Original paper

The activities of a rural hospital located in south-eastern Poland during the COVID-19 pandemic

Działalność szpitala z regionu wiejskiego położonego w południowo-wschodniej Polsce podczas pandemii COVID-19

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Key words: COVID-19, rural hospital, activities during pandemic.

Słowa kluczowe: COVID-19, wiejski szpital, działalność medyczna.

Abstract

Introduction: During the COVID-19 pandemic, hospitals had to made enormous efforts to reorganise medical assistance.
Aim of the research: The assessment of the activities of an entire rural hospital during the COVID-19 pandemic.
Material and methods: The number of hospitalisations in the individual departments, length of stay, the numbers of the major surgeries, reperfusion procedures, number of births, and in-hospital deaths in the periods between 1 March 2018 and 31 May 2019 (n = 24,437) and between 1 March 2020 and 31 May 2021 (n = 20,686) were compared.
Results: In the analysed pandemic period there were 798 patients with a SARS-CoV-2 infection, and 179 (22.4%) of them died. In the univariate analysis during the pandemic compared to the period before pandemic, the significant decrease in the number of hospitalisations both in operating ($p < 0.001$) and in conservative departments ($p < 0.001$) were recorded; however, these numbers varied from department to department, and the average length of hospital stay was statistically significantly shorter ($p < 0.001$). The multivariate analysis showed that in most departments there was a decrease of the number of hospitalised patients, except for the internal medicine ($p < 0.001$), neurosurgery ($p < 0.001$), neonatology ($p < 0.001$), and urology ($p < 0.001$) departments. The shorter hospital stay was also found in almost all departments, unlike the cardiology ($p < 0.001$) and daytime rehabilitation ($p < 0.001$) departments. Higher numbers of deaths in the cardiology ($p < 0.001$) and palliative care ($p < 0.001$) departments were reported.
Conclusions: The COVID-19 pandemic resulted in a reduction in the number of patients in hospital and shorter stays in most hospital departments.

Streszczenie

Wprowadzenie: W czasie pandemii COVID-19 szpitale musiały podjąć ogromny wysiłek, aby zreorganizować pomoc medyczną.
Cel pracy: Analiza działalności szpitala położonego w wiejskim regionie w czasie pandemii COVID-19.
Materiał i metody: Oceniono liczbę hospitalizacji na poszczególnych oddziałach, długość pobytu, liczbę zabiegów chirurgicznych, procedur reperfuzyjnych, liczbę urodzeń i zgonów wewnątrzszpitalnych w obu porównywanych okresach od 1 marca 2018 do 31 maja 2019 roku (n = 24 437) oraz od 1 marca 2020 do 31 maja 2021 roku (n = 20 686).
Wyniki: W analizowanym okresie pandemii zakażenie wirusem SARS-CoV-2 stwierdzono u 798 pacjentów, z czego 179 (22,4%) zmarło. W analizie jednoczynnikowej w czasie pandemii w porównaniu z okresem przed pandemią odnotowano istotną redukcję liczby hospitalizacji na oddziałach zarówno operacyjnych ($p < 0,001$), jak i zachowawczych ($p < 0,001$), przy czym wielkości te różniły się w zależności od oddziału. Średni czas pobytu w szpitalu był statystycznie istotnie krótszy niż w poprzednim okresie ($p < 0,001$). Analiza wieloczynnikowa wykazała, że na większości oddziałów nastąpiło zmniejszenie liczby hospitalizowanych pacjentów, z wyjątkiem oddziału chorób wewnętrznych ($p < 0,001$), neurochirurgii ($p < 0,001$), neonatologii ($p < 0,001$) i urologii ($p < 0,001$). Krótszy pobyt w szpitalu stwierdzono także na prawie wszystkich oddziałach, w przeciwieństwie do oddziałów kardiologii ($p < 0,001$) i rehabilitacji dziennej ($p < 0,001$). Najwięcej zgonów odnotowano na oddziałach kardiologii ($p < 0,001$) i opieki paliatywnej ($p < 0,001$).
Wnioski: Pandemia COVID-19 spowodowała zmniejszenie liczby pacjentów hospitalizowanych i skrócenie pobytów w większości oddziałów szpitala.

