by the infectious disease specialist and the intensivist. Based on the hypothesis that the patient's respiratory function may deteriorate further, it was decided to treat the coronary disease percutaneously to avoid surgical-related morbidity, going beyond current practice guidelines (1).

In the light of the complex coronary artery disease, given the left ventricular dysfunction and the intention to perform LMCA stenting with a double-stent bifurcation technique in the presence of a chronic total occlusion of the right coronary artery, it was given indication to use a temporary left ventricular support device: the Impella CP system (Abiomed, Inc., Danvers, Massachusetts). (Disclaimer: The use of Impella described in this case is not currently approved in the United States.)

The LMCA was treated using the double kissing-crush technique, with excellent angiographic result confirmed by intravascular ultrasounds (Figures 3

and 4, Video 4). The double kissing-crush technique has been widely described elsewhere (2).

After the procedure, the Impella CP catheter was removed without complications, and the femoral access was closed with the use of 2 Proglide closure systems (Abbott Vascular, Santa Clara, California).

PROTECTIVE EQUIPMENT IN THE CATHETERIZATION LAB

The staff allowed to enter the catheterization lab consisted of 2 cardiologists as first and second operator, 2 nurses, and an x-ray technician. The catheterization lab could not be negative pressure as we could not change the settings. However, after discussing the risks and benefits of proceeding, we accepted the risk of the positive flow.

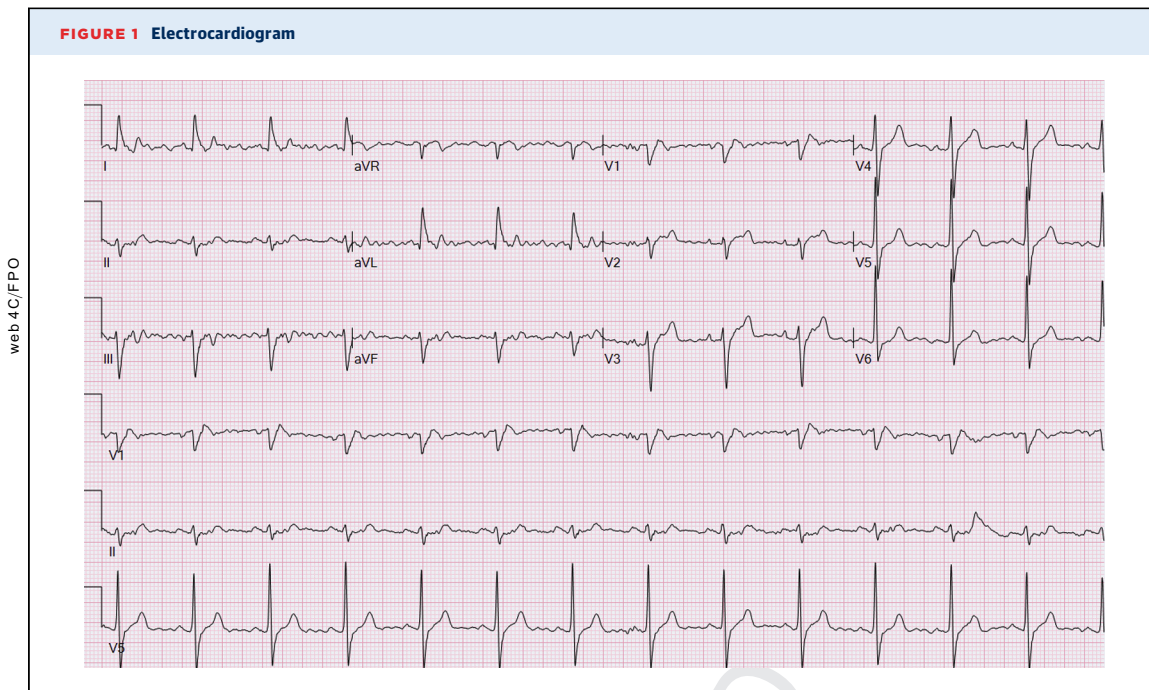
The patient entered the operating room with a surgical mask, whereas all the operators were wearing a FFP3 mask along with facial shield, a sterile surgical gown, leg covers, and 2 pairs of surgical gloves per World Health Organization protocol (3).

