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Characteristics, comorbidities, 30-day outcome and in-hospital mortality of patients hospitalised with COVID-19 in a Swiss area – a retrospective cohort study

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Summary

BACKGROUND: Since its first description in December 2019, coronavirus disease 19 (COVID-19) has spread worldwide. There is limited information about presenting characteristics and outcomes of Swiss patients requiring hospitalisation. Furthermore, outcomes 30 days after onset of symptoms and after hospital discharge have not been described.

AIMS: To describe the clinical characteristics, outcomes 30 days after onset of symptoms and in-hospital mortality of a cohort of patients hospitalised for COVID-19 in a Swiss area.

METHODS: In this retrospective cohort study, we included all inpatients hospitalised with microbiologically confirmed COVID-19 between 1 March and 12 April 2020 in the public hospital network of a Swiss area (Fribourg). Demographic data, comorbidities and outcomes were recorded. Rate of potential hospital-acquired infection, outcomes 30 days after onset of symptoms and in-hospital mortality are reported.

RESULTS: One hundred ninety-six patients were included in the study. In our population, 119 (61%) were male and the median age was 70 years. Forty-nine patients (25%) were admitted to the intensive care unit (ICU). The rate of potential hospital-acquired infection was 7%. Overall, 30 days after onset of symptoms 117 patients (60%) had returned home, 23 patients (12%) were in a rehabilitation facility, 18 patients (9%) in a medical ward, 6 patients (3%) in ICU and 32 (16%) patients had died. Among patients who returned home within 30 days, 73 patients (63%) reported persistent symptoms. The overall in-hospital mortality was 17%.

CONCLUSION: We report the first cohort of Swiss patients hospitalised with COVID-19. Thirty days after onset of the symptoms, 60% had returned home. Among them, 63% still presented symptoms. Studies with longer follow-up are needed to document long-term outcomes in patients hospitalised with COVID-19.

Keywords: *COVID-19, hospital-acquired infection, 30-day outcome, in-hospital mortality, Switzerland*

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Introduction

Since the initial description of new coronavirus pneumonia was reported in December 2019 in Wuhan, China [1], Coronavirus Disease 2019 (COVID-19) has spread across the world. By April 2020, more than 29,000 cases had been registered in Switzerland [2]. Outcomes of patients has been documented in several regions of the world [3–6], but little information is available on Swiss patients.

Furthermore, the World Health organization (WHO) recommended droplet and contact precautions for every patient suspected or infected with COVID-19, and applying airborne precautions when performing aerosol-generating procedures [7]. Few data are available to evaluate the effectiveness of these precautions to prevent transmission of the SARS-CoV-2 in healthcare setting.

To date, the available literature describes mainly patients' outcomes during intensive care unit (ICU) or hospital stay. In most studies, follow-up was short with a majority of patients remaining hospitalised at the end of the study [4] and little information available on outcomes after the discharge [3–5].

In this retrospective study, we report data on all patients hospitalised with a real-time polymerase chain reaction (RT-PCR)-confirmed COVID-19 infection between 1 March and 12 April 2020 in the public hospitals of the area of Fribourg, a semi-rural Swiss region of 318,000 inhabitants. We report the demographic characteristics of this cohort, the number of potential hospital-acquired infections,

outcome 30 days after illness onset and the all-cause in-hospital mortality.

Methods

This descriptive study was conducted at Fribourg hospital (HFR), a public hospital network comprising five regional hospitals serving 318,000 persons in the canton of Fribourg, Switzerland. This network is composed of one intensive care unit (ICU), four medical wards, four rehabilitation facilities and a paediatric unit. Our hospital network was the only centre to admit patients with COVID-19 in this area. The study was approved by HFR institutional board with a waiver of informed consent due to the descriptive nature of the study and the use of data collected for clinical practice.

All consecutive patients with COVID-19 confirmed by RT-PCR testing of a nasopharyngeal and oropharyngeal swab and hospitalised in one of the five HFR hospitals between 1 March and 12 April 2020 were included. Asymptomatic patients, patients coming from or transferred to other hospitals for other than medical reasons were excluded.

Demographic data, comorbidities, date of diagnosis, date of admission, length of stay, ICU stay, ventilatory support and antiviral treatment were collected from electronic health records. All cases of COVID-19 with symptoms beginning 5 days after admission were considered as potential nosocomial infection [8]. For these cases, the date of COVID-19 diagnosis was considered as the date of admission, in order to be able to calculate the length of stay.