Introduction

The new coronavirus pandemic (COVID-19) was the main global health crisis of our time. To cope with the increasing number of patients infected with SARS-CoV-2, hospitals made enormous efforts to reorganise medical assistance [1]. The medical staff had to face logistical problems related to critical changes in their work environment and hard personal life decisions [1]. Units for exclusive care of patients with COVID-19 were organised. Shortages of medical and nursing workforce, exacerbated by changes in the form of on-call work, shortages of appropriate personal protective equipment, and lack of relevant regulations disrupted the operation of many hospitals. Physicians and nurses were reallocated from their parent departments to other care-delivery environments [2–4]. Hospital staff experienced a variety of work-related stress and anxiety issues and the possibility of COVID-19 infection [5].

In most of the reports, hospital admissions for all major non-COVID-19 disease groups decreased during national lockdowns compared with the pre-pandemic baseline period [6–8].

The literature mainly comprised publications evaluating the operation of individual departments in hospitals, while there are few reports on the assessment of the work of entire hospitals during the COVID-19 pandemic. There is a particularly lack of such reports from Eastern European countries, in which it is known that the overall mortality during the COVID-19 pandemic period was high [9, 10].

Aim of the research

The aim of our study was the assessment of activities of an entire rural hospital located in south-eastern Poland during the COVID-19 pandemic in terms of the number of hospitalised patients, non-invasive and invasive medical procedures, and the number of births, comparing the period in question with the corresponding period in the previous year.

Material and methods

Study designed

We conducted a retrospective observational study based on the hospital registry of the Holy Spirit Specialist Hospital in Sandomierz. The hospital is located in a rural region and cares for a population of approximately 100,000, and in some specialist departments 250,000 patients. The hospital consists of 460 beds and has 20 departments, including 14 that provide a 24-hour stroke service 7 days a week and are equipped with monitoring and diagnostic facilities. Six of them are operating departments, and in 2 endovascular procedures are performed. The hospital in Sandomierz was not a hospital specifically dedicated to the treatment of patients with COVID-19, but it was a hospital in which patients with all diseases, including COVID-19, were admitted. The number of infected patients in all regions was so large that the infectious diseases hospitals and hospitals specially created to treat COVID-19 patients were unable to admit all those in need. Therefore, each time, more patients with COVID-19 had to treated in our community hospital. In the hospital throughout the pandemic, patients requiring conservative treatment were treated, and surgical and endovascular procedures were performed. To isolate patients with COVID-19, isolation rooms were set up in individual wards, and a buffer ward was created in which more seriously ill patients requiring intensive care were isolated. The care of these infected patients was provided by physicians from the home wards.

Patients admitted to the hospital acutely were examined by the Emergency Department's physician, who decided on consultations of another specialists. Patients underwent all necessary laboratory tests, radiographs, ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI). Individual diagnostic departments were divided into those dedicated to patients infected with the SARS-CoV-2 virus and those who were uninfected, while in the CT Department and MRI Department special hours were set for infected patients. This did not apply to patients requiring immediate diagnosis.

Definition of patients with SARS-CoV-2

At the beginning of the pandemic, patients were enrolled in the study based on clinical symptoms. When the pandemic progressed, only patients with a positive test result performed on admission or during hospitalisation made up the study group.

Study population

The data of all consecutive patients admitted to the hospital in Sandomierz between 1 March 2018 and 31 May 2019 and between 1 March 2020 and 31 May 2021 were analysed. The number of hospitalisations in the individual departments, length of stay, the major surgical procedures, the reperfusion procedures, number of births, and in-hospital deaths in both periods were compared.

Statistical analysis

This study was based on a retrospective database analysis. Gathering and characteristics of data were performed using Microsoft Excel 2019. Statistical analysis was performed with R v. 4.1.3. implemented in RStudio 2023 v. 06.1 and custom C-language program CONTAB implemented in Microsoft Visual Studio Community 2019 v.16.11.11 IDE, Ó 2021 Microsoft Corporation, due to 2 different classes of gathered data. The first were data with detailed information about each patient, and the second were collective data gathered for particular hospital departments or for specific hospital activities.

The data gathered for each patient were analysed using RStudio program. All continuous variables were tested for normal distribution and equality of variance. Because of the non-normality of the variables, non-parametric Wilcoxon-Mann-Whitney *U* tests were used to perform univariate analysis of the continuous variables. Categorical data were compared using Pearson's χ^2 tests; *p*-values < 0.05 were considered statistically significant. The multivariate analysis was performed using multiple logistic regression models in R (RStudio) for factors that were identified in the univariate analysis with a *p*-value < 0.01. Each model was created by carrying out preliminary tests for correlations among predictors variables, for exclusion of multicollinearity problems. However, the multivariate analysis for collective data was performed using contingency table analysis instead of multiple logistic regression analysis. It was performed by using RStudio and CONTAB software.