The procedure of wearing and removing these devices was proposed by the European Center of Disease Protection and Control (4).

At the end of the procedure, all the used disposable material was treated separately to avoid any possible contamination.

SUBSEQUENT HOSPITAL CARE AND FOLLOW-UP

During the post-operative stay, the patient had no other episodes of chest pain, and his vital parameters remained stable. The patient had another echocardiogram that demonstrated that his ejection fraction increased to 55% and regional wall motion abnormalities resolved (Videos 5 and 6). Given the previous treatment with aspirin 100 mg daily, at the time of the procedure, 2 crushed 90-mg pills (180 mg) of ticagrelor (5,6) were administered to put the patient in dual antiplatelet therapy. Regarding COVID-19, despite the continuous high fever and dry cough, the patient's respiratory parameters remained stable. Medical treatment consisted of antipyretic treatment (1 g of paracetamol e.v.) and antibiotic prophylaxis with vancomycin 2 g/24 h e.v. and piperacillin/tazobactam 4.5 g every 8 h to avoid possible bacterial superinfections. Up to now, the patient has shown an improvement of his clinical conditions with no more need for oxygen supplementation. There has been no fever in the last 5 days despite the persistence of dry cough. The patient has been mobilized but is still isolated due to COVID-19 management protocol.



DISCUSSION

Q8

241
242
243
244 Since its outbreak in Italy in mid-February, the new
245 severe acute respiratory syndrome coronavirus 2 vi-
246 rus has spread rapidly, with over 40,000 cases and

247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270

more than 3,000 deaths to date. Epidemiologic anal-
ysis shows that the presence of comorbidities signifi-
cantly increases mortality: 10.5% in patients with
cardiovascular diseases; 7.3% in patients with di-
abetic; 6.3% in patients with chronic respiratory
diseases; 6% in patients with hypertension; and 5.6%
in oncologic patients (7). Given the high number of
infected patients, we often diagnose cardiovascular
diseases at different stages during the viral pathol-
ogy. In this perspective, some selected patients could
benefit from treatments that deviate from current
guidelines.

295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324

We report the first case of a patient with COVID-19
and acute coronary syndromes treated in Italy for
unprotected LMCA stenosis with protected percuta-
neous coronary intervention. The use of the Impella
CP cardiac assist system to provide left ventricular
support during high-risk percutaneous coronary in-
terventions is recommended in such settings,
because its efficacy is supported by randomized-
controlled trials (8) and large registries (9,10).
Nevertheless, this case also highlights the importance
of personal protection protocols to reduce the risk of
infection during a spreading pandemic. The American
College of Cardiology very recently published a po-
sition paper on catheterization considerations in pa-
tients positive for COVID-19. Our patient was treated