All patients were followed-up for at least 30 days after onset of symptoms. Data of all patients were collected from the electronic health record database until discharge from hospital, death or 10 May 2020. Patients discharged before 30 days after onset of symptoms were contacted by telephone to document their outcomes at 30 days.

The outcomes at 30 days after onset of symptoms were collected from the electronic data for patients still hospitalised or by telephone call for discharged patients. The outcomes at 30 days were reported as death from any cause, still in ICU, still in medical ward, still in rehabilitation facilities or discharged from hospital. For patients discharged from hospital before day 30, persistence of symptoms 30 days after onset of symptoms was reported.

All-cause in-hospital mortality rate was based on data available on 10 May 2020 and was described by sex, age, presence of comorbidities, administration of antiviral treatment and week of admission.

We present continuous variables as median and interquartile range (IQR) and categorical variables as number and percentage. All analyses were performed using STATA version 14.2.

Results

Between 1 March and 12 April 2020, 201 patients were hospitalised with a microbiologically confirmed COVID-19. After excluding two patients transferred from other hospitals, one patient transferred to another hospital for administrative reasons, one for asymptomatic infection and one readmitted after an initial stay in another hospital, we included 196 patients in the final analysis. The median age was 70 years (IQR 60–80), ranging from 1 to 101 years. Only one patient was under 18 years old. One hundred and nineteen patients (61%) were male. The most common comorbidity was hypertension (60%) followed by diabetes (27%) and obesity (21%). Fifty-six patients (29%) were smokers. The median time between illness onset and hospital admission was 7 days (IQR 4–10). Data are presented for the total population, the population without an ICU stay and the population treated on the ICU (table 1). Forty-nine patients (25%) required ICU admission and the median age of ICU patients was 65 years (IQR 56–71), ranging from 18 to 80 years. Median time between illness onset and ICU admission was 10 days (IQR 8–12), ranging from 1 day to 24 days. Among the ICU population, 44 patients (90%) received ventilatory support.

Median stay in acute care was 8 days (IQR 5–14) for the general population, 7 days (IQR 4–10) for the population without an ICU stay and 15 days (IQR 9–26) for the population with an ICU stay. The median ICU stay was 8 days (IQR 3–14), ranging from 1 to 27 days. Fifty-seven patients (29%) received antiviral treatment (table 2). Most of the patients received a combination of hydroxychloroquine and atazanavir (54%) or of hydroxychloroquine and ritonavir/lopinavir (30%).

A potential nosocomial COVID-infection was identified in 13 cases (7%). Duration from hospital admission till appearance of symptoms was 10 days in 1 patient, and more than 10 days (minimum 12, maximum 58) in 12 patients. Of these potential hospital-acquired infections, 6 (3%) were associated with a stay in acute care, 7 (4%) were associated with a stay in a rehabilitation facility and none was associated with an ICU stay.

At day 30 after onset of symptoms, 117 patients (60%) had returned home, 23 patients (12%) were in a rehabilitation facility, 18 patients (9%) were still hospitalised in a medical ward, 6 patients (3%) were still in the ICU and 32 patients (16%) had died. Of the 49 patients with an ICU stay, 30 days after onset of symptoms 17 patients (35%) had returned home, 4 patients (8%) were in a rehabilitation facility, 11 patients (22%) were still hospitalised in a medical ward, 6 patients (12%) were still hospitalised in the ICU and 11 patients (22%) had died.

Among 117 patients discharged from hospital within 30 days after the beginning of symptoms, 116 (99%) were contacted by telephone to confirm the 30-day outcome. After hospital discharge, five patients (4%) had an unplanned medical appointment and two patients (2%) had an unplanned hospitalisation, one for asthenia and the other one for pulmonary embolism. Seventy-three patients (63%) reported persistent symptoms. Asthenia (67%), respiratory symptoms (56%) and anosmia/dysgeusia (10%) were the most frequently reported symptoms.

Up tol 10 May 2020, there were 33 deaths, corresponding to an overall in-hospital mortality rate of 17%, with only one death observed 30 days after the onset of symptoms. The median time from onset of symptoms to death was 12 days (IQR 10–16), ranging from 5 days to 36 days. Mortality rates are presented by sex, age, comorbidities, administration of antiviral therapy and week of admission (table 3). The mortality rate was higher for men (22%) than for women (12%). It increased with age and no death was observed in patients younger than 60 years of age.

Table 1: Baseline demographic data of patients hospitalised with COVID-19.

