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Seventy patients treated for COVID-19 by Østfold Hospital Trust

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BACKGROUND

There is a need for further data on the COVID-19 situation in Norway. Our aim was to describe the patients admitted to our local hospital with COVID-19 in the spring of 2020.

MATERIAL AND METHOD

Data were retrieved retrospectively from our local quality register for COVID-19 and include all patients admitted to Østfold Hospital in the period 10 March 2020–31 May 2020.

RESULTS

A total of 70 patients were admitted, of whom 47 (67 %) were men. The mean age was 59 years (range 18–95). The most common comorbid conditions were obesity (n = 22, 31 %), chronic coronary artery disease (n = 21, 30 %) and diabetes (n = 17, 24 %). Thirteen patients (19 %) had no comorbidities. The most common symptoms were cough (n = 56, 80 %), dyspnoea (n = 51, 73 %) and fever (n = 48, 69 %). The most frequent complications were cardiac manifestations (n = 18, 26 %), acute respiratory distress syndrome (n = 14, 20 %) and acute kidney injury (n = 9, 13 %). Four (6 %) patients developed venous thromboembolism. Twenty patients (29 %) became critically ill. Thirteen (19 %) received treatment in the intensive care unit, and seven (10 %) died while in hospital.

INTERPRETATION

Most of those admitted were middle-aged men. Many had no comorbidities. The most frequent non-respiratory complications were cardiac manifestations and kidney injury. A large proportion of patients became critically ill secondary to acute respiratory distress syndrome.

The clinical picture associated with COVID-19 can vary from asymptomatic to acute respiratory distress syndrome (ARDS) and death (1). It is estimated that 15–40 % of patients hospitalised with COVID-19 will require treatment in intensive care (1, 2). The disease appears to affect all age groups, with morbidity and mortality increasing with age (3–5). In Norway, data have been published by Bærum Hospital, which has reported hospital mortality of 19 %, and Oslo University Hospital, Ullevål, which has reported 91 % survival in an intensive care population (6–8).

Østfold Hospital is a local hospital with a catchment population of approximately 317 000 persons. The aim of our study was to describe patient characteristics, as well as disease course and outcomes, in patients hospitalised with confirmed COVID-19 in our catchment area in the spring of 2020.

Material and method

Data were retrieved from our local quality register for COVID-19. All 70 patients with SARS-CoV-2 confirmed in nasopharyngeal, pharyngeal or tracheal secretions in the period 10 March 2020–31 May 2020 were included retrospectively. The samples were analysed by reverse transcription PCR (RT-PCR) in the hospital laboratory.

The quality register was based on the ISARIC (International Severe Acute Respiratory and Emerging Infection Consortium) and the WHO COVID-19 case report form, which is available online and consists of a set of standardised, predefined variables (9). The register includes epidemiological and demographic data, comorbidities, symptoms, biochemical markers, microbiological test results, treatment, outcomes and complications. Data were obtained through a review of medical records and electronic charts. Immigrants were defined as individuals who have immigrated to Norway and who have foreign-born parents.

Clinical scoring tools such as NEWS2 (National Early Warning Score 2), CRB-65 (confusion, respiratory rate, blood pressure, age ≥ 65 years), SIRS (systemic inflammatory response syndrome) and qSOFA (Quick Sequential Organ Failure Assessment) (10–13) are intended to capture patients at risk of becoming seriously ill. Measures obtained upon arrival were used retrospectively to calculate scores. The Charlson Comorbidity Index was calculated for all patients to reveal the level of morbidity in the population. Obesity was defined as a body mass index > 30 kg/m^2. Anaemia was defined as a haemoglobin concentration < 12 g/dL in women and < 13 g/dL in men.

Complications such as pneumonia were registered if they were noted in the medical records or assigned as a diagnostic code upon discharge. ARDS was classified according to the Berlin criteria, and subclassified as mild (pO_2(a)/FO_2(I) < 39.9 kPa), moderate (pO_2(a)/FO_2(I) 13.3–26.6 kPa) or severe (pO_2(a)/FO_2(I) < 13.3 kPa) (14). Acute kidney injury was defined according to the RIFLE criteria (risk, injury, failure, loss of kidney function, end-stage kidney disease) based on creatinine levels (15). Cardiac involvement was defined as myocardial injury with at least one troponin I value above the 99th percentile, or newly diagnosed cardiac arrhythmia.

Critical illness was defined as death, discharge to palliative care, requirement for intensive care, or non-invasive ventilation while in hospital.