Results

In the period from 1 March 2020 to 30 May 2021 in the Holy Spirit Specialist Hospital in Sandomierz 20,456, and in the comparable period before the pandemic from 1 March 2018 to 31 May 2019 – 24,057 patients were treated (Table 1). In the analysed pandemic period there were 798 patients with SARS-CoV-2 infection, and 179 (22.4%) of them died. During the analysed pandemic period, there were 880 deaths in all hospital departments, which constituted 4.25%

Table 1. Hospital activities in the period before and during the first and second waves of the COVID-19 pandemic – number of hospitalisations

Variables	Tested time interval				
	1.03.2020–31.05.2021		1.03.2018–31.05.2019		*P*-value
	n	%	*n*	%	
Number of patients treated in hospital	20,686		24,439		
Number and percentage of patients treated in:					
Internal medicine department	1218	5.9	1186	4.9	**< 0.001**
Surgery department	1253	6.1	1776	7.3	**< 0.001**
Cardiology department	3015	14.6	3817	15.6	**0.002**
Neurology department	2453	11.9	3109	12.7	**0.006**
Neurosurgery department	1038	5.0	795	3.3	**< 0.001**
Gynaecology department	1899	9.2	2275	9.3	0.650
Neonatology department	640	3.1	626	2.6	**0.001**
Intensive care department	116	0.6	102	0.4	**0.034**
Laryngology department	208	1.0	705	2.9	**< 0.001**
Paediatric department	1124	5.4	1940	7.9	**< 0.001**
Urology department	2606	12.6	1744	7.1	**< 0.001**
Orthopaedic department	1051	5.1	1105	4.5	**0.005**
Psychiatry department	789	3.8	1213	5.0	**< 0.001**
Nephrology department	477	2.3	564	2.3	0.999
Paediatric nephrology department	918	4.4	1164	4.7	0.106
Rehabilitation department	418	2.0	464	1.9	0.369
Rheumatology department	838	4.1	1046	4.3	0.235
Palliative medicine department	257	1.2	388	1.6	**0.002**
Daytime rehabilitation department	278	1.3	306	1.3	0.413
Daytime psychiatry department	90	0.5	114	0.5	0.965
Number of patients depending on the type of department:					
Conservative departments	12631	61.1	16,039	65.6	**< 0.001**
Operating departments	8055	38.9	8400	34.4	**< 0.001**

Significant p-values are shown in bold font.

of all hospitalised patients compared to the analysed period before the pandemic – 847 (3.47%).

In univariate analysis during the pandemic compared to the period before pandemic, a significant decrease in the number of hospitalisations both in operating and in conservative departments was recorded; however, these numbers varied from department to department. Significantly more patients in the internal medicine, neurosurgery, neonatology, intensive care, and urology departments were hospitalised during the pandemic period than in the analysed period before pandemic. In turn, during the pandemic there were statistically significantly fewer patients in the surgery, cardiology, neurology, laryngology, paediatric, orthopaedic, psychiatry, and palliative care departments. There were no differences in the number of hospitalised patients between both analysed periods in gynaecology, nephrology, paediatric nephrology, rehabilitation, rheumatology, daytime rehabilitation, and daytime psychiatry departments.

In the univariate analysis the average length of stay in hospital was statistically significantly shorter during the pandemic than in the assessed previous period. Shorter hospital stays occurred in both daytime and inpatient departments. Among inpatient departments, shorter stays occurred mainly in operating departments. Shorter hospital stays during the pandemic concerned patients from gynaecology, neonatology, paediatric, urology, rehabilitation, rheumatology, and daytime psychiatry departments; however, in the cardiology and daytime rehabilitation departments the length of stay in hospital was longer than in the period before the pandemic. There was no difference in the length of stay in hospital during the both analysed periods in internal medicine, surgery, neurology, neurosurgery, intensive care, laryngology, orthopaedic, psychiatry, nephrology, paediatric nephrology, and palliative care departments (Table 2).

