ISSN: 2083-389X
eISSN: 2084-3127

© J Hear Sci, 2022; 12(4): 26–31
DOI: 10.17430/JHS.2022.12.4.3

LARGE-SCALE SCREENING FOR SARS-COV-2 INFECTION IN ENT PATIENTS DURING THE COVID-19 PANDEMIC

Katarzyna Szkutnik[A-F], Natalia Ratajczyk-Socha[A-F], Jurek Olszewski[A-F]

Department of Otolaryngology and Laryngological Oncology, Audiology and Phoniatrics, Medical University, Poland

Corresponding author: Katarzyna Szkutnik, Department of Otolaryngology and Laryngological Oncology, Audiology and Phoniatrics, Medical University, Żeromskiego 113, 90-549 Łódź, Poland; email: kasia.szkutnik@wp.pl

Contributions:
A Study design/planning
B Data collection/entry
C Data analysis/statistics
D Data interpretation
E Preparation of manuscript
F Literature analysis/search
G Funds collection

Abstract

Introduction: Based of the authors' own material, the results of screening tests for SARS-CoV-2 infection were analysed in ENT patients scheduled for a diagnostic procedure or elective surgery in our hospital during 10 months of the COVID-19 pandemic.

Material and methods: The study was carried out on 546 women, aged 18–94 years and 696 men, aged 18–87 years, who were scheduled for hospitalisation between 1 May 2020 and 28 February 2021. PCR and antigen tests for the SARS-CoV-2 virus were performed in all patients. A negative result was a prerequisite for admission in order to undergo a diagnostic procedure or surgery.

Results: SARS-CoV-2 virus testing was performed in 1242 patients, 44% of whom were female and 56% male. In terms of age distribution, the peak for women was either 51–60 years (7.3%) or 61–70 years (10.5%), while for males the peak age was lower, at 18–30 years (10.5%) or 31–40 years (12.1%). In each month, a similar number of tests were performed, which was related to our contract with the Polish National Health Fund. To allow for a patient scheduled for a procedure being COVID-19 positive and unable to attend, the department asked us to qualify more patients for surgery in each week so as to keep up the standard number of surgical treatments. Our data showed that 1.5% of women and 2.5% of men became COVID-19 positive. The number of infected patients increased gradually from October 2020 to January 2021, related to an increase in morbidity.

Conclusions: Of the 1242 patients, 236 (19.0%) women and 231 (18.6%) men were scheduled for a diagnostic procedure, while 310 (25.0%) women and 465 (37.4%) men were tested for elective surgery. Screening tests for SARS-CoV-2 infection in all these patients allowed us to disqualify patients from hospitalization if they had a positive result, thereby limiting the transmission of the virus while allowing us to fulfill our contract.

Key words: screening • SARS-CoV-2 infection • hospitalisation

WIELKOSKALOWE BADANIE PRZESIEWOWE NA ZAKAŻENIE SARS-COV-2 WŚRÓD PACJENTÓW ORL PODCZAS PANDEMII COVID-19

Streszczenie

Wprowadzenie: Na podstawie materiału własnego autorzy przeanalizowali wyniki testów przesiewowych na zakażenie wirusem SARS-CoV-2 pacjentów ORL przyjętych do szpitala na badania diagnostyczne lub planowy zabieg chirurgiczny podczas 10 miesięcy pandemii COVID-19.

Materiał i metoda: Badanie przeprowadzono na 546 kobietach w wieku 18–94 lata i 696 mężczyznach w wieku 18–87 lat, przyjętych do szpitala między 1 maja 2020 r. a 28 lutego 2021 r. U wszystkich pacjentów przeprowadzono testy PCR i antygenowe na obecność wirusa SARS-CoV-2. Wynik negatywny testu był warunkiem przyjęcia do szpitala w celu wykonania procedury diagnostycznej lub zabiegu chirurgicznego.

