Effects of lockdown on acute coronary syndrome incidence in an area without community transmission of COVID-19

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INTRODUCTION

During the COVID-19 pandemic, widespread use of social isolation has been instituted to reduce disease spread. A decrease in acute coronary syndrome (ACS) related hospital admissions was noted among populations with high rates of COVID-19. However, these results were significantly impacted by confounding due to high rates of COVID-19 transmission. During the mandatory lockdown period in the Hunter New England (HNE) region of Australia, with a total population of approximately 950,000, there was very low community transmission of COVID-19. This has allowed the establishment of a natural control group to examine the true effects of social isolation on ACS incidence rates, independent of the impact of widespread COVID-19 disease and transmission.

METHODS

We examined the rates of the following types of admissions: total cardiology, non-ST segment elevation myocardial infarction (NSTEMI), primary percutaneous coronary intervention (PCI) for ST segment elevation myocardial infarction (STEMI) and out-of-hospital cardiac arrest (OOHCA) emergency department presentations to the John Hunter Hospital, the only tertiary hospital of the HNE region.
On 23 March 2020, chosen as the starting date, the Australian Federal Government officially enforced social isolation, announcing the closure of public food, entertainment and religious venues. On 31 May, the chosen end date, the Australian Government relaxed restrictions, permitting local travel and reopening select public venues. The same dates were examined in 2018 and 2019. A 10-week pre-COVID-19 period was assessed between 6 January and 15 March 2020. Cardiology admissions, OOHCA and primary PCI records were sourced via the local patient administration system. NSTEMI presentations were collected from an ACS database that incorporated presentations across the entire district, including small community hospitals. This highly sensitive database identified all presentations with chest pain or elevated high-sensitivity troponin above the 99th centile. Patients in this dataset were excluded if they did not meet the Fourth Universal definition of type 1 myocardial infarction (MI). Population data were sourced from the Australian Bureau of Statistics. The population of the HNE district in 2018 was 927,607. Populations for 2019 and 2020 were extrapolated from 2018 with an average yearly increase of 1.26% in New South Wales over the past 10 years.

Normally distributed data were expressed as a mean with SD. Non-normally distributed data were expressed as a median with an IQR. Incidence rate ratios (IRRs) were calculated for each admission type comparing the COVID-19 isolation period to the prior time periods. The non-parametric continuous variable of symptom to balloon time was analysed with the Mann-Whitney U test.

RESULTS

The total number of new cases of COVID-19 in HNE during the isolation period was 96, the majority of which were returned travellers. In a projected population of 951,299, this reflects an incidence of 0.14 per 100,000 per day. Of these, nine patients were hospitalised, one required intensive care and two died. This is over 30 times lower than the incidence experienced in Italy (4.3 per 100,000 per day) during the period studied by De Filippo et al.\textsuperscript{4,5}

Sixty-five percent of presentations were male (Table 1). There was a significant decline in total cardiology and NSTEMI admissions during the COVID-19 isolation period (see Table 2). The number of ACS admissions per day was 4.4 in 2019 compared with 2.4 during COVID-19 isolation, which is a 45% reduction. The IRR of NSTEMI admissions during isolation compared with 2019 was 0.59 (95% CI 0.47 to 0.73), p-value <0.0001. Primary catheterisation laboratory activation rates for STEMI were significantly lower during the COVID-19 isolation period, without any change in clinical practice guidelines (specifically, thrombolysis was not recommended to replace primary PCI in those with suspected COVID-19). The IRR of STEMI presentations for the isolation period compared with 2019 was 0.24 (95% CI 0.14 to 0.40), p-value <0.0001. This was not accompanied by a change in OOHCA presentations to the major tertiary centre of the region. There was no difference in symptom to balloon time for those with STEMI comparing prior time periods to COVID-19 isolation (see Table 3).

DISCUSSION

In our unique population with exceptionally low incidence of COVID-19 infection, we observed lower rates of cardiology admissions, NSTEMI presentations and catheterisation laboratory activation for STEMI during the COVID-19 isolation period. This was not associated with changes in OOHCA presentations to the emergency department or symptom to balloon time for STEMI. In comparison, De Filippo et al\textsuperscript{4} found a similar 30% decline in hospital admissions from January to April 2020, which was associated with reduced frequency of cardiac presentations. However, our study included all ACS presentations during the COVID-19 isolation period, whereas De Filippo et al\textsuperscript{4} only studied STEMI presentations. The IRR of STEMI admissions for the isolation period compared with 2019 was 0.24 (95% CI 0.14 to 0.40), p-value <0.0001. This was not accompanied by a change in OOHCA presentations to the major tertiary centre of the region. There was no difference in symptom to balloon time for those with STEMI comparing prior time periods to COVID-19 isolation (see Table 3).