The univariate analysis showed that during the pandemic, compared to the earlier period, significantly fewer operations were performed in the surgery department, while in the neurosurgery, urology, and orthopaedic departments there were significantly more surgical procedures during this period. There was no difference between both analysed periods in the number of surgical procedures in the gynaecology department, the number of reperfusion procedures in the cardiology and neurology departments, and in the number of natural births and Caesarean sections.

The number of in-hospital deaths was significantly higher during the pandemic, which mainly concerned the cardiology and palliative medicine departments (Table 3).

The multivariate analysis confirmed the higher number of patients treated during the pandemic compared with the number of patients before the pandemic in internal medicine, neurosurgery, neonatology, and urology department; in turn, fewer patients of surgery, laryngology, paediatric, orthopaedic, psychiatry, and palliative care medicine departments were noted. The multivariate analysis also showed the shorter length of stay in hospital during the pandemic than in the analysed period before pandemic in gynaecology, neonatology, paediatric, urology, rehabilitation, rheumatology, and daytime psychiatry departments and longer length of stay in cardiology and daytime rehabilitation departments.

The multivariate analysis showed a higher number of operations in neurosurgery and urology departments and a smaller number in surgery department during the pandemic, and a higher number of deaths in the cardiology and palliative care departments compared to the analysed period before the pandemic (Table 4).

Discussion

COVID-19 significantly affected the use of health care worldwide and, consequently, admissions to hospital patients requiring treatment of diseases other than SARS-CoV-2 infection. Hospital activity in this area was limited, especially in the first months of the pandemic.

The results of our study showed a lower number of hospitalised patients during the analysed period of the pandemic compared to the earlier period. This situation was influenced not only by the health care organisation not adapted to the pandemic, but also by measures taken to prevent the spread of COVID-19 infection, incorrect orders, especially regarding the isolation of potentially infected people, and people's fear of infection.

Reports of fewer hospitalised patients during the first waves of the COVID-19 pandemic came from many countries. A retrospective serial cross-sectional study in 9 UK hospitals showed that compared with before the first UK COVID-19 case (31 January 2020), activity declined across diseases and specialties between the first case and lockdown (total ED attendances relative reduction 6% and total hospital admissions 4%) [11]. Analysis of a population-based healthcare register that encompass the entire Danish population showed that compared with the pre-pandemic baseline period the overall hospital admission rate for non-COVID-19 conditions decreased by 30% after the first national lockdown [6]. Among the population in 2 Italian Regions, Tuscany and Apulia, the overall mean non-COVID-19 hospital admission rate per 100,000 residents/week decreased to 77.3% during the second lockdown (November-December 2020) [12]. According to data from the Brazilian public health system, compared to 2019, in 2020 there was a 42% decrease in hospital admissions [13]. A sharp decline of acute care admissions to the largest tertiary care referral hospital, designated national referral centres for cardiac, cancer, and maternity hospital in the State of Qatar, during March 2020 (COVID-19 era)

Table 2. Hospital activities in the period before and during the first and second waves of the COVID-19 pandemic – length of stay in the hospital

Variables	Tested time interval		
	1.03.2020–31.05.2021	1.03.2018–31.05.2019	*P*-value
	Mean (SD)	Mean (SD)	
Length of stay in hospital	7.7 ±11.56	8.3 ±13.07	**< 0.001**
Length of stay in hospital in:			
Internal medicine department	10.5 ±7.53	10.2 ±7.08	0.321
Surgery department	8.8 ±10.31	8.4 ±11.17	0.363
Cardiology department	6.2 ±6.56	5.7 ±5.44	**< 0.001**
Neurology department	6.8 ±8.79	6.5 ±7.47	0.223
Neurosurgery department	4.5 ±3.79	4.7 ±4.21	0.209
Gynaecology department	4.5 ±4.27	5.6 ±5.17	**< 0.001**
Neonatology department	5.9 ±2.91	6.8 ±3.27	**< 0.001**
Intensive care department	17.9 ±16.42	25.7 ±42.90	0.086
Laryngology department	4.7 ±3.96	5.0 ±1.83	0.405
Paediatric department	4.3 ±2.86	6.2 ±3.43	**< 0.001**
Urology department	2.9 ±3.55	4.9 ±5.88	**< 0.001**
Orthopaedic department	6.7 ±6.70	7.1 ±7.65	0.267
Psychiatry department	28.2 ±33.47	25.7 ±36.93	0.113
Nephrology department	10.4 ±9.25	10.9 ±11.18	0.424
Paediatric nephrology department	3.2 ±1.41	3.3 ±1.25	0.506
Rehabilitation department	23.7 ±9.08	25.3 ±8.91	**0.010**
Rheumatology department	5.5 ±3.51	6.4 ±3.59	**< 0.001**
Palliative medicine department	18.2 ±25.61	17.7 ±21.84	0.780
Daytime rehabilitation department	21.7 ±5.94	19.8 ±3.47	**< 0.001**
Daytime psychiatry department	49.2 ±29.51	64.7 ±31.81	**< 0.001**
Length of stay depending on the type of department:			
Inpatient departments	7.3 ±11.02	7.9 ±12.33	**< 0.001**
Daytime departments	28.4 ±19.44	32.0 ±26.09	**0.026**
Conservative departments	9.3 ±13.61	9.3 ±14.84	0.978
Operating departments	4.0 ±6.14	6.2 ±7.53	**< 0.001**