Wyniki: Testy na obecność wirusa SARS-CoV-2 wykonano u 1242 pacjentów, wśród których było 44% kobiet i 56% mężczyzn. Odnośnie rozkładu wiekowego najwięcej kobiet było w wieku 51–60 lat oraz w wieku 61–70 lat (odpowiednio 7,3% i 10,5%), podczas gdy w grupie mężczyzn – 18–30 lat i 31–40 lat (odpowiednio 10,5% i 12,1%). W każdym miesiącu przeprowadzono podobną liczbę testów, co wynikało z kontraktu z polskim Narodowym Funduszem Zdrowia. Uwzględniając, że pacjent zgłaszający się na planowy zabieg chirurgiczny może otrzymać pozytywny wynik testu na COVID-19 i związku z tym nie będzie zakwalifikowany do operacji, klinika poprosiła nas o kwalifikowanie większej liczby pacjentów do operacji w każdym tygodniu, aby utrzymać przeciętną liczbę wykonywanych zabiegów chirurgicznych. Nasz dane wykazały, że 1,5% kobiet i 2,5% mężczyzn miało pozytywny wynik testu na COVID-19. Liczba zakażonych pacjentów rosła stopniowo w okresie od października 2020 r. do stycznia 2021 w związku ze wzrostem liczby zachorowań.

Wnioski: Z grupy 1242 pacjentów 236 (19,0%) kobiet i 231 (18,6%) mężczyzn przyjęto do szpitala na procedurę diagnostyczną, a 310 (25,0%) kobiet i 465 (37,4%) mężczyzn – na planowy zabieg chirurgiczny. Testy przesiewowe na zakażenie SARS-CoV-2 przeprowadzone u wszystkich tych pacjentów umożliwiły wyłączenie z hospitalizacji z hospitalizacji pacjentów z wynikiem pozytywnym, dzięki czemu ograniczyliśmy transmisję wirusa, a jednocześnie mogliśmy wywiązać się z kontraktu.

Słowa kluczowe: badania przesiewowe • zakażenie SARS-CoV-2 • hospitalizacja

Introduction

SARS-CoV-2 is the second Severe Acute Respiratory Syndrome Coronavirus 2. It belongs to the coronavirus group and is a positive-sense single-stranded RNA (+ssRNA) virus which causes severe respiratory disease (COVID-19). It is one of seven known human pathogenic species in this group of viruses [1–3].

The first cases of human infection with this virus were reported in late 2019 in the city of Wuhan in eastern China [4]. The virus is transmitted via airborne respiratory droplets and in some patients causes severe pneumonia and acute respiratory distress syndrome, requiring mechanical ventilation. SARS-CoV-2 is an enveloped virus with each virion largely spherical in shape, although somewhat pleomorphic, with a diameter of 60–140 nm. It is surrounded by prominent spikes 9–12 nm long, giving it a crown-like appearance. The length of the genome ranges from 29,867 to 29,903 nucleotides, with the exact number depending on the source. Like other coronaviruses it is one of the largest RNA viruses, both in terms of genome length and virion size [5].

The SARS-CoV-2 genome encodes nonstructural proteins needed for replication, structural proteins, and accessory proteins. Like other coronaviruses, SARS-CoV-2 has four structural proteins [6]: S (spike), a fusion protein or surface glycoprotein responsible for interacting with a receptor on the cell surface; E (envelope), a coat protein responsible for virion formation; M (membrane), a membrane protein which is the main viral matrix protein; N (nucleocapsid), a nucleocapsid protein playing a protective role for a large RNA molecule and involved in modifying cellular processes and viral replication.

The N protein maintains the RNA genome and the S, E, and M proteins together form the viral envelope. The S glycoprotein is responsible for binding to the membrane of the host cell and is functionally differentiated into S1 and S2 subunits. The S1 subunit mediates binding to the host cell surface receptor and the S2 subunit mediates fusion with its cell membrane, with the virus then entering the cell via endocytosis.

Compared to the SARS and MERS viruses, the SARS-CoV-2 virus is less virulent and associated with a much lower mortality rate. However, it is far more infectious. The new virus is probably eradicated faster than that of SARS and MERS, although data on critical cases are inconclusive [7].

The SARS-CoV-2 virus can colonise and invade five physiological systems [8,9]: first, the respiratory system, causing acute atypical pneumonia and acute respiratory distress syndrome in severe cases; second the nervous system, where it induces neurological symptoms such as headache, nausea, confusion, disturbed consciousness, and in severe cases cerebrovascular diseases (in vivo studies report possible brainstem infection and loss of smell and taste due to affected olfactory and taste receptors); third, the gastrointestinal tract where it causes, among other things, diarrhoea and vomiting (studies have shown the presence of the virus in faeces); fourth, the urinary system, causing complications including acute kidney injury (tests have shown the presence of the virus in the urine); and fifthly the circulatory system, where it can contribute to acute heart failure.

