ORIGINAL ARTICLE

Presenting symptoms of COVID-19 and clinical outcomes in hospitalised older adults

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Abstract

Background: In July 2020, a COVID-19 outbreak was recognised in the geriatric wards at a subacute campus of the Royal Melbourne Hospital affecting patients and staff. Patients were also admitted to this site after diagnosis in residential care.

Aims: To describe the early symptoms and the outcomes of COVID-19 in older adults.

Methods: Patients diagnosed with COVID-19 at the facility in July or August 2020 were identified and their medical records were examined to identify symptoms present before and after their diagnosis and to determine their outcomes.

Results: Overall, 106 patients were identified as having COVID-19, with median age of 84.3 years (range 41–104 years); 64 were diagnosed as hospital inpatients after a median length of stay of 49 days, 31 were transferred from residential aged care facilities with a known diagnosis and 11 were diagnosed after discharge. There were 95 patients included in an analysis of symptom type and timing onset. Overall, 61 (64.2%) were asymptomatic at the time of diagnosis of COVID-19, having been diagnosed through screening initiated on site. Of these, 88.6% developed symptoms of COVID-19 within 14 days. The most common initial symptom type was respiratory, but there was wide variation in presentation, including fever, gastrointestinal and neurological symptoms, many initially not recognised as being due to COVID-19. Of 104 patients, 32 died within 30 days of diagnosis.

Conclusions: COVID-19 diagnosis is challenging due to the variance in symptoms. In the context of an outbreak, asymptomatic screening can identify affected patients early in the disease course.

Introduction

In the global pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), it is estimated that approximately 40–45% of people with a positive swab remain asymptomatic,[1] although the variable methodology between studies means that estimates vary widely, particularly as many studies only measure symptoms at the time of positive swab when people may be pre-symptomatic rather than asymptomatic.[2–4] The proportion who

remain asymptomatic may also vary with age, with older adults more likely to develop symptoms.[5] In an outbreak on the cruise ship the Diamond Princess, which included many elderly people, 17.4% of people of all ages with a positive viral swab remained asymptomatic.[6] In one outbreak report from a skilled nursing facility in Washington state, USA, all residents were tested for SARS-CoV-2. Of the 57 residents who were positive, 56% were asymptomatic at the time of testing, but only 6.2% of those who tested positive remained asymptomatic.[7]

An additional challenge to identifying cases of COVID-19 is the high variation in presenting symptoms. While

COVID-19 was initially identified to cause fever and respiratory symptoms, it is now apparent that it can cause symptoms affecting multiple systems, including, lethargy, diarrhoea, anosmia, nausea, myalgias and loss of appetite.[8,9] In older adults, geriatric syndromes have been identified including functional decline, delirium, exacerbation of underlying chronic condition and falls.[10] The clinical course of COVID-19 is highly variable, but symptom onset typically occurs around Days 3–5 after contracting the virus and further clinical deterioration has been described in a subgroup of patients at around Days 7–10.[11] While it has been described that fever is present in 76.5–83.6% of older adults with COVID-19,[12–14] most of these studies have used populations hospitalised for the infection and are likely to present a more severe spectrum of disease.[14]

As well as being at increased risk for symptomatic infections, it is apparent that older adults are at higher risk for mortality; the overall COVID-19 mortality is reported to be 1.38%, rising sharply with age to 13.4% for those aged over 80 years,[15] with mortality rising to over 30% for those who are living with frailty.[16] In one meta-analysis, it was reported that approximately half of all people over 60 years of age with COVID-19 will experience a severe disease course, although the majority of included studies were based on cohorts admitted to hospital for COVID-19 and thus likely do not represent the breadth of community cases.[17]