The hospital's own internal guidelines were followed for receiving patients with confirmed or suspected COVID-19. The recommended practice was for a decision to be made upon

admission regarding the appropriate level of intervention. Treatment limitations were introduced if judged appropriate on the basis of a comprehensive assessment taking into account age, comorbidity and frailty (Clinical Frailty Scale) (16).

In order to highlight potential differences between more and less severe disease courses, patients treated in intensive care and those treated on a standard ward were described separately. Continuous data are presented as medians and interquartile ranges, or as means if appropriate, while categorical data are presented as frequencies and percentages. We have chosen not to perform statistical analyses owing to the small size of the dataset.

Four patients were readmitted during the study period, and data from their first stay were included in the analysis. One patient who died shortly after arrival in the intensive care unit was included in the demographic analysis and outcomes, but excluded from the other analyses owing to missing data.

The data were collected as part of an internal quality assurance process. The study was submitted to the Regional Committee for Medical and Health Research Ethics (REC) and to the hospital's Data Protection Officer, and was granted exemption from the requirement to obtain written consent on condition that anonymity was preserved.

Results

Seventy patients were admitted during the study period, of whom 40 (57 %) were admitted in the month of March. The median age of the patients was 59 years (interquartile range 50–66 years) (Table 1). Forty-seven patients (67 %) were male, and twenty-eight patients (40 %) were immigrants. The most common comorbid disorders were obesity (n = 22, 31 %), chronic coronary artery disease (n = 21, 30 %) and diabetes (n = 17, 24 %). Thirteen patients (19 %) had no comorbidities; three of them were over the age of 65. The median score on the Charlson Comorbidity Index was 2 (interquartile range 1–4), and did not differ between patients treated in the intensive care unit versus on a ward. Twenty-four patients (34 %) had a history of smoking.

Table 1

Characteristics of 70 patients admitted to Østfold Hospital with COVID-19 in the period 10 March 2020–31 May 2020. Number (%) unless otherwise specified.

	All patients (n = 70)	**Patients treated in intensive care (n = 13)**	**Patients treated on a ward (n = 57)**
Age, mean, years	59	60	58
Age, median, years (interquartile range)	59 (50–66)	62 (52–66)	57 (49–68)
Age distribution, years			
18–39	8 (11)	0 (0)	8 (14)
40–59	31 (44)	6 (46)	25 (44)
60–79	23 (33)	7 (54)	16 (28)
≥ 80	8 (11)	0 (0)	8 (14)
Sex			
Male	47 (67)	10 (77)	37 (65)
Female	23 (33)	3 (23)	20 (35)
Comorbidities			
Obesity (BMI > 30)	22 (31)	4 (31)	18 (32)
Chronic coronary artery disease	21 (30)	5 (38)	16 (28)
Diabetes	17 (24)	6 (46)	11 (19)
COPD/asthma	11 (16)	2 (15)	8 (14)

	All patients (n = 70)	Patients treated in intensive care (n = 13)	Patients treated on a ward (n = 57)
Chronic kidney disease	7 (10)	2 (15)	5 (9)
Rheumatic disease	7 (10)	0 (0)	7 (12)
Comorbidities ≥ 2	25 (36)	7 (54)	18 (32)
Charlson Comorbidity Index, median (interquartile range)	2 (1–4)	2 (2–4)	2 (1–4)

The most common symptoms prior to admission were cough (n = 56, 80 %), dyspnoea (n = 51, 73 %) and fever (n = 48, 69 %). The median duration of symptoms prior to admission was 7 days (interquartile range 4–12 days), with a longer symptom duration observed for patients in intensive care (median 11 days, interquartile range 7–14 days) than for those on a standard ward (7 days, 4–11 days). Twenty-seven patients (39 %) had a symptom duration of 10 days or more. Of these, 11 (41 %) became critically ill, compared with 8 patients (19 %) in the group with shorter symptom duration.

Table 2 provides an overview of vital signs on arrival. The most frequent observations were tachypnoea (n = 30, 43 %) and fever (n = 27, 39 %). Thirty-four patients (49 %) fulfilled two or more SIRS criteria on arrival. Twenty-one patients (30 %) had a NEWS2 score ≥ 5, indicating a need for more intensive monitoring. Seven out of 12 patients (58 %) who later required treatment in intensive care had a NEWS2 score ≥ 5 on arrival, versus 14 of 57 patients (25 %) who remained on a standard ward. qSOFA and CRB-65 captured fewer patients who went on to become seriously ill (8 % and 17 %, respectively). Biochemical analyses revealed moderately elevated CRP (median 110 mg/L, interquartile range 61–195 mg/L), lymphopenia ($0.9 \cdot 10^9$/L, 0.7–1.3 $\cdot 10^9$/L), platelets at the lower end of the reference range ($172 \cdot 10^9$/L, 128–234 $\cdot 10^9$/L) and elevated D-dimer (1.4 mg/L, 0.7–2.5 mg/L).

