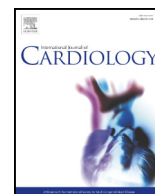




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Short communication

Catheterization laboratory activity before and during COVID-19 spread: A comparative analysis in Piedmont, Italy, by the Italian Society of Interventional Cardiology (GISE)



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ABSTRACT

Background: COReonaVirus Disease 19 (COVID-19) led to the reorganization of Cardiology Units in terms of working spaces and healthcare personnel. In this scenario, both outpatient visits and elective interventional cardiology procedures were suspended and/or postponed. We aimed to report the impact of COVID-19 on interventional coronary and structural procedures in Piedmont, Italy.

Methods: The number of coronary angiographies (CAG), percutaneous coronary interventions (PCI), primary PCI (pPCI), transcatheter aortic valve replacements (TAVR) and Mitraclip performed in Piedmont between March 1st and April 20th, 2020 (CoV-time) were collected from each catheterization laboratory and compared to the number of procedures performed the year before in the same months (NoCoV-time).

Results: Procedural data from 18 catheterization laboratories were collected. Both coronary (5498 versus 2888; difference: −47.5%; mean 305.4 VS 160.4; $p = 0.002$) and structural (84 versus 17; difference: −79.8%; mean 4.7 Vs 0.9; $p < 0.001$) procedures decreased during CoV-time compared to NoCoV-time. In particular, coronary angiographies (1782 versus 3460), PCI (1074 versus 1983), p PCI (271 versus 410), TAVR (11 versus 72) and Mitraclip (6 versus 12) showed a reduction of 48.5%, 45.7%, 33.7%, 84.7% and 50.0%, respectively (all p for comparison < 0.05).

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Conclusions: Compared to the same time-period in 2019, both coronary and structural interventional procedures during COVID-19 epidemic suffered a dramatic decrease in Piedmont, Italy. Organizational change and structured clinical pathways should be created, together with awareness campaigns.

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1. Introduction

CoronaVirus Disease 19 (COVID-19) emergency led to Italian hospital reorganization in terms of logistical and departmental structure, to allow the hospitalization of patients with severe acute respiratory syndrome [1]. In Piedmont, Italy, Cardiology Units have been involved in the reorganization process: most of them have been closed or turned into COVID units. Elective interventional cardiology procedures (coronary, structural and electrophysiological) have been suspended and/or postponed.

Unfortunately, while the general attention of the healthcare world is focused on the pandemic, cardiovascular disease remains the leading cause of mortality [2].

Since the beginning of the emergency there has been a marked reduction in hospital admissions for myocardial infarction, as confirmed by US registries [3]. Furthermore, because of the fear of COVID-19 infection, patients with myocardial infarction arrive to the hospital with considerable delay, with consequent worsening of the clinical status and increased mortality rate [4].

To confirm this trend, we reported the impact of COVID-19 on interventional coronary and structural procedures in Piedmont, the seventh most populated region in Italy (4,450,000 inhabitants), but the second most hit region in the Country.

2. Methods

The Italian Society of Interventional Cardiology (GISE) collected the number of coronary and structural procedures performed in every catheterization laboratory of the Piedmont region between March 1st and April 20th, 2020 (CoV-time) and in the same-year period in 2019 (NoCoV-time).

Coronary procedures were defined as coronary angiographies and percutaneous coronary interventions (PCI). Moreover, the number of primary PCI (pPCI) was recorded. Structural procedure included transcatheter aortic valve replacements (TAVR) and Mitraclip.

Data from each catheterization laboratory were pooled together and compared according to the corresponding time-period. The relative change (%) in the number of procedures was calculated for each type of cardiac intervention as (number of procedures in CoV-time – number of procedures in NoCoV-time) / number of procedures in NoCoV-time * 100. Variables were expressed as mean ± standard deviation and were compared with Student's *t*-test. Statistical significance was set at the 2-tailed 0.05.

3. Results

Data from 18 catheterization laboratories were collected.