The virus can induce an excessive immune response of the body, which is manifested by increased levels of the cytokines IL2, IL7, IL10, G-CSF, IP10, MCP1, MIP1A, and TNFα. In extreme cases, SARS-CoV-2 can lead to systemic infection (sepsis) and the viral RNA can enter the bloodstream (viremia). Infection with the virus is non-specific and may be asymptomatic or have mild symptoms, and the respiratory system is usually the primary route of infection. However, colonisation factors still have not been fully explained.

On 20 January 2020, the National Health Commission of the Republic of China announced that human-to-human transmission of the virus was possible, especially when two people are in close contact. It is believed to spread similarly to other respiratory disease pathogens via droplets. The virus has been detected in nasopharyngeal secretions, sputum, urine, stool, tears, and blood [10,11]. Studies have shown high viral loads on textiles and objects in the bedrooms and bathrooms of coronavirus-infected people.

On the basis of quantitative RT-PCR analyses of the nasopharynx, Chinese researchers concluded that the virus, like influenza, can be transmitted by inhalation. In 17 patients with disease symptoms, the viral load was higher in the nose than in the pharynx, which implies that the virus had already replicated in the upper respiratory tract. Only when it has reached deeper areas of the lungs can it fuse with host cells and multiply by binding to the ACE2 membrane receptor (angiotensin-converting enzyme 2 or kininase II) via the receptor binding domain encoded in the S fusion protein (the spike).

The incubation period is the time between infection with the virus and onset of disease and can be up to 14 days. There is some evidence that the virus is infectious during incubation, which would distinguish it from SARS. However, there is no consensus as to whether asymptomatic and pre-symptomatic patients transmit the virus. Viral load is the highest in the first week of the disease and then gradually drops, suggesting that the early stages of the disease are the most transmissible [10].

During the SARS-CoV-2 pandemic, the situation was similar in many different hospitals and in many different

departments, but ENTs and anesthesiologists were particularly vulnerable. Screening tests for SARS-CoV-2 infection are designed to disqualify infected patients from hospitalization. At the same time, hospitals have contracts with the Polish National Health Fund for fixed numbers of procedures per week. The available literature does not set out how these two requirements can be reconciled.

This study analysed results of screening tests for SARS-CoV-2 infection in patients scheduled for a diagnostic procedure or elective surgery for otorhinolaryngological reasons during 10 months of the pandemic based of our own material.

Material and methods

The study was conducted on 546 women, aged 18–94 years (mean age 55.4 years), and 696 men, aged 18–87 years (mean age 51.7 years), who were scheduled for hospitalisation in the Department of Otolaryngology, Laryngological Oncology, Audiology and Phoniatrics at the Military Medical Academy University Teaching Hospital – Central Veterans' Hospital in Lodz, between 1 May 2020 and 28 February 2021.

PCR and antigen tests for the SARS-CoV-2 virus were performed on all patients. First, an antigen test was performed for the presence of SARS-CoV-2 virus. If the result was negative, it was necessary to order a PCR test. At the time of screening, the patients were asymptomatic. A negative result was a prerequisite for admission to the department in order to undergo a diagnostic procedure or surgery.

The study was retrospective and did not require the approval of the bioethics committee.

Results

SARS-CoV-2 virus testing was performed on 546 women (44.0%) and 696 men (56.0%). As shown in **Table 1**, the women were mostly aged 51–60 years or 61–70 years (91 cases or 7.3% and 131 or 10.5%, respectively). The majority of males was aged 18–30 years or 31–40 years (131 cases or 10.5% and 150 or 12.1%, respectively).

The one-day diagnostic procedures related to audiological, otoneurological, phoniatric, or imaging examinations. The surgical procedures were planned otolaryngology procedures or first-line oncological procedures.

Positive COVID-19 results were obtained in 18 (1.5%) women and 31 (2.5%) men. Detailed results of patients tested for the SARS-CoV-2 virus during the selected period of the pandemic are shown in **Table 2**.