Description of outbreak

In institutional settings where people are dependent on others for care, such as hospitals and residential care, it is particularly important to recognise potential cases of COVID-19 early to minimise nosocomial transmission. An outbreak of COVID-19 in an inpatient facility provided an opportunity to examine the clinical presentation in elderly people in more detail. Royal Park is a campus (RPC) of the Royal Melbourne Hospital that provides four aged care (AC) wards with 95 beds in total, one Transitional Care Programme (TCP) ward with 32 beds and a rehabilitation ward with 25 beds. The geriatric wards provide subacute care to people after an acute illness. Patients admitted to TCP are generally medically stable with complex discharge planning issues. Of the four geriatric wards, three are located on different floors of the same building, while the fourth geriatric ward and TCP are in separate buildings (Supporting Information Fig. S1). From 12 July 2020, residents already diagnosed with COVID-19 from several residential care facilities with COVID-19 outbreaks were admitted to RPC in an effort to help manage workforce shortages and infection control difficulties at the AC facilities. On 15 July, the first cases of COVID-19 were identified after positive

swabs on an AC ward (Fig. 1). These patients were swabbed due to symptoms suggestive of COVID-19. Over July and August, increasing numbers of cases of COVID-19 were identified in both staff and patients on all geriatric wards and TCP. No cases were identified on the rehabilitation ward.

Rooms in the relevant RPC wards are typically four or five bed spaces with shared bathrooms, although there were some single rooms. Nursing and medical staff were dedicated to the 'positive wards' – where patients are known to have COVID-19 were being cared for, or the 'quarantine wards' where patients defined as contacts were located. If patients in the quarantine ward were diagnosed with COVID-19 they were transferred to a 'positive ward'. Staff wore gowns, gloves, face shields and surgical masks for all patient contact from 15 to 20 July, and changed from surgical masks to N95/P2 respirators after 21 July. There were no shortages of personal protective equipment (PPE) and all staff were trained in use. A number of measures was implemented concurrently to help contain infection, which included increased cleaning, on site PPE champions in each ward, increased staffing where possible, outdoor break spaces, physical distancing requirements for all staff, visitor restrictions, masks on patients if possible, according to the hierarchy of infection control described elsewhere.[10]

Eventually, given the high rates of transmission, four wards were closed at the Royal Park on 2 August and patients from the affected wards were transferred to other hospitals or to the two wards at RPC with better facilities for infection control.

As many patients were diagnosed prior to the onset of symptoms and the patients had daily medical review by medical staff and regular nursing assessments, this provided an opportunity to describe the symptom onset, clinical outcome of COVID-19 in older adults.

Methods

Timeline of analysis period

The analysis period covered the period from 12 July when the first cohort of residents from AC homes was transferred until to 16 August 2020, which is 2 weeks after the ward closures (Fig. 1). Patients were included if they were identified as having COVID-19 either prior to, during or within 14 days after their admission to the Royal Park campus.