Table 1 shows the number of procedures performed in each center as well as the total number of procedures performed in Piedmont from March 1st to April 20th, 2020 (CoV-time) and in the same-year period in 2019 (NoCoV-time). One thousand seven hundred eighty-seven patients underwent an interventional procedure during CoV-time, 32 of them (1.8%) being COVID-19 positive.

A total of 2888 coronary procedures were performed in the CoV-time versus 5498 cases in the NoCoV-time, determining a 47.5% decrease (mean 305.4 versus mean 160.4 procedures; $p = 0.002$). An even higher reduction was noted for structural heart disease (17 versus 84 procedures; 79.8% decrease; mean 4.7 vs mean 0.9 procedures;

$p < 0.001$). In particular, the number of coronary angiographies (1782 versus 3460), PCI (1074 versus 1983), pPCI (271 versus 410), TAVR (11 versus 72) and Mitraclip (6 versus 12) was reduced by 48.5%, 45.7%, 33.7%, 84.7% and 50.0%, respectively (all p for comparison < 0.05) (Fig. 1).

The great majority of catheterization laboratories showed an impressive decrease in coronary procedures during CoV-time with the exception of Maurizio Hospital [+ 1 (0.6%) coronary angiography], Cuneo Hospital [+ 1 (4.2%) pPCI], Rivoli Hospital [+ 19 (13.3%) PCI and + 13 (72.7%) pPCI] and Domodossola [+ 3 (75%) pPCI]. All catheterization laboratories except Maria Pia Hospital [+ 1 (25%) Mitraclip] showed a significant decrease in structural procedures.

4. Discussion

COVID-19 represents a public health emergency of international concern [5]. In order to face its spread, several containing strategies, both in healthcare and non-healthcare settings, have been developed [6–8]. The implementation of economic and medical resources has become a priority [9]. Italy represents one of the most affected countries worldwide, and Piedmont still remains the second most hit region in the Country. Northern Italy Cardiology departments had to deal with a thorough reorganization process, with most of intensive care units (ICU) converted to COVID wards. Scientific Italian Societies provided guidelines on the management of outpatient visits and cardiac invasive procedures, in order to guarantee the proper level of care to patients with cardiovascular disease and, in the meantime, the safety and protection of healthcare providers [10–12].

In the present analysis we reported the catheterization laboratory activity in Piedmont, Italy, during COVID-19 era, and we compared these data with the same period in 2019.

Most of catheterization laboratories suffered a dramatic reduction in the total number of coronary and structural procedures, with a decrease of 47.5% and 79.8%, respectively, compared to 2019 data. However, if elective procedure were judiciously postponed by cardiologists, explaining part of the global reduction, the 33.7% decrease in pPCI was not linked to the medical will. Our results are consistent with those reported in European and non-European countries dealing with COVID-19 epidemic. Dr. Garcia and Colleagues [3] showed an estimated 38% reduction in US cardiac catheterization laboratory activation for STEMI patients, that was similar to the 40% reduction noticed in Spain [13]. Dr. Metzler and Colleagues [14] confirmed this trend, showing a significant decline (39.4%) in the number of patients admitted with acute coronary syndrome in Austria between March 2nd and 29th, 2020. Potential reasons to explain this reduction could be the combination of avoidance of medical care due to social distancing, concerns of contracting COVID-19 in the hospital, or increased use of pharmacological reperfusion [15]. However, in our registry, no STEMI patients admitted to Piedmont hospital were treated with fibrinolytic therapy between March 1st and April 20th, 2020: these data confirmed that the reduction rate of pPCI was mainly due to a decrease in hospital admissions rather than a change in reperfusion therapies.

Although fibrinolytic therapy was adopted as the favorite reperfusion strategy in STEMI patients in a single center in China [16], latest recommendations support pPCI as the preferred therapeutic approach [17].