Table 1. Patients scheduled for hospitalisation during the selected period of the COVID-19 pandemic according to age and gender

Age (years)	18–30		31–40		41–50		51–60		61–70		Over 70		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Women	84	6.8	84	6.8	83	6.7	91	7.3	131	10.5	73	5.9	546	44.0
Men	131	10.5	150	12.1	125	10.1	106	8.5	118	9.5	66	5.3	696	56.0
Total	215	17.3	234	18.9	208	16.8	197	15.8	249	20.0	139	11.2	1242	100.0

Table 2. Patients scheduled for hospitalisation during the selected period of the COVID-19 pandemic according to COVID-19 test result and gender

Month of study	Positive result of COVID-19				Negative result of COVID-19			
	Women		Men		Women		Men	
	n	%	*n*	%	*n*	%	*n*	%
May 2020	2	2.8	2	2.8	21	29.1	47	65.3
June 2020	1	0.7	1	0.7	62	42.2	83	56.4
July 2020	1	0.6	–	–	91	51.1	86	48.3
August 2020	–	–	–	–	56	41.2	80	58.8
September 2020	1	0.7	2	1.4	57	41.4	78	56.5
October 2020	2	1.6	5	4.0	58	46.8	59	47.6
November 2020	2	5.4	2	5.4	14	37.8	19	51.4
December 2020	5	3.6	6	4.3	56	40.6	71	51.5
January 2021	2	1.3	9	5.9	59	38.6	83	54.2
February 2020	2	1.7	4	3.4	54	45.4	59	49.5
Total	18	1.5	31	2.5	528	42.4	665	53.6

Table 3. COVID-19 positive patients scheduled for hospitalisation during the selected period of the pandemic according to age and gender

Age range (years)	18–30		31–40		41–50		51–60		61–70		Over 70		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Women	4	8.2	1	2.0	–	–	3	6.1	8	16.3	2	4.1	18	36.7
Men	6	12.2	4	8.2	–	–	2	4.1	16	32.7	3	6.1	31	63.3
Total	10	20.4	5	10.2	–	–	5	10.2	24	49.0	5	10.2	49	100.0

Table 4. COVID-19 positive patients scheduled for hospitalisation during the selected period of the pandemic according to age and month of the pandemic

Age range (years) Month of study	18–30		31–40		41–50		51–60		61–70		Over 70		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
May 2020	2	4.1	–	–	–	–	–	–	2	4.1	–	–	4	8.2
June 2020	–	–	–	–	–	–			2	4.1	–	–	2	4.1
July 2020	–	–	–	–	–	–	–	–	1	2.0	–	–	1	2.0
August 2020	–	–	–	–	–	–	–	–	–	–	–	–	–	–
September 2020	1	2.0	–	–	–	–	–	–	2	4.1	–	–	3	6.1
October 2020	–	–	2	4.1	–	–	2	4.1	3	8.1	–	–	7	14.2
November 2020	2	4.1	–	–	–	–	1	2.0	1	2.0	–	–	4	8.2
December 2020	2	4.1	1	2.0	–	–			6	12.3	2	4.1	11	22.5
January 2021	2	4.1	2	4.1	–	–			5	10.2	2	4.1	11	22.5
February 2020	1	2.0	–	–	–	–	2	4.1	2	4.1	1	2.0	6	12.2
Total	10	20.4	5	10.2	–	–	5	10.2	24	50.0	5	10.2	49	100.0

Table 3 shows that positive COVID-19 results most often were obtained in women aged 61–70 years (8 cases, 16.3%), while in men they were found most often in those aged 61–70 years (16 cases, 32.7%) or 18–30 years (6 cases, 12.2%).

Detailed results regarding the occurrence of a positive result for COVID-19 in the examined period of the pandemic, depending on age, are presented in **Table 4**.

Discussion

All medical personnel, including paramedics, nursing staff, but particularly anaesthetists, otolaryngologists, and other specialists, were susceptible to COVID-18 infections due to virus transmission. During the first days of COVID-19 infection, upper respiratory tract symptoms, including olfactory and taste disturbances, occur most frequently [12–16]. As reported by Martínez et al. [12], 62.7% of sufferers had olfactory deterioration and 46% anosmia; some 59.5% reported disturbed taste perception and 45.2% ageusia. Risk factors most commonly associated with these disturbances were female sex, allergic rhinitis, and young age. The authors reported that the most common symptoms were nasal congestion and oozing of secretions down the posterior pharyngeal wall, without watery nasal discharge.

Chronologically, during the pre-pandemic period combatting COVID-19 infection involved the following steps. 8 March 2020, recommendation of cancellation of some mass events by the Chief Sanitary Inspectorate. 11 March 2020, imminent suspension of school activities. 12 March 2020, suspension of school activities (but children are allowed to come to school). 15 March 2020, closure of Polish borders to air and rail traffic. 16 March 2020, complete closure of schools. 20 March 2020, Declaration of an epidemic. 25 March 2020, restrictions on travelling. 1 April 2020, further restrictions (closed forests, parks, beaches, etc.).