Table 2

Vital signs, biochemical markers, diagnostic imaging and results from clinical scoring tools upon arrival. One intensive care patient has been excluded due to missing data. Number (%) unless otherwise specified. FEU = fibrinogen-equivalent units.

	All patients (n = 69)	Patients treated in intensive care (n = 12)	Patients treated on a ward (n = 57)
Vital signs			
Respiratory rate ≥ 22 breaths/min	30 (43)	8 (67)	22 (39)
Temperature ≥ 38.0 °C	27 (39)	7 (58)	20 (35)
Pulse > 100 beats/min	19 (28)	3 (25)	16 (28)
SpO_2 ≤ 93 %	18 (26)	8 (67)	10 (18)
Clinical scoring tools			
SIRS ≥ 2	34 (49)	8 (67)	26 (46)
NEWS2 ≥ 5	21 (30)	7 (58)	14 (25)
CRB-65 ≥ 2	7 (10)	2 (17)	5 (9)
qSOFA ≥ 2	3 (4)	1 (8)	2 (4)
Diagnostic imaging			
Infiltrate present	57 (83)	12 (100)	45 (79)
Biochemical markers, median (interquartile range)			
CRP, mg/L (ref. range < 6)[1, 3]	110 (61–195)	307 (247–339)	95 (52–157)
Leukocytes, $\cdot 10^9$/L (ref. range 3.5–11.0)[1, 3]	8.0 (5.9–11.6)	13.4 (12.1–14.4)	7.1 (5.8–9.4)

	All patients (n = 69)	Patients treated in intensive care (n = 12)	Patients treated on a ward (n = 57)
Lymphocytes, · 10^9/L (ref. range 1.0–5.0)[1, 4]	0.9 (0.7–1.3)	0.7 (0.4–0.8)	1.0 (0.7–1.3)
Platelets, · 10^9/L (ref. range 150–450)[1, 4]	172 (128–234)	146 (117–246)	176 (130–228)
Creatinine, µmol/L (ref. range 60–105)[1, 3]	87 (72–118)	167 (91–281)	84 (69–103)
D-dimer, mg/L FEU (ref. range < 0.5)[2, 3]	1.4 (0.7–2.5)	2.4 (2.2–20)	1.1 (0.7–2.3)
Procalcitonin, µg/L (ref. range < 0.10)[2, 3]	0.2 (0.05–0.75)	6.02 (1.47–29.41)	0.12 (0.04–0.31)

[1]Missing for one patient

[2]Missing for three patients

[3]Highest value

[4]Lowest value

Table 3 summarises the clinical course, treatment and outcomes for all patients. Fifty-nine patients (86 %) were diagnosed with viral pneumonia. Thirty-nine patients (57 %) were treated with anti(retro)viral agents, and 37 patients (54 %) received immunomodulatory therapy, usually in combination. Fifty-eight patients (84 %) were given thrombosis prophylaxis. Fourteen patients (20 %) were diagnosed with bacterial superinfection, and 57 patients (83 %) received empirical antibiotic treatment while in hospital. Bacteriological cultures from the respiratory tract were positive in four patients (6 %). Fourteen patients (20 %) developed ARDS, and this was classified as mild in one patient, moderate in eleven and severe in two.

Table 3

Clinical outcomes over the course of the hospital stay. Number (%) unless otherwise specified.

	All patients (n = 69)	Patients treated in intensive care (n = 12)	Patients treated on a ward (n = 57)
Complications			
Viral pneumonia	59 (86)	12 (100)	47 (82)
Anaemia[1]	45 (65)	11 (92)	34 (60)
Cardiac manifestations[2]	17 (25)	5 (42)	12 (21)
Bacterial superinfection[3]	14 (20)	3 (25)	11 (19)
Acute respiratory distress syndrome[4]	14 (20)	12 (100)	2 (4)
Acute kidney injury[5]	9 (13)	7 (58)	2 (4)
Bacterial coinfection[6]	8 (12)	4 (33)	4 (7)
Viral coinfection[7]	4 (6)	1 (8)	3 (5)
Venous thromboembolism[8]	4 (6)	1 (8)	3 (5)
Treatment			
Thrombosis prophylaxis[9]	58 (84)	12 (100)	46 (81)
Antibiotics	57 (83)	12 (100)	45 (79)
Oxygen therapy[10]	47 (68)	12 (100)	35 (61)
Immunomodulatory therapy[11]	39 (57)	10 (83)	29 (51)
Anti(retro)viral agents[12]	37 (54)	10 (83)	27 (47)
Corticosteroids	8 (12)	1 (8)	7 (12)
Antifungal agents[13]	6 (9)	6 (50)	