Subjects and settings

From 15 July, all patients underwent twice weekly asymptomatic screening for SARS-CoV-2 using combined nasal
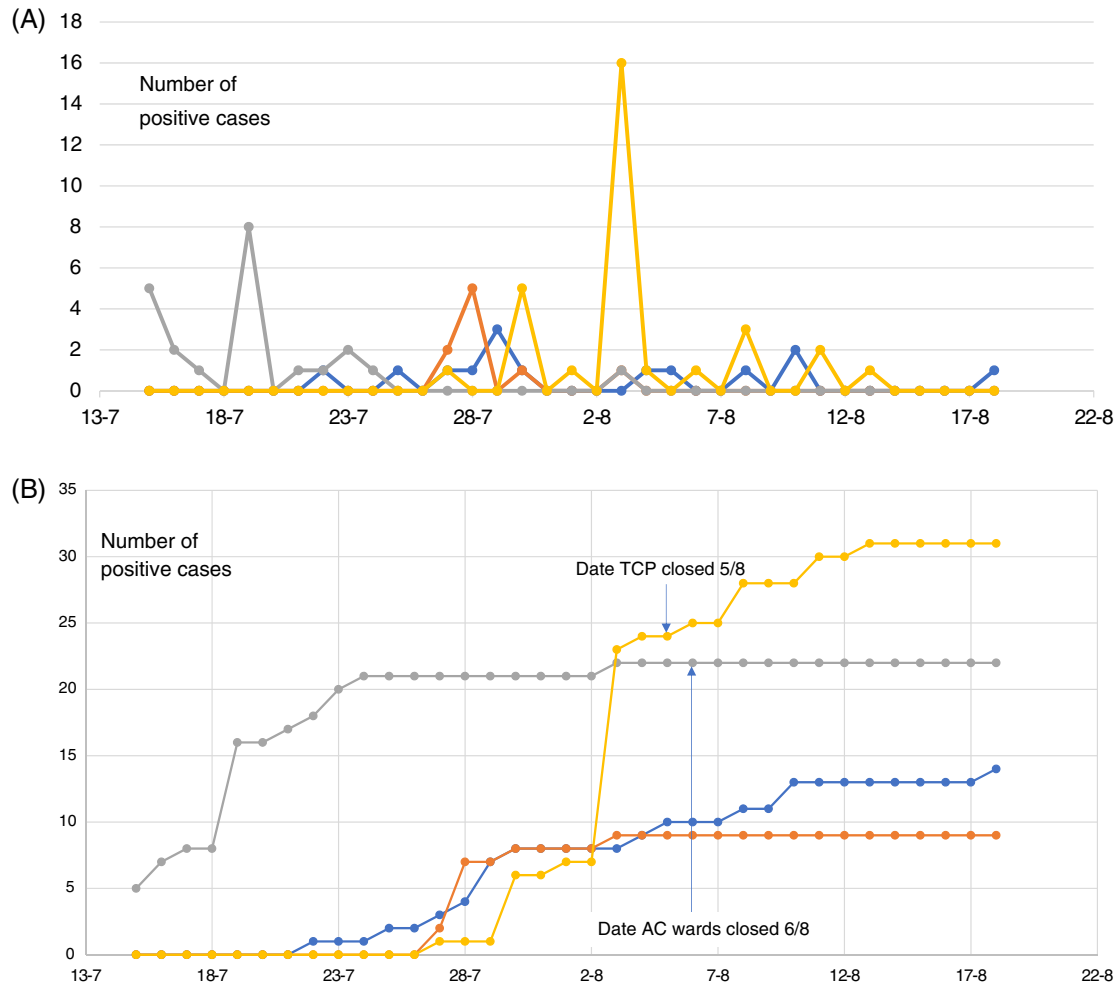
Figure 1 (A) Timeline of positive cases by ward where suspected exposure occurred. (B) Cumulative total positive cases by ward where suspected exposure occurred. (——●——), AC1; (——●——), AC2; (——●——), AC3; (——●——), TCP. AC, aged care; TCP, Transitional Care Programme.

and throat swabs. Additional tests could be requested if clinically indicated due to symptoms. The medical record was examined by trained researchers to determine whether the patient was symptomatic or asymptomatic at the time of the test for SARS-CoV-2 that provided a positive result (using any notes made by medical or nursing staff). Data on demographics (age, gender, baseline mobility and usual place of residence) and medical comorbidities (dementia, diabetes, cardiovascular disease, stroke, hypertension, past delirium, cancer, chronic kidney disease, chronic liver disease and chronic lung disease) were also extracted from medical records. Frailty was measured by clinical staff using the Rockwood Clinical Frailty Scale (CFS) at admission to AC wards.[18] For inpatients at RPC, the medical record was interrogated by clinician-researchers for a pre-specified list of symptoms (cough, dyspnoea, fatigue, decreased oral intake, vomiting and nausea, diarrhoea, sore throat, myalgias, anosmia, headache) and signs

(fever 37.5–38 or >38°C, tachypnoea defined as respiratory rate >24 breaths/min, tachycardia defined as heart rate >100 b.p.m.), and hypoxia, defined as oxygen saturations on room air of <92% using the observation charts. Delirium was identified from medical notes as all patients had daily review by a geriatrician. The date of first onset was recorded for each symptom. The record was examined for 48 h prior to the patient's COVID-19 diagnosis and 14 days after. Mortality and location at 30 days after diagnosis were obtained from hospital records. Patients who were diagnosed after leaving RPC were excluded from the analysis of symptoms but included in 30-day outcomes.

Analysis

Descriptive statistics were used to describe baseline characteristics. Logistic regression was used to identify factors associated with mortality examining baseline factors

such as gender, age, mobility preadmission, comorbidities, frailty score (calculated by Rockwood CFS) and signs and symptoms. Factors with $P < 0.05$ in the univariate analysis were later entered into a multivariate model. A separate assessment was made for the patients for whom the Rockwood frailty score was available. Stata version 14.1 (StataCorp, College Station, TX, USA) was used for data analysis and Microsoft Excel Version 16.47 was used to create graphs.