Thus, at the end of the third week in March 2020, the operation of the Department of Otolaryngology was suspended by the hospital management. Patients were admitted to the department only due to life-threatening conditions or oncological indications. After a month, during which the Department of Otolaryngology provided limited health services, a screening programme for COVID-19 in patients scheduled for hospitalisation was developed.

Consequently, 546 (44.0%) women and 696 (56.0%) men were screened for SARS-CoV-2 between 1 May 2020 and 28 February 2021. The majority of women were aged 51–60 years or 61–70 years (7.3% and 10.5%, respectively). For males, the patients were mostly aged 18–30 years or 31–40 years (10.5% and 12.1%, respectively). During the study

period, 236 (19.0%) women and 231 (18.6%) men were tested for a diagnostic procedure, while 310 (25.0%) women and 465 (37.4%) men were tested for elective surgery.

In each month, a similar number of tests were performed, which was related to the contract signed with the National Health Fund. The department decided to qualify a higher number of patients for a surgical procedure in a given week, so as to be able to perform the previously arranged number of surgical treatments in case a patient scheduled for the procedure was COVID-19 positive.

In November 2020, fewer patients were tested for COVID-19. This was because the department was closed for 2 weeks due to a high number of COVID-19 infections in the medical personnel.

The results show that 1.5% of women and 2.5% of men were COVID-19 positive. The number of infected patients increased gradually from October 2020 to January 2021, which was related to an increase in morbidity in Poland.

According to government data [17], the daily number of infections in Poland (and the number of tests performed during the selected pandemic period) were as follows: 4 May 2020 – 313 (350,048); 3 June 2020 – 292 (881,907); 5 July 2020 – 231 (1,639,370); 5 August 2020 – 640 (2,027,951); 5 September 2020 – 691 (2,723,162); 5 October 2020 – 2,006 (3,325,513); 4 November 2020 – 24,692 (4,779,914); 6 December 2020 – 9,176 (6,432,494); 4 January 2021 – 4432 (7,119,350); 6 February 2021 – 5,965 (8,593,146). According to the current Coronavirus Report of 28 September 2022, a total of 37,336,791 tests have been performed since the beginning of the pandemic [17].

In the present study, 16.3% of women aged 61–70 years as well as 32.7% and 12.2% of men aged 61–70 years and 18–30 years, respectively, were COVID-19 positive.

There were five major waves of infection. At the peak of each the following numbers of infected people were recorded: wave I, 21 August 2020 (903); wave II, 7 November 2020 (27,875); wave III, 31 March 2021 (32,874); wave IV, 1 December 2021 (29,064); wave V, 27 January 2022 (57,659). On 28 March 2022, the Polish government lifted most restrictions that applied to entrepreneurs. Now, only restrictions that prevent an epidemic, i.e. those that combat virus transmission, are still in effect [17]. Isolation for the infected, quarantine for householders and visitors arriving in Poland, as well as the obligation to wear masks in public enclosed spaces still have to be observed.

Vaccination against COVID-19 is the best prophylaxis. In Poland, a total of 56,731,878 vaccines were administered up to 29 September 2022. Some 22,785,552 people received the first dose, 19,733,671 two doses, and 22,560,209 people have been fully vaccinated, a figure that represents 59.7% of all Poles.

Unfortunately, the COVID-19 pandemic provided the opportunity for further advancement of disease in oncology patients, and therefore less effective treatment options. Many patients with malignant neoplasms of otolaryngology organs were more afraid of the virus than of the consequences of neoplastic disease, and therefore did not choose hospitalization and treatment.

Conclusions

During the analysed period, pandemic testing for the SARS-CoV-2 virus showed that our tested women were mostly aged 51–60 years and 61–70 years (7.3% and 10.5%, respectively). The majority of men were aged 18–30 years and 31–40 years (10.5% and 12.1%, respectively).

During the analysed period, 236 (19.0%) women and 231 (18.6%) men were tested for a diagnostic procedure, while 310 (25.0%) women and 465 (37.4%) men were tested for elective surgery, which was related to our contract with the Polish National Health Fund.

Testing showed that 1.5% of women and 2.5% of men were COVID-19 positive. The number of infected patients increased gradually from October 2020 to January 2021, which was related to an increase in morbidity in Poland.

Screening tests for SARS-CoV-2 infection in patients hospitalized in our clinic allowed us to disqualify patients from hospitalization if they showed a positive result. This limited transmission of the virus while still fulfilling our contract.

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