SD – standard deviation; significant p-values are shown in bold font.

and January 2020 and March 2019 (pre-COVID-19 era) from 9% to 75% depending on the department was observed [14]. Data obtained from the Africa Health Research Institute (AHRI), located in a subdistrict of northern KwaZulu-Natal, uMkhanyakude District in South Africa, reported that the daily number of infants admitted to Hlabisa Hospital from 1 January 2020 to 20 October 2020 reduced by 37%, and for children aged 1–5 years by 57% [15].

In our material during the pandemic more patients were treated in internal medicine, neonatology, and 2 operative departments: neurosurgery and urology. The increase in hospitalisations in the above-mentioned surgical departments was unusual in the first months of the pandemic; most reports indicated a sharp decline of patients in surgical departments for adults [14, 16–19], also in paediatric surgical wards [20].

We also found a shorter length of stay of patients in most departments of the hospital during the pandemic. In this study we did not assess the length of stay of COVID-19 patients, but we examined the length

Table 3. Hospital activities in the period before and during the first and second waves of the COVID-19 pandemic – number of major surgical procedures, reperfusion therapy, births, and deaths

Parameter	Tested time interval				
	1.03.2020–31.05.2021		1.03.2018–31.05.2019		*P*-value
	n	%	*n*	%	
The major surgical procedures:					
All major surgical procedures:	3886		3479		
Surgery department	544	14.0	843	24.0	**< 0.001**
Neurosurgery department	1029	26.5	769	22.1	**< 0.001**
Gynaecology department	696	17.9	681	19.6	0.072
Urology department	993	25.6	566	16.3	**< 0.001**
Orthopaedic department	624	16.1	620	17.9	**0.047**
The reperfusion procedures:					
All reperfusion procedures:	1080		1005		
Cardiology department	972	90.0	906	90.1	0.968
Neurology department	108	10.0	99	9.9	0.968
Births:	636		624		
Natural births	229	36.0	237	38.0	0.504
Caesarean section	407	64.0	387	62.0	0.504
In-hospital deaths:					
All in-hospital deaths	880	4.25	847	3.47	**< 0.001**
In-hospital deaths in:					
Internal medicine department	175	19.8	156	18.4	0.468
Surgery department	77	8.7	77	9.1	0.876
Cardiology department	147	16.7	88	10.4	**< 0.001**
Neurology department	127	14.4	122	14.4	0.999
Neurosurgery department	8	0.9	12	1.4	0.449
Intensive care department	90	10.2	80	9.4	0.636
Urology department	9	1.0	12	1.4	0.600
Orthopaedic department	14	1.6	6	0.7	0.136
Psychiatry department	6	0.7	6	0.7	0.999
Nephrology department	68	7.7	45	5.3	0.053
Palliative medicine department	159	18.0	243	28.6	**< 0.001**
In-hospital deaths depending on the type of department:					
Conservative departments	770	87.5	740	87.4	0.995
Operating departments	110	12.5	107	12.6	0.995

Significant p-values are shown in bold font.

of stay of patients in individual medical specialties during the pandemic and compared it with the pre-pandemic period.