	All patient (n = 196)		Without ICU stay (n = 147)		With ICU stay (n = 49)	
Characteristics	**n**	**%**	**n**	**%**	**n**	**%**
Sex						
– Male	119	61	89	60	30	61
– Female	77	39	58	40	19	39
Age						
– Age (years), median (IQR)	70	(60–80)	74	(61–83)	65	(56–71)
– 10–29	4	2	3	2	1	2
– 30–39	3	2	1	1	2	4
– 40–49	17	9	11	8	6	12
– 50–59	24	12	18	12	6	12
– 60–69	48	24	30	20	18	37
– 70–79	50	26	35	24	15	31
– 80–89	42	21	41	28	1	2
– 90–101	8	4	8	5	–	–
Comorbidities*	**n**	**%**	**n**	**%**	**n**	**%**
With comorbidities	162	83	122	83	40	82
– Hypertension	118	60	91	62	27	55
– Diabetes mellitus	52	27	41	28	11	22
– Obesity (BMI >30 kg/m^2)	41	21	28	19	13	27
– Coronary heart disease	26	13	20	14	6	12
– SAS	25	13	16	11	9	18
– Cardiac insufficiency	21	11	17	12	4	8
– COPD	16	8	11	8	5	10
– Active cancer	15	8	14	10	1	2
– Immunosuppression	10	5	7	5	3	6
– Smoker	56	29	38	26	18	37
Time to hospital admission	**Median**	**(IQR)**	**Median**	**(IQR)**	**Median**	**(IQR)**
Time to admission†, days	7	(4–10)	6	(3–9)	8	(6–10)

BMI = body mass index (weight in kilograms divided by height in metres squared);COPD = chronic obstructive pulmonary disease; ICU = intensive care unit; IQR = interquartile range; SAS = sleep apnoea syndrome * Diagnoses according to electronic medical records; † time elapsed since onset of symptoms

Table 2: Length of stay, invasive mechanical ventilation, antiviral therapy and follow-up at 30 days after onset of symptoms.

	All patients (n = 196)		Without ICU stay (n = 147)		With ICU stay (n = 49)	
Length of stay (days)	**Median**	**IQR**	**Median**	**IQR**	**Median**	**IQR**
Acute care	8	(5–14)	7	(4–10)	15	(9–26)
ICU Stay	–	–	–	–	8	(3–14)
Ventilation support	**n**		**n**		**n**	**%**
Patients ventilated					44	90
Invasive ventilation	–	–	–	–	30	61
Invasive ventilation duration (days), median (IQR)	–	–	–	–	10	(7–14)
Antiviral therapy	**n**	**%**	**n**	**%**	**n**	**%**
Patients treated	57	29	24	16	33	67
Therapeutic options	57	100	24	100	33	100
– Hc + Az	31	54	5	21	26	79
– Hc + Lo/Ri	17	30	13	54	4	12
– Hc	8	14	6	25	2	6
– Remdesivir	1	2	–	–	1	3
Outcome at 30 days	**n**	**%**	**n**	**%**	**n**	**%**
Home	117	60	100	68	17	35
– Asymptomatic	43	37*	39	39*	4	24
– Symptomatic	73	63*	60	61*	13	76
Rehabilitation	23	12	19	13	4	8
Medical ward	18	9	7	5	11	22
ICU	6	3	–	–	6	12
Death	32	16	21	14	11	22

ICU = intensive care unit; IQR = Interquartile range; Hc = hydroxychloroquine; Lo/Ri = lopinavir/ritonavir; Az = atazanavir * Patients' follow-up assessed by telephone at 30 days. Percentage calculated with a total of 116 participants, due to the loss of follow-up of one participant. † Patients still complaining of any symptoms during phone call 30 days after onset of symptoms.

The in-hospital mortality rate seems increased in cases of coronary heart disease (39%), congestive heart failure (38%), chronic obstructive pulmonary disease (25%), obesity (27%) and active cancer (43%), but apparently not in cases of hypertension (19%) or immunosuppression (10%). Administration of antiviral treatment was associated with lower in-hospital mortality. Mortality seemed to decrease over time according to week of admission.

Discussion

In this study, we describe the characteristics and outcomes of 196 consecutively hospitalised patients with COVID-19 in a Swiss region. In this population, we find demographic characteristics similar to those described in other studies, namely a higher proportion of men (61%), a higher proportion of elderly patients with a median age of 70 years and a high prevalence of comorbidities (83%) such as hypertension (60%), diabetes (27%) and obesity (21%) [4–6]. Smoking prevalence (29%) was higher than that reported in other studies [4, 5]. Except for hypertension, active cancer and immunosuppression, the prevalence of comorbidities in the patients studied seems higher than for the Swiss population of this age [9].