| Characteristic | 2018 | 2019 | P-COV 2020 | COVID-19 2020 |
|---------------|------|------|------------|---------------|
| Total MI numbers | 290  | 308  | 266        | 164           |
| Age (SD)      | 69.8 (±12.9) | 69.4 (±13.6) | 68.8 (±13.3) | 68.0 (±12.9) |
| Males, % (no.) | 65.9 (191)  | 65.6 (202)  | 60.9 (162)  | 69.5 (141)   |
| Death at 28 days, % (no.) | 4.5 (13)    | 7.1 (22)    | 6.0 (16)   | 3.0 (5)      |
| NSTEMI, % (no.) | 65.5 (190)  | 70.5 (217)  | 75.2 (200) | 78.7 (129)   |
| STEMI, % (no.) | 34.5 (100)  | 29.5 (91)   | 24.8 (66)  | 21.3 (35)    |
| P-PCI STEMI, % (no.) | 25.9 (75)   | 23.0 (71)   | 18.0 (48)  | 10.4 (17)    |
| Thrombolysed STEMI, % (no.) | 8.6 (25)    | 6.5 (20)    | 6.8 (18)   | 11.0 (18)    |
| Angiogram, % (no.) | 78.6 (228)  | 78.8 (242)  | 73.3 (195) | 74.4 (122)   |
| Revascularisation, % (no.) | 57.9 (132)  | 59.5 (144)  | 62.6 (122) | 77.9 (95)    |
| PCI, % (no.)   | 46.1 (105)  | 54.1 (131)  | 54.9 (107) | 68.0 (83)    |
| CABG, % (no.)  | 11.8 (27)   | 5.4 (13)    | 7.8 (15)   | 9.8 (12)     |

CABG, coronary artery bypass graft surgery; MI, myocardial infarction; NSTEMI, non-ST segment elevation myocardial infarction; OOHCA, out-of-hospital cardiac arrest; PCI, percutaneous coronary intervention; P-COV, pre-COVID-19 isolation; P-PCI, primary percutaneous coronary intervention; STEMI, ST-segment elevation myocardial infarction.
Coronary artery disease

There are several potential reasons for this observation in our population. There is a significant association between respiratory tract infections and rates of MI.6 Social isolation has resulted in a reduced incidence of respiratory infective illness in the community.7 This decreased inflammatory milieu may reduce risk of plaque destabilisation and MI.8 Second, while habitual exercise decreases cardiovascular risk, acute vigorous exercise can increase risk of ACS.9 Activity modification with reduced exercise during social isolation may have contributed to lower short-term rates of MI. Third, behavioural changes in the population due to fear of contracting COVID-19 from healthcare facilities may have led to decreased hospital presentations. However, the most dramatic difference was on catheter laboratory activation for STEMI. This would be predicted to be the least affected, due to the typically more severe nature of symptoms, if patient reluctance were contributing to reductions in presentations.

Although there appeared to be a decrease in ACS incidence during the lockdown, behavioural changes observed in other studies may not be beneficial for long-term cardiovascular health. A study from Denmark found 28% of surveyed participants reported eating more during the isolation period.10 Sedentary behaviour also increased during social isolation in the UK.11 Others argue that lockdown from the COVID-19 pandemic may increase population risk of cardiovascular events long term.12 The degree to which isolation measures may have contributed to cardiac morbidity is unable to be answered based on this review.

Table 2 Comparison of cardiology admissions, NSTEMI admissions, primary catheterisation laboratory activation for STEMI and OOHCA presentations between COVID-19 isolation and three prior time periods

| Years     | Admissions | Per 100 000 | IRR COV versus prior periods | P value |
|-----------|------------|-------------|------------------------------|---------|
| 2018      | 453        | 47.97       | 0.87 (0.76 to 0.99)          | 0.035   |
| 2019      | 463        | 48.23       | 0.86 (0.75 to 0.98)          | 0.024   |
| P-COV 2020| 473        | 49.41       | 0.85 (0.74 to 0.97)          | 0.016   |
| COV 2020  | 402        | 41.32       |                              |         |
| NSTEMI    | 2018       | 190         | 20.48                        |         |
|           | 2019       | 217         | 23.10                        |         |
|           | P-COV 2020 | 200         | 21.03                        |         |
|           | COV 2020   | 129         | 13.56                        |         |
| STEMI P-PCI| 2018      | 75          | 8.09                         | <0.0001 |
|           | 2019      | 71          | 7.56                         | <0.0001 |
|           | P-COV 2020 | 48          | 5.05                         | 0.0002  |
|           | COV 2020  | 17          | 1.79                         |         |
| OOHCA     | 2018       | 12          | 1.29                         | 0.51    |
|           | 2019       | 15          | 1.60                         | 0.97    |
|           | P-COV 2020 | 16          | 1.68                         | 0.86    |
|           | COV 2020  | 15          | 1.58                         |         |

COV, COVID-19; IRR, incidence rate ratio; NSTEMI, non-ST segment elevation myocardial infarction; OOHCA, out-of-hospital cardiac arrest; P-COV, pre-COVID-19 isolation; P-PCI, primary percutaneous coronary intervention; STEMI, ST-segment elevation myocardial infarction.

Table 3 Comparison of symptom to balloon times for STEMI presentations using the Mann-Whitney U test between COVID-19 isolation and three prior time periods

| Years     | Symptom to balloon time | COV versus prior periods (p value) |
|-----------|-------------------------|-----------------------------------|
| 2018      | 366 (±334)*              | 0.97                              |
| 2019      | 345 (±493)*              | 0.83                              |
| P-Cov 2020| 332 (±239)*              | 0.83                              |
| COVID-19 2020 | 324 (±274)*             | 0.83                              |

*SD.
COV, COVID-19; P-Cov, pre-COVID-19 isolation.
influence of social and behavioural factors on coronary event rates.

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