Table 1
Coronary and structural procedures performed in Piedmont from March 1st to April 20th, 2020 (CoV-time) and in the same-year period in 2019 (NoCoV-time).

| Hospital/procedures | NoCoV-time | CoV-time | NoCoV-time | CoV-time | NoCoV-time | CoV-time | NoCoV-time | CoV-time | NoCoV-time | CoV-time |
|---------------------------------------|------------|----------|------------|----------|------------|----------|------------|----------|------------|----------|
| | CAG | CAG | PCI | PCI | pPCI | pPCI | TAVR | TAVR | MTR | MTR |
| Alba | 98 | 55 | 55 | 32 | 6 | 5 | 0 | 0 | 0 | 0 |
| Alessandria ^d | 279 | 130 | 171 | 97 | 45 | 17 | 4 | 0 | 0 | 0 |
| Asti | 110 | 58 | 92 | 30 | 21 | 14 | 0 | 0 | 0 | 0 |
| Biella | 111 | 65 | 67 | 39 | 16 | 10 | 0 | 0 | 0 | 0 |
| Ciriè/Ivrea | 245 | 158 | 137 | 71 | 46 | 19 | 0 | 0 | 0 | 0 |
| Cuneo ^d | 241 | 90 | 112 | 55 | 24 | 25 | 10 | 0 | 2 | 0 |
| Domodossola | 130 | 47 | 73 | 40 | 4 | 7 | 0 | 0 | 0 | 0 |
| Giovanni Bosco TRN | 188 | 95 | 138 | 77 | 27 | 19 | 0 | 0 | 0 | 0 |
| Maria Pia Hospital TRN ^{b,d} | 231 | 75 | 84 | 34 | 0 | 0 | 19 | 6 | 4 | 5 |
| Maria Vittoria TRN | 226 | 99 | 149 | 71 | 28 | 11 | 0 | 0 | 0 | 0 |
| Mauriziano TRN ^d | 170 | 171 | 105 | 73 | 24 | 18 | 14 | 2 | 2 | 0 |
| Molinette TRN ^d | 308 | 114 | 155 | 71 | 34 | 18 | 15 | 3 | 4 | 1 |
| Moncalieri | 123 | 78 | 89 | 61 | 23 | 18 | 0 | 0 | 0 | 0 |
| Novara ^d | 295 | 160 | 161 | 77 | 31 | 30 | 10 | 0 | 0 | 0 |
| Orbassano ^{a,c} | 150 | 23 | 82 | 9 | 10 | 0 | 0 | 0 | 0 | 0 |
| Rivoli ^c | 257 | 219 | 143 | 162 | 22 | 38 | 0 | 0 | 0 | 0 |
| Savigliano | 121 | 76 | 101 | 58 | 20 | 12 | 0 | 0 | 0 | 0 |
| Vercelli | 177 | 69 | 124 | 49 | 35 | 15 | 0 | 0 | 0 | 0 |
| TOTAL | 3460 | 1782 | 2038 | 1106 | 416 | 276 | 72 | 11 | 11 | 6 |
| Mean | 192.2 | 99.0 | 113.2 | 61.4 | 23.1 | 15.3 | 4.0 | 0.6 | 0.7 | 0.3 |
| SD | 69.4 | 50.7 | 35.1 | 33.2 | 12.8 | 9.6 | 1.6 | 1.4 | 1.4 | 1.2 |
| P-Value | 0.004 | | 0.002 | | 0.015 | | <0.001 | | 0.001 | |

Legend: TRN: Turin. CAG: coronary angiography. PCI: percutaneous coronary intervention. pPCI: primary PCI; TAVR: transcatheter aortic valve replacement; MTR: Mitraclip; SD: standard deviation.

- ^a Stop of activities on March 20th 2020.
- ^b Stop of activities on March 28th 2020.
- ^c Orbassano and Rivoli Hospital share the same Interventional Cardiology Unit.
- ^d Cardiac surgery on site.