COVID-19 is a disease transmitted mainly through droplets and contacts. It is therefore important to recognise the effectiveness of the measures taken to prevent transmission between inpatients. During this period, we followed official Swiss recommendations and applied droplet and contact precautions for every suspected or infected patient, optimal adherence to hand hygiene and airborne precautions for procedures generating aerosols. Each suspect patient was isolated in a single-bed room and confirmed cases were cohorted in multiple-bedded rooms. We reported an overall rate of potential hospital-acquired infection of 7%. when the analysis was restricted to infection potentially acquired in acute care setting, the rate was even lower (3%). Little information is available about the rate of these hospital-acquired infections [10]. Wang et al. [11] reported a higher transmission rate with a potential hospital-associated infection rate of 12% among patients hospitalised in a university hospital in Wuhan, China in January 2020. The lower rate in our study could be explained by a better knowledge of the mode of transmission of the disease and better preparation when COVID-19 appeared in Switzerland. As a result, we were able to introduce adequate protective measures when the first patients were hospitalised. We believe that the information about the potential hospital-acquired infection rate can be useful to evaluate the quality of the measures taken to prevent trans-

Table 3: In-hospital mortality for all patients, patients with and without ICU stay.

	All patients			Without ICU stay			With ICU stay		
	Patients (n)	Death (n)	Mortality (%)	Patients (n)	Death (n)	Mortality (%)	Patients (n)	Death (n)	Mortality (%)
All	196	33	17	147	22	15	49	11	22.4
Sex									
Females	77	9	12	58	6	10	19	3	16
Males	119	24	22	89	16	18	30	8	25
Age category									
10–59	48	–	–	33	–	–	15	–	–
60–69	48	6	13	30	2	7	18	4	22
70–79	50	9	18	35	3	9	15	6	40
80–89	42	14	33	41	13	32	1	1	100
90–101	8	4	50	8	4	50	–	–	–
Comorbidities*									
HTA	118	22	19	91	15	17	27	7	26
Diabetes mellitus	52	10	19	41	5	12	11	5	46
Obesity (BMI >30 kg/m^2)	41	11	27	28	7	25	13	4	31
Coronary heart disease	26	10	39	20	7	35	6	3	50
SAS	25	5	20	16	4	25	9	1	11
Cardiac insufficiency	21	8	38	17	7	41	4	1	25
COPD	16	4	25	11	1	9	5	3	60
Active cancer	14	6	43	14	6	43	1	–	–
Immunosuppression	10	1	10	7	1	14	3	–	–
Smoker	56	11	20	38	5	13	18	6	33
Antiviral treatment									
No	139	27	20	123	20	16	16	7	44
Yes	57	6	11	24	2	8	33	4	12
Week of admission									
1st	4	1	25	1	–	–	3	1	33
2nd	5	3	60	2	1	50	3	2	67
3rd	37	9	25	28	6	21	9	3	38
4th	75	11	15	60	8	13	15	3	27
5th	49	7	14	36	5	14	13	2	15
6th	26	2	8	20	2	10	6	–	–

BMI = body mass index; COPD = chronic obstructive pulmonary disease; DM = diabetes mellitus; HTA = hypertension; SAS = sleep apnoea syndrome * Diagnoses according to electronic medical records.

mission of infection inside hospitals. However, comparison with other hospitals should take into account the various definitions of potential hospital-acquired infection and the site where observations take place. The inclusion of potential hospital-acquired infection in rehabilitation facilities could lead to higher infection rates than studies reporting only cases occurring in acute care settings.

To our knowledge, this is the first study describing the outcomes 30 days after onset of symptoms for patients hospitalised for COVID-19. The majority of our patients (60%) returned home 30 days after onset of the symptoms. A minority of these patients (6%) needed an unplanned consultation or hospitalisation and no death was reported after hospital discharge. However, a majority of these patients (63%) continued to be symptomatic. Given the recent emergence of COVID-19, few data are available on long-term outcomes of these patients. Our data should encourage the conduct of studies with longer follow-up to assess the outcomes of these patients.

