myocardium. A single randomized clinical trial and several observational studies have demonstrated Reducer safety and efficacy in patients with obstructive coronary artery disease and refractory angina, who are not candidates for revascularization (1–3). Recurrent angina following successful percutaneous coronary interventions (PCI) is common: a focused analysis of the SYNTAX trial reported a prevalence of recurrent angina of 28.5% at 1 year and 25.9% at 5 years after PCI (4). In particular, patients with refractory angina and evidence of myocardial ischemia despite optimal medical therapy and angiographically successful percutaneous revascularization frequently present to clinicians (5). Coronary microvascular dysfunction seems to be the underlying pathophysiological mechanism.

Because no data are available with regards to Reducer performance in this patient group, we address this issue with this preliminary study.

Between 2015 and 2016 all patients referred to 2 Italian institutions (San Raffaele Hospital, Milan, Italy; ASST Bergamo Est, Bolognini Hospital, Seriate, Italy) undergoing coronary angiography because of chronic stable angina (Canadian Cardiovascular Society [CCS] class 3 to 4) with noninvasive evidence of myocardial ischemia despite optimal medical therapy (OMT) were screened.

Eight patients with evidence of complete revascularization and nonobstructed epicardial coronary arteries (absence of coronary plaques, <50% narrowing in all epicardial coronary arteries, or a negative intracoronary fractional flow reserve test in case of intermediate lesions) underwent compassionate CS Reducer implantation for the treatment of microvascular angina. All patients had previously undergone at least 1 PCI.

Four (50%) patients were women. Median age was 61.5 years (range 50 to 68 years). Seven patients were in CCS class 3, and 1 was in class 4 despite OMT (median number of anti-ischemic drugs used was 3; range 2 to 4). Median left ventricle ejection fraction was 58.0% (interquartile range [IQR]: 55.0% to 61.5%).

No cases of death, need for coronary angiography/PCI, or hospitalization for angina were noted during the follow-up period. Median CCS class improved from 3.0 (3 to 4) to 1.5 (1 to 3) (p = 0.014) (Figure 1A). At 1 year, this benefit was maintained for 3 of the 5 patients assessed. Discontinuation of at least 1 antianginal agent was possible in 3 of 8 (37.5%) patients.

A significant improvement in most of the questionnaire domains of the Seattle Angina Questionnaire was observed. Physical limitation improved from 46.0 (IQR: 40.5 to 53.2) to 64.0 (IQR: 52.0 to 80.0) (p = 0.028), angina stability from 40.0 (IQR: 21.3 to 58.0) to 80.0 (p = 0.028), and overall quality of life from 42.0 (IQR: 39.7 to 49.0) to 72.0 (p = 0.005).

The Coronary Sinus (CS) Reducer (Neovasc Inc., Richmond, British Columbia, Canada) is a percutaneous device implanted in the CS to create a controlled narrowing of the lumen leading to an increase in coronary venous pressure, capillary and arteriolar dilatation, and restoration of the endocardial/epicardial blood flow ratio typically impaired in ischemic Heart disease. The Coronary Sinus (CS) Reducer (Neovasc Inc., Richmond, British Columbia, Canada) is a percutaneous device implanted in the CS to create a controlled narrowing of the lumen leading to an increase in coronary venous pressure, capillary and arteriolar dilatation, and restoration of the endocardial/epicardial blood flow ratio typically impaired in ischemic Heart disease. The Coronary Sinus (CS) Reducer (Neovasc Inc., Richmond, British Columbia, Canada) is a percutaneous device implanted in the CS to create a controlled narrowing of the lumen leading to an increase in coronary venous pressure, capillary and arteriolar dilatation, and restoration of the endocardial/epicardial blood flow ratio typically impaired in ischemic Heart disease.
to 43.0) to 80.0 (IQR: 58.0 to 100.0) (p = 0.028),
angina frequency from 47.0 (IQR: 33.0 to 58.0) to 66.0
(IQR: 56.0 to 80.0) (p = 0.028), treatment satisfaction
from 40.0 (IQR: 26.8 to 73.3) to 75.0 (IQR: 66.0 to
82.0) (p = 0.063), and quality of life from 26.5 (IQR:
17.8 to 39.0) to 56.0 (IQR: 53.0 to 60.0) (p = 0.018).

At the 6-min-walk test, the distance walked
increased from 266 m (IQR: 238.5 to 372.8 m) to 360 m
(IQR: 341 to 420 m) (p = 0.018) and the Borg scale
scores reduced from 4.0 (IQR: 3.0 to 5.0) to 0.0 (IQR:
0.0 to 2.5) (p = 0.042) (Figure 1A).

A subgroup of 3 patients underwent dipyridamole
stress cardiac magnetic resonance with myocardial
perfusion reserve index (MPRI) calculation to objec-
tively measure the effect of Reducer implantation.

MPRI of the ischemic segments significantly
increased after Reducer implantation in all 3 patients.
Mean MPRI of the ischemic segments increased after
Reducer implantation, rising from 1.00 to 2.06 in Pa-
tient #1 (p = 0.023), from 1.08 to 1.38 in Patient #4
(p = 0.004), and from 1.00 to 2.85 in Patient #5
(p = 0.052). Mean left ventricular MPRI showed an
absolute increase at follow-up from 2.25 to 3.08 in
Patient #1 (p = 0.028), from 1.25 to 1.51 in Patient
#4 (p = 0.004), and from 1.33 to 2.20 in Patient #5
(p < 0.001). Figure 1B shows mean MPRI improve-
ment in patients with available dipyridamole cardiac
magnetic resonance before and after Reducer
implantation.

This preliminary experience suggests that CS Reducer
is safe and may have a role in the management of pa-
tients presenting with refractory angina, in spite of
complete epicardial revascularization with PCI and
OMT. Its use was associated with a reduction in CCS
angina class, angina burden, and increasing quality of
life and exercise tolerance. Reducer system is particu-
larly appealing in this setting, because it has the unique
sustained biologic effect of normalizing subendocardial
to subepicardial blood flow ratio, typically compromised
in such patients. In a subgroup of patients, Reducer use
was further found to objectively improve the MPRI.
Larger studies with longer-term follow-up are war-
ted to build on these findings and to further investigate
the role of this promising novel therapy in this challeng-
ing patient subgroup.

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REFERENCES