Ethics

The study was approved by the Melbourne Health Human Research Ethics Committee, Melbourne, Victoria, Australia (No. HREC/17/MH/103).[19] A consent waiver was granted to allow the use of routine clinical data in research.

Results

In the time period assessed, 106 patients were identified with COVID-19, with a median age of 84.3 years (range 41–104 years, interquartile range 79.9,91, 63/106 (59.4%) female). There was a high prevalence of comorbidity, the most common being dementia at 65/106 (61.3%) (Table 1). Frailty was measured on 63 patients and, overall, 60 were frail with a score of five or above, with a median of six (range 3–9). Overall, 31 (29.2%) patients were diagnosed with COVID-19 prior to transfer from the residential AC home to RPC, 64 (60.4%) were diagnosed with COVID-19 during their admission at RPC, with a median length of stay of 49 days prior to diagnosis, and 11 (10.4%) were diagnosed within 14 days of discharge. Of the 75 who were diagnosed during or shortly after inpatient stay at RPC, 66 (88.0%) had a previous negative test (median 4 days, range 1–33 prior to their positive test).

Of the patients with a positive polymerase chain reaction (PCR) test for SARS-CoV-2, 36 (37.1%) patients were initially tested due to recognition of symptoms and 61 (62.9%) were tested as part of asymptomatic screening. Excluding the 11 patients who were diagnosed after discharge from the hospital, 86 of the 95 (88.6%) patients with a positive PCR test for SARS-CoV-2 developed symptoms of COVID-19. Nine patients who were tested as part of asymptomatic screening, actually had symptoms documented in the medical record on the day of the test or within the 2 days preceding. The most common first symptoms were respiratory, in 44 of the 95 (46.3%) patients. Cough was the earliest symptom, present at a median of 1 day after positive PCR (Table 2), although some had cough 2 days prior to a positive swab. The most common sign overall was hypoxia,

Table 1 Baseline characteristics of patients

Total number	106	
Average age (years)	84.3 (min 41, max 104)	
Female, *n* (%)	63 (59.4)	
Location when COVID-19 identified, *n* (%)		Median of days and range between admission and diagnosis
Hospital inpatient	61 (32.1)	49 (4304)
RACF	31 (29.2)	−2 (−8, 1)
		Range of days between discharge and diagnosis
Within 14 days of separation from aged care ward, *n* (%)	5 (4.7)	3–13 days
Within 14 days of separation from TCP, *n* (%)	6 (5.7)	
Usual residence, *n* (%)		
Home alone	38 (35.9)	
Home with others	35 (33.0)	
RACF/supported accommodation	33 (31.1)	
Premorbid mobility, *n* (%)		
Independent	19 (17.9)	
Independent with gait aid	50 (47.2)	
Supervision	6 (5.7)	
Hand-on assistance	18 (17.0)	
Non-ambulant	13 (12.3)	
Medical comorbidities, *n* (%)		
Dementia	65 (61.3)	
Past history of delirium	44 (42.0)	
Diabetes	39 (36.8)	
Cardiovascular disease	43 (40.6)	
Hypertension	66 (62.3)	
Stroke	37 (35.0)	
Cancer	21 (19.8)	
Chronic kidney disease	23 (21.7)	
Chronic liver disease	7 (6.6)	
Chronic lung disease	20 (18.9)	

RACF, residential aged care facility; TCP, Transition Care Programme.

which was present in 59 (62.1%) patients; less than half developed a fever above 38°C (Table 2).

Of the 104 in the cohort with outcome data at 30 days, 32 (30.8%) died, although three of the deaths were from causes other than COVID-19. Nine (8.7%) had returned

Table 2 Presence of symptoms and signs of COVID-19 and days between positive polymerase chain reaction and onset of symptoms