The shortening of hospital stays in patients treated for diseases other than COVID-19 has been reported in many publications [6, 14]. A post-hoc analysis of a multicentre retrospective study of trauma patients presenting to 11 American Colleges of Surgeons Level-I and II trauma centres in Southern California from 19 March 2019 to 30 June 2019, and from 19 March 2020 to 30 June 2020 showed decreased length of hospital stay and intensive care unit admissions for non-

Table 4. Multivariate analysis showing types of department with changing number of patients, extending and shortening the hospital stay, increasing and reducing the number of procedures, and increasing in-hospital deaths

Variables	OR	95% CI	*P*-value
Changing the number of patients:			
Internal medicine department	1.24	1.13–1.36	**< 0.001**
Surgery department	0.85	0.78–0.93	**< 0.001**
Cardiology department	0.95	0.89–1.02	0.178
Neurology department	0.95	0.89–1.03	0.191
Neurosurgery department	1.58	1.42–1.75	**< 0.001**
Gynaecology department	1.00	0.93–1.09	0.851
Neonatology department	1.23	1.09–1.39	**< 0.001**
Laryngology department	0.36	0.30–0.42	**< 0.001**
Paediatric department	0.69	0.64–0.76	**< 0.001**
Urology department	1.80	1.67–1.95	**< 0.001**
Orthopaedic department	0.88	0.79–0.96	**0.005**
Psychiatry department	0.79	0.71–0.87	**< 0.001**
Palliative medicine department	0.80	0.68–0.94	**0.008**
Daytime rehabilitation department	1.10	0.93–1.30	0.287
Daytime psychiatry department	0.96	0.72–1.26	0.736
Changing of time of the in-hospital stay:			
Cardiology department	0.50	0.47–0.53	**< 0.001**
Gynaecology department	2.17	2.00–2.38	**< 0.001**
Neonatology department	2.04	1.75–2.33	**< 0.001**
Paediatric department	2.08	1.89–2.27	**< 0.001**
Urology department	5.00	4.35–5.56	**< 0.001**
Rehabilitation department	49.97	35.9–69.53	**< 0.001**
Rheumatology department	1.36	1.23–1.50	**< 0.001**
Daytime rehabilitation department	0.009	0.005–0.016	**< 0.001**
Daytime psychiatry department	25.71	15.42–42.87	**< 0.001**
Increasing the number of procedures:			
Major surgical procedures:			
Surgery department	0.48	0.39–0.59	**< 0.001**
Neurosurgery department	1.27	1.02–1.56	**< 0.001**
Urology department	1.79	1.45–2.17	**< 0.001**
Orthopaedic department	1.17	0.95–1.44	0.068
In-hospital deaths:			
Cardiology department	2.13	1.28–3.57	**< 0.001**
Nephrology department	0.61	0.37–1.00	0.055
Palliative care medicine department	2.50	1.51–4.12	**< 0.001**

Significant p-values are shown in bold font.

COVID-19 blunt trauma patients during the pandemic [21]. A systemic review by Seidu *et al.* reported shorter length of hospital stay during the pandemic than before the pandemic (1–8 vs. 2–12 days) in patients with cardioembolic diseases [22]. In many surgical centres, attention was paid to a significant shortening of hospital stay after surgical procedures [23–25]. However, in some medical wards, patients were hospitalised longer during the pandemic than before, as reported by, among others, Park *et al.* in stroke patients [26]. Also, cancer patients required longer hospital stays [27].

The higher number of operations in neurosurgery and urology departments cannot be explained other than by good organisation of the hospital's work and the introduction of special local guidelines. At the time there were no nationwide pandemic guidelines prepared for most departments, including operational ones. Such recommendations were introduced only after several months of the pandemic [28].

In most neurosurgical and urological departments the number of surgeries decreased [29–31]. This was confirmed in a systematic review by Airth *et al.* assessing the work of hospitals performing neuro-oncological procedures in children and adults [32]. Data from 27 urological centres in Italy showed a decrease in the number of patients with urgent/emergent urological disease [33]. According to information resulting from a survey sent by the American Confederation of Urology, among residents of South, Central, and North America, only 60.9% of the planned ones attended urgent surgeries. However, centres with fewer urological beds (10–20) compared to centres with more urological beds (31–40) more frequently performed major urologic cancer surgeries [34].

In our analysed group higher numbers of deaths in the cardiology and palliative care departments were found. In the palliative department of our hospital, only cancer patients in the final stages of the disease are treated. Omar *et al.* demonstrated that the cardiac injury group had significantly higher in-hospital mortality than the non