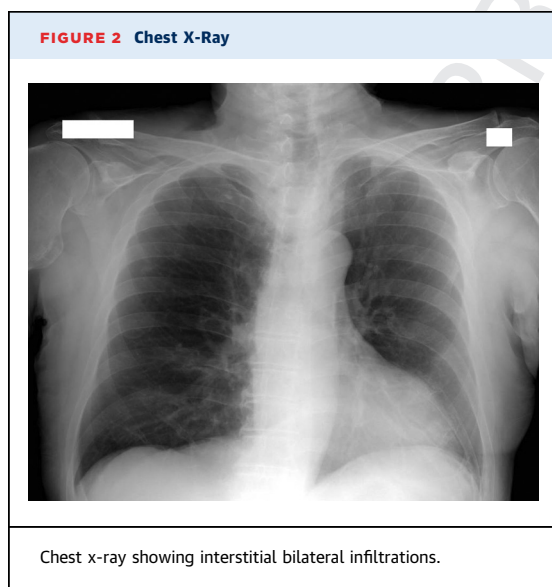
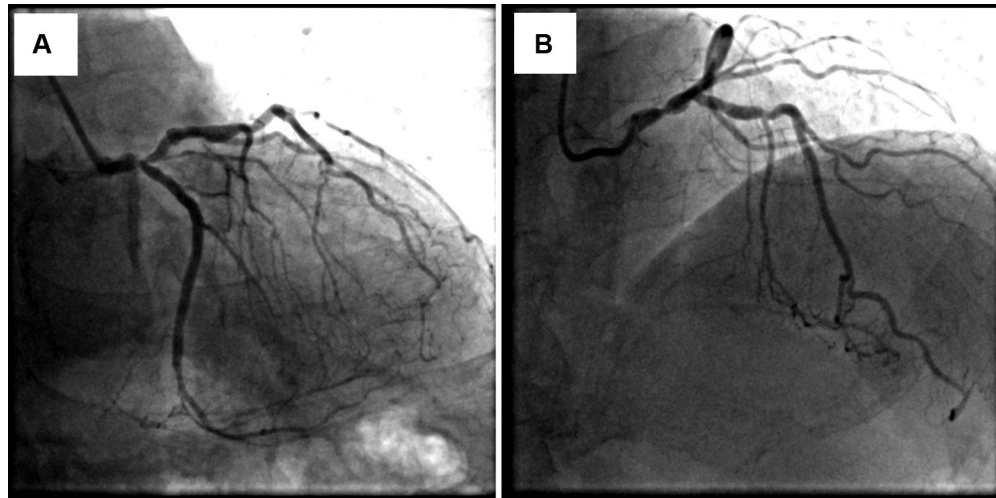


FIGURE 3 Distal LMCA Critical Stenosis

Coronary angiography showing distal left main coronary artery (LMCA) critical stenosis. (A) Right caudal view; (B) cranial view.

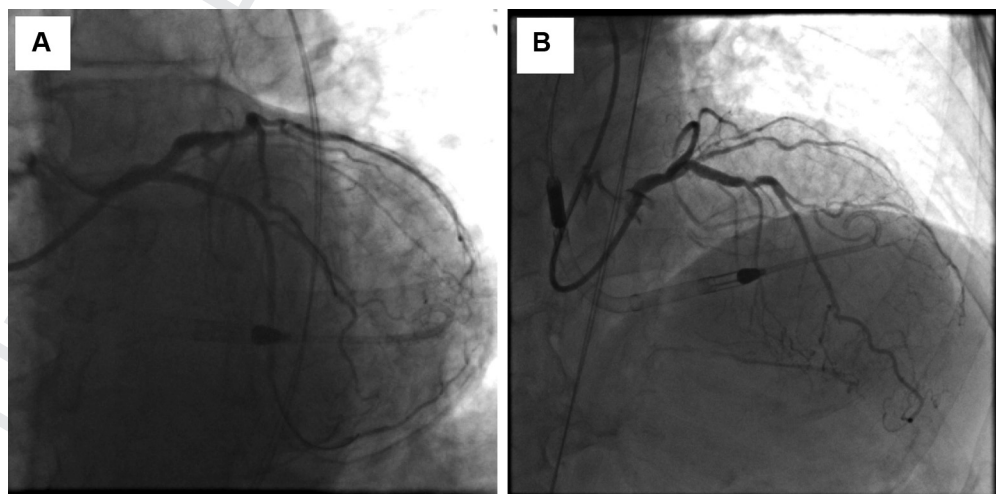
almost a month prior to the release of these guidelines (11).

As of now, the Italian Ministry of Health reports 2,629 cases of COVID-19 among health care workers (8.3% of all active cases). These data confirm that the correct application of safety protocols is of utmost importance while dealing with this exploding emergency. Although we understand that few hospitals in

China may have administered thrombolysis, we did not consider this option as we employ thrombolysis if time to percutaneous intervention exceeds 120 min.