	Number (%)	Median (days after positive swab)
Total patients with data on symptoms available for analysis	95	
Total with symptoms	87 (88.9)	3 (−2, 10)†
Fever		
Fever >37.5°C and <38°C only	13 (13.6)	3 (0, 11)
Fever above 38°C	39 (41.1)	4 (0, 13)
Respiratory		
Dyspnoea	23 (24.2)	2.5 (−2, 12)
Cough	54 (56.8)	1 (−2, 10)
Tachypnoea	44 (46.3)	6 (−2, 14)
Hypoxia‡	59 (62.1)	5 (−2, 14)
Anosmia	0	
Rhinorrhoea	10 (10.5)	2 (−1, 7)
Sore throat	9 (9.5)	2 (−2, 7)
Cardiac		
Tachycardia	49 (51.6)	2 (−2, 13)
Gastrointestinal		
Nausea/vomiting	7 (7.4)	4.5 (1, 8)
Diarrhoea	17 (17.9)	4 (−2, 14)
Loss of appetite	24 (25.3)	5 (−2, 12)
Decreased oral intake	49 (51.6)	4 (−2, 14)
Neurological		
Lethargy	49 (51.6)	4 (−2, 14)
Myalgias	7 (7.4)	2 (−1, 11)
Headache	7 (8.4)	6 (−1, 10)
Hyperactive delirium	18 (18.9)	3 (−1, 14)
Hypoactive delirium	35 (36.8)	4 (−1, 14)

†Of the 61 people who had a swab with the reason listed as asymptomatic screening.
‡Saturations less than 92% on room air.

Table 3 Outcome at 30 days after positive swab

Outcome at 30 days (n = 104)	Number (%)
Death	32 (31.7)
Return home	9 (8.7)
Ongoing inpatient rehabilitation	35 (33.7)
Discharge to residential care	27 (26.0)

Table 4 Results of multivariate analysis of baseline characteristics for mortality

Factor	OR mortality (95% CI); P-value
Model 1: variables included if P < 0.05, n = 103	
Female gender	0.31 (0.12–0.81); 0.017
Prior delirium	2.41 (0.93–6.22); 0.07
Age	1.05 (1.00–1.11); 0.058
Diagnosed as inpatient	2.31 (0.74–7.25); 0.124
Model 3: variables included if P < 0.05 and Rockwood CFS, n = 62	
Female gender	0.17 (0.04–0.67); 0.011
Prior delirium	2.48 (0.70–8.76); 0.160
Age	1.08 (1.00–1.16); 0.035
Diagnosed as inpatient	2.60 (0.44–15.40); 0.291
Rockwood CFS	2.61 (1.25–5.45); 0.01

CFS, Clinical Frailty Scale; CI, confidence interval; OR, odds ratio.

mortality (OR 0.31 (0.12–0.81); $P = 0.017$). For the 62 patients where a measure of frailty was available, frailty was associated with increased mortality (OR 2.61 (1.25–5.45); $P = 0.01$) and women had a lower risk of mortality at 30 days than men (OR 0.17 (0.04–0.67); $P = 0.011$) (Table 4).

Discussion

In this cohort of adults with an average age of 84.3, 86 of 95 (88.6%) developed symptoms of COVID-19. This low rate of asymptomatic infection contrasts with previous reports that around 40–45% of people with a positive swab for SARS-CoV-2 have asymptomatic infections.[1] The proportion of people who developed symptoms is similar to a cohort in an assisted living facility in Washington state, USA, where 89% developed symptoms during the observation period.[7] It is likely that the rate of symptomatic infections is higher in older adults than the general population. It is also possible that the proportion of people who develop symptoms has been underestimated as many studies only measure symptoms at one time point, and do not rely on direct observation by medical and nursing staff.

For most patients, the earliest symptom type was respiratory, which included cough and dyspnoea, or signs such as tachypnoea or hypoxia. Cough had the earliest median time to onset at 1 day after (range −2, 10 days). In a population where many have cardiovascular disease and chronic lung disease, this provides a diagnostic challenge as it can be difficult to differentiate a new respiratory symptom in a highly comorbid population. Fever above 38°C occurred in only 41.1% at any time within the study period, so screening by temperature alone would risk missing many cases of COVID-19.

home at 30 days and 27 (26.0%) had been discharged to residential care (Table 3), with 36 (34.6%) still in hospital. People diagnosed before transfer from residential care facilities had lower mortality at 30 days (5/31; 16.1%) than those diagnosed in hospital (25/75; 33.3%) (odds ratio (OR) 3.1; 95% confidence interval (CI) (1.05–8.88); $P = 0.041$) (Supporting Information Table S1). On multivariate analysis, for the whole group, only female gender was independently associated with

Many patients also developed 'atypical' symptoms of COVID-19, including gastrointestinal symptoms, with 17/95 (17.9%) developing diarrhoea. For some, this was the first symptom and, on review of the notes, it was apparent that this had not been recognised as due to COVID-19 at the time. Other atypical presentations included delirium, lethargy and nausea. This shows that, particularly where there is high suspicion of COVID-19, a broad clinical definition is essential to identify affected patients.

The patients in this cohort were more likely to develop hypoactive (35; 36.8%) rather than hyperactive (18; 18.9%) delirium (Table 3), although some had both. The clinical implication of this is that few patients were wandering, but it was important to pay careful attention to patients with delirium to ensure adequate nutrition, with 49 (51.6%) having decreased oral intake (Table 3), which was managed with feeding assistance, i.v. fluids and antiemetics.

Mortality in this cohort was high at 31.3% compared to some age-matched cohorts; however, this group were already admitted either to residential AC (and thus likely quite frail) or in subacute geriatric inpatient care. People are usually admitted to AC wards as due to increased care needs following an acute hospital admission, and so being in these wards is likely already to be a marker of poor recovery from an acute event. Our findings are consistent with previous studies that have identified increasing frailty as a risk for mortality.[16] There was also an increased risk for mortality for people who were diagnosed as inpatients, where the median time between admission and positive swab was 49 days, and those who were diagnosed in residential care (OR 3.1 (95% CI 1.05–8.88); *P* = 0.041). While three of these deaths were attributed to causes other than COVID-19, it is likely that the physiological burden of a recent illness with poor recovery is a previously unrecognised risk factor for mortality for people with COVID-19. This has implications for priority groups for vaccination.

Given the intensity of the outbreak with large numbers of cases in a short period of time, universal implementation of additional transmission-based infection control precautions for all patients (whether known positive or in isolation as a contact) was critically important. The fact that negative tests could be followed by positive results a median of 4 days later, but as little as 1 day later, demonstrates the effects of a long incubation period of this virus and is a reminder that a negative test does not exclude SARS-CoV-2 acquisition. On review of medical records, it was apparent that some patients who had a test while they were defined as asymptomatic,

actually had early symptoms of COVID-19 that had not yet been recognised by staff as such, highlighting that the onset of the disease can be subtle. The decision to use frequent (twice weekly) screening despite initial negative results enabled early identification of cases.[20] It should also be noted that many patients with dementia also found it challenging to comply with nasal swabs so it is possible that this group has a higher than expected false-negative test rate.

While the source of this outbreak and chains of transmission are still under investigation, this outbreak did occur during a period of high community prevalence.[21] This highlights that when community prevalence is high, the risk assessment of wards should include factors such as shared rooms and the dependence of patients for personal care.

The strength of this study is that many of the patients were diagnosed prior to developing symptoms, or early in the disease course, which contrasts to many cohorts which included patients admitted to hospital due to moderate to severe disease. Another strength of our study is that the regular nursing and medical observations, and regular testing facilitated a detailed record of the types of early symptoms and timing of their onset relative to infection, rather than relying only on patient report. An important limitation is that many of the patients in this study had English as a second language, hearing impairment and/or dementia and delirium. These barriers to communication mean that there may have been symptoms that were not recognised. As many also had chronic cardiovascular and lung disease, it was clinically difficult to ascertain whether a respiratory symptom was new or related to their underlying comorbidity. This study also relied on routine clinical data, and so some factors, such as frailty, were not measured for all patients due to many of the usual staff who are trained in the usual research protocol, being furloughed at the time of the outbreak.

Conclusions

The present study highlights that COVID-19 can be difficult to recognise in older adults due to the range of presentations. In the context of outbreaks, asymptomatic testing is very useful to identify people in presymptomatic stages and those with very mild symptoms that were not yet recognised as attributable to COVID-19. Our findings are consistent with international cohorts that showed COVID-19 has an increased risk of mortality for older adults who are physiologically vulnerable, and it may be that people who have had an incomplete recovery from an illness are at particular risk.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web-site:

Table S1. Univariate analysis of factors and mortality.
Figure S1. Map of the Royal Park campus of the Royal Melbourne Hospital.