	All patients (n = 69)	Patients treated in intensive care (n = 12)	Patients treated on a ward (n = 57)
Mechanical ventilation[14]	13 (19)	13 (100)	
Days on ventilator, median (interquartile range)		12 (6–14)	
Non-invasive ventilation[15]	4 (6)		4 (7)
Kidney-replacement therapy (prisma)	3 (4)	3 (25)	
Status upon discharge	**n = 70**	**n = 13**	**n = 57**
Discharged home	52 (74)	5 (38)	49 (86)
Discharged to 24-hour care	11 (16)	3 (23)	7 (12)
Death	7 (10)	5 (38)	2 (4)
Duration of hospital stay, median (interquartile range)	6 (4–11)	18 (7–23)	6 (4–9)
Days in intensive care, median (interquartile range)		14 (6–17)	

[1]Hb < 13 g/dL for men, Hb < 12 g/dL for women.

[2]Troponin release > 99th percentile or new-onset cardiac arrhythmia.

[3]Respiratory tract, four confirmed by means of microbiological culture.

[4]All subclassifications based on the Berlin criteria.

[5]RIFLE criteria: I(njury), F(ailure).

[6]Respiratory tract excluded, eight confirmed with microbiological culture.

[7]Parainfluenza virus, human metapneumovirus, adenovirus and influenza B virus.

[8]Deep vein thrombosis diagnosed via lower venous extremity ultrasound or pulmonary embolism diagnosed via pulmonary CT angiography.

[9]Low molecular weight heparin.

[10]During hospital stay.

[11]Anakinra, hydroxychloroquine.

[12]Lopinavir/ritonavir, oseltamivir.

[13]Anidulafungin.

[14]Including one patient who died shortly after arrival, n = 13 of 70.

[15]Patients intubated during hospital stay are excluded.

The most frequent non-respiratory complications were anaemia (n = 45, 65 %), cardiac manifestations (n = 17, 25 %) and acute kidney injury (n = 9, 13 %). Ten of the patients with cardiac manifestations (59 %) had chronic coronary artery disease. Four patients (6 %) developed thromboembolism; two of these cases have been reported previously (17). Delirium and confusion were not included among the predefined complications in the register.

Twenty patients (29 %) became critically ill, and 13 (19 %) were admitted to the intensive care unit. Seven patients (10 %) died while in hospital (median age 66 years, interquartile range 62–83 years), five of whom had received mechanical ventilation (62 years, 62–66 years).

The patients admitted in March had a longer median hospital stay (8 days) than the patients as a whole (median 6 days, interquartile range 4–11 days). For patients who received treatment in intensive care, the median hospital stay was 18 days (7–23 days), including a median of 14 days (6–17 days) in the intensive care unit. A greater proportion of patients were intubated in the first two weeks (n = 8 of 21, 38 %) compared to the study period as a whole (19 %), and a higher percentage of these patients died (3 of 21, 14 %). Symptom

duration (median 7 days) and mean age (59 years) did not differ between the groups.

Discussion

Of the 70 patients admitted during the study period, two thirds were men. The median age of the patients was 59 years, and 40 % of those admitted were immigrants. The most common comorbid conditions were obesity, chronic coronary artery disease and diabetes. However, about one fifth of patients had no comorbidities, consistent with previous reports suggesting that it is not only elderly people with pre-existing conditions who become seriously ill (4, 18). Most patients reported multiple symptoms prior to hospitalisation. The median duration of symptoms was one week, with respiratory symptoms, fever and general malaise typically reported. The vast majority of patients were screened by the primary health care service, and the reason for admission was usually reduced general condition or respiratory difficulties.

The month of March saw the largest number of admissions during the study period (57 %). A higher percentage of patients developed ARDS and died in the first two weeks than in the study period as a whole. With no previous experience of COVID-19, we had to rely on the international literature and WHO guidelines. As the pandemic progressed, healthcare professionals were trained in the management of patients with COVID-19, with a focus on early pulmonary rehabilitation and the prevention of atelectasis. Monitoring equipment was installed on wards to enable continuous monitoring of patients at risk of decompensation. Intensive care specialists and anaesthesiologists were involved in the daily assessment of the most seriously ill patients.