CONCLUSIONS

COVID-19 cases are rapidly growing and cardiovascular diseases significantly increase their mortality.

FIGURE 4 Result of ULMCA PCI With Impella CP Support

Coronary angiography showing the result of upper left main coronary artery (ULMCA) percutaneous coronary intervention (PCI) with Impella CP support. (A) Caudal view; (B) cranial view.

To our knowledge, our case is the first to report a patient with COVID-19 with associated acute coronary syndromes and hemodynamic instability requiring urgent treatment.

The rapid growth of the ongoing severe acute respiratory syndrome coronavirus 2 pandemic dictates the adoption of complex personal

protection protocols to avoid infection in health care operators.

ADDRESS FOR CORRESPONDENCE: Dr. Luca Bettari, Via L. Bissolati 57, Brescia, Brescia 25125, Italy. E-mail: luca.bettari@poliambulanza.it. Twitter: @LBettari.

REFERENCES

1. Neumann FJ, Sousa-Uva M, Ahlsson A, et al. 2018 ESC/EACTS guidelines on myocardial revascularization. *Eur Heart J* 2019;40:87-165.
2. Lassen JF, Burzotta F, Banning AP, et al. Percutaneous coronary intervention for the left main stem and other bifurcation lesions: 12th consensus document from the European Bifurcation Club. *EuroIntervention* 2018;13:1540-53.
3. World Health Organization. Rational Use of Personal Protective Equipment for Coronavirus Disease 2019 (COVID-19): Interim guidance 27 February 2020. Available at: https://apps.who.int/iris/bitstream/handle/10665/331215/WHO-2019-nCov-IPCPE_use2020.1-eng.pdf. Accessed.
4. European Centre for Disease Prevention and Control. Guidance for Wearing and Removing Personal Protective Equipment in Healthcare Settings for the Care of Patients With Suspected or Confirmed COVID-19 February 28, 2020. Available at: <https://www.ecdc.europa.eu/en/publications-data/guidance-wearing-and-removing-personal-protective-equipment-healthcare-settings>. Accessed.
5. Venetsanos D, Sederholm Lawesson S, Swahn E, et al. Chewed ticagrelor tablets provide faster platelet inhibition compared to integral tablets: the inhibition of platelet aggregation after administration of three different ticagrelor formulations (IPAAD-Tica) study, a randomised controlled trial. *Thromb Res* 2017;149:88-94.
6. Lancellotti P, Musumeci L, Jacques N, et al. Antibacterial activity of ticagrelor in conventional antiplatelet dosages against antibiotic-resistant gram-positive bacteria. *JAMA Cardiol* 2019;4:596-9.
7. Livingston E, Bucher K, Rekitto A. Coronavirus disease 2019 and influenza. *JAMA* 2020 Feb 26 [E-pub ahead of print].
8. Russo G, Burzotta F, D'Amario D, et al. Hemodynamics and its predictors during Impella-protected PCI in high risk patients with reduced ejection fraction. *Int J Cardiol* 2019;274:221-5.
9. Maini B, Naidu SS, Mulukutla S, et al. Real-world use of the Impella 2.5 circulatory support system in complex high-risk percutaneous coronary intervention: the USpella Registry. *Catheter Cardiovasc Interv* 2012;80:717-25.
10. Sjauw KD, Konorza T, Erbel R, et al. Supported high-risk percutaneous coronary intervention with the Impella 2.5 device the Europella registry. *J Am Coll Cardiol* 2009;54:2430-4.
11. Welt FGP, Shah PB, Aronow HD, et al. Catheterization laboratory considerations during the coronavirus (COVID-19) pandemic: from ACC's Interventional Council and SCAI. *J Am Coll Cardiol* 2020 Mar 16 [E-pub ahead of print].

KEY WORDS COVID-19, high-risk PCI, personal protection equipment

APPENDIX For supplemental videos, please see the online version of this paper.