In order to deal with the worrisome reduction in interventional procedures, the creation of protected pathways to guarantee a safe hospital admission is of utmost importance. In this regard, the Italian Society of Interventional Cardiology (GISE) released a document with the purpose of managing patients with known cardiac disease and concomitant COVID-19 and patients without infection requiring ambulatory cardiological evaluations and/or interventional procedures [18]. Concurrently, campaigns to raise awareness on the risk of fatality related to cardiac disease should be promoted among the general population.

5. Limitations

Our registry does not provide data on mortality related to the decrease in hospital admission for cardiac disease. However, the literature reports an increase in hospital mortality for cardiac reasons during the COVID-19 epidemic, likely reflecting the delay in reaching medical attention due to the fear of infection [19]. Moreover, one should theoretically account for the out-of-hospital sudden cardiac death rate, whose incidence is still

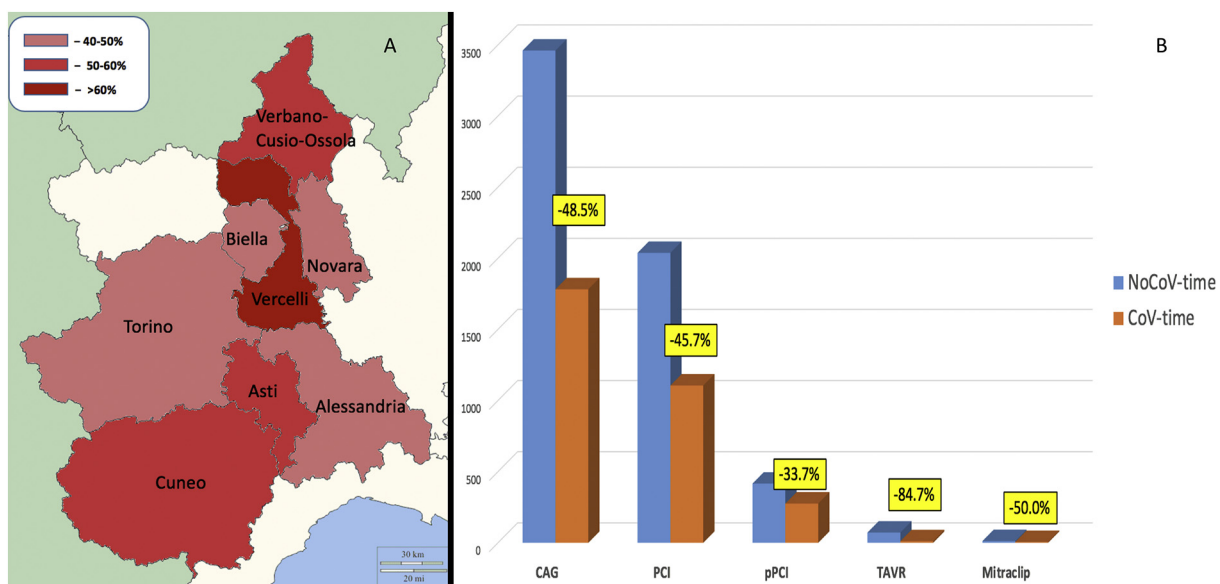


Fig. 1. Reduction of coronary procedures (CAG + PCI) in the 8 Provinces of Piedmont region (Panel A) and of each interventional procedure in the whole region (Panel B) during CoV-time compared to NoCoV-time. CAG: coronary angiography, PCI: percutaneous coronary artery intervention, pPCI: primary percutaneous coronary artery intervention, TAVR: transcatheter aortic valve replacements.

unknown. The actual number of STEMI patients hospitalized during CoV-time could be higher than the one reported in our analysis since we didn't consider very late presenters medically treated only.

6. Conclusion

Compared to the same time-period in 2019, both coronary and structural interventional procedures during COVID-19 epidemic suffered a dramatic decrease in Piedmont, Italy, likely reflecting medical decision and patients' fear of infection. Organizational change and structured clinical pathways should be created, together with awareness campaigns.

Contributors

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Declaration of Competing interest

None.

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