In-hospital mortality was 17% for all hospitalised patients, 15% for non-intensive care patients and 22% for patients with an ICU stay. In accordance with other studies, we observed an increased mortality in males [3–5], in advanced age [3–5] and in patients with ischaemic heart disease [12], heart failure [12], diabetes [12] and obesity [13]. Among 14 patients with active cancer, 6 died, corresponding to a surprisingly elevated mortality rate (43%). A high mortality rate in oncology patients has been previously reported [14, 15]. This high mortality rate can reflect the overall mortality from these cancers [15] and the frailty of these patients. Furthermore, advance care planning may have limited admission to the ICU. This hypothesis is reinforced by the fact that only one patient with active cancer was admitted to the ICU.

The inpatient mortality reported in the literature is variable [5, 6, 11]. These data should be interpreted with caution. They depend on the criteria for hospital admission, the characteristics of the inpatient population and the duration of follow-up [16]. The population described in our study was older and has more co-morbidities than the populations included in the studies describing lower or similar mortality [6, 11]. In addition, a fairly long follow-up of patients is necessary to obtain a reliable estimate of mortality [17]. Several studies publishing data on inpatient mortality had a shorter follow-up [4], limited to hospital discharge [5, 6, 11], and a higher proportion of patients still in hospital at the time of the analysis [4–6, 11]. Our study had the advantage of providing information on patient outcomes at least 30 days after the onset of symptoms with telephone follow-up for patients discharged from hospital. In addition, only three patients (2%) were still hospitalised in an acute care setting at the time of the analysis of in-hospitality mortality. The mortality rate described in our study therefore seems less subject to bias. In our population, only one death occurred more than 30 days after the onset of the symptoms. These facts reinforce our impression that mortality 30 days after the onset of symptoms could be a suitable surrogate for estimating mortality associated with hospitalisation for COVID-19.

Administration of antiviral treatment seems associated with lower mortality. However, several confounding factors, in particular the variability of the regimens administered, the variability of indications to initiate an antiviral treatment during the period studied and the selection of the patients eligible to receive a treatment do not allow any conclusions.

Our data suggest a decrease in mortality over time, based on the week of admission. The data are not interpretable for the first 2 weeks because of the low number of patients admitted to hospital, but the trend seemed to be confirmed in the following weeks. This decrease in mortality may be explained by several factors. Firstly, knowledge of the disease increased rapidly, leading to improvement of supportive care and treatment of complications, such as management of the high thromboembolic risk among COVID-patients according to our own observations [18]. Secondly, although its effectiveness remains uncertain [19], we cannot exclude the possibility that the administration of antiviral treatments which became general from 31 March 2020 may have contributed to an improvement in the prognosis. Thirdly, the admission criteria for hospitalisation were restrictive during the first weeks because of the fear of a massive influx of patients. Consequently, only the most severely affected patients with severe pneumonia were admitted to hospital. From 31 March, the admission criteria were broadened to allow patients with risk factors for poor outcomes but without pneumonia severity criteria to be admitted. Finally, our clinical intelligence was indeed affected by specific emotional and organisational factors, as we reported elsewhere [20].

Strength of the study

We describe one of the first cohorts of consecutive hospitalised patients with confirmed COVID-19 in Switzerland. The follow-up of all patients until 30 days after onset of the symptoms provides reliable information on the outcomes, including all-cause mortality. Furthermore, the follow-up of patients after hospital discharge provides information about the readmission rate, late mortality and the persistence of symptoms. The data on the rate of potential nosocomial infections can be useful to evaluate the quality of the protective measures adopted within our institution.

Limitations

There are several limitations. Firstly, owing to the retrospective nature, the prevalence of co-morbidities is most likely underestimated. Comorbidities were described if present in the patients' electronic records but were not actively sought. Consequently, obesity or active smoking may have been underestimated. Secondly, even though only three patients (2%) were still hospitalised at the end of the study, their outcomes could slightly alter our results. Thirdly, a telephone call to patients discharged from hospital before the end of the study could not provide precise information on persistent symptoms and their clinical relevance. Further studies are needed to better document the outcomes of these patients after hospital discharge. Finally, no statistical tests were performed to confirm the association between age, sex, comorbidity, week of admission, administration of antiviral treatment and mortality. Our study focused only on the descriptive aspect and all potential associations should be confirmed in other studies.

Conclusion

In conclusion, our study is one of the first to describe the outcomes of Swiss patients hospitalised for symptomatic COVID-19 infection. We report patient outcomes at 30 days and show that persistent symptoms are frequent in patients discharged from hospital. These results encourage further studies with longer follow-up.

Disclaimer

The view expressed in the submitted are the own authors view and not an official position of the institution

Disclosure statement

No financial support and no other potential conflict of interest relevant to this article was reported.

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