Guidelines for the management of patients with COVID-19 changed significantly over the course of the study period. Initial reports from China recommended early intubation, but we subsequently switched to trying a non-invasive approach (19, 20). About half of all patients received anti(retro)viral therapy and/or immunomodulatory therapy, the vast majority before the hospital was enrolled in the WHO Solidarity Trial. In line with guidelines at the time, we limited the use of corticosteroids (21).

Fifty-eight patients (83 %) received antibiotics during their hospital stay, but only 14 had a clinical diagnosis of bacterial pneumonia. Microbiological assays were positive for respiratory pathogens in four patients, none of whom were considered critically ill. Nevertheless, we observed a low threshold for initiating antibiotic treatment, most likely due to inexperience with COVID-19 and the discrepancy between biochemical and clinical status. Bacterial superinfection does not appear to be a frequent complication of COVID-19, and current guidelines advise against antibiotic prophylaxis (22, 23).

Many patients (29 %) became critically ill while in hospital. Biochemical markers such as elevated CRP, lymphopenia, thrombocytopaenia and elevated D-dimer have proven to be prognostic markers of severe disease (24, 25). These abnormalities were more pronounced in the patients in intensive care. The intensive care cohort also had significantly higher levels of inflammatory markers (CRP, leukocytes, procalcitonin) and higher levels of coagulopathy (D-dimer) and cardiac, renal and hepatic dysfunction than patients treated on a standard ward. Intensive care patients tended to have had symptoms for longer prior to hospitalisation (median eleven days) than patients with less severe illness (median seven days). Moreover, patients who had had symptoms for at least ten days scored more highly on clinical scoring tools on admission, and were twice as likely to become critically ill as patients with a shorter disease history. This may indicate that patients hospitalised late in the disease course (tend to) become more seriously ill. In common with Bærum Hospital, we found that NEWS2 appears to be better than SIRS for identifying patients at risk of serious illness (6).

The age of our patients was lower than that of patients at Bærum Hospital (median 71 years), and in the UK (73 years) and Italy (69 years), but comparable to that in certain cohort analyses from the USA and Spain (median 61 years) (2, 7, 26–28). However, those studies

reported far higher case mortality rates than in our cohort (23.5 % and 20.7 %, respectively) and a higher percentage of intensive care admissions (27.9–32.0 % and 19 %, respectively). Immigrants were overrepresented among the inpatients in our study (40 %) compared to the proportion of immigrants in the local area (approximately 16 %) (29). The explanation for this is probably multifactorial, with underlying comorbidities as well as socioeconomic and demographic factors playing a part. Since the study was conducted early in the pandemic, it is possible that information about COVID-19 had not reached these communities to a sufficient degree. The proportion of critically ill patients in our study (29 %) was approximately the same as at Bærum Hospital (26 %), but mortality at our hospital was far lower. The patients who died at Bærum Hospital were older than those who died at our hospital (mean 79.5 years vs 70.9 years), and a greater proportion of those who died at Bærum had never received mechanical ventilation. We believe age can account for many of the differences seen between the two hospitals.

Cardiovascular complications are often seen in cases of COVID-19, and may predict an increased risk of death (30). The most common non-respiratory complications observed in our study were cardiac manifestations (26 %) and acute kidney injury (13 %). The proportion of patients with myocardial injury was in the upper range of figures reported internationally (20–28 %) (30, 31). We observed a similar incidence of kidney injury to that seen at Bærum Hospital. However, we had far fewer cases of confusion or delirium, and believe these to have been underreported.

Our study includes all patients who were hospitalised in our region, and thus provides a population-based overview. Non-interventional studies can be a valuable source of information on COVID-19 for future reference, and our dataset is presented unadjusted. Our study population was small, however, which naturally makes it difficult to draw conclusions and to make comparisons with larger international populations.

CONCLUSION

The 70 patients admitted to Østfold Hospital were younger on average than those admitted to a comparable Norwegian hospital. Twenty per cent required intensive care, and 20 % were diagnosed with bacterial superinfection. Many became seriously ill, and the cohort mortality rate was 10 %.

MAIN POINTS

The majority of patients hospitalised with COVID-19 were middle-aged men with obesity, chronic coronary artery disease or diabetes.

One in five patients developed acute respiratory distress syndrome and required ventilatory support.

A quarter of patients developed cardiac manifestations in the form of myocardial injury or newly diagnosed cardiac arrhythmia, and one in ten patients developed kidney injury.

Seven out of 70 patients died while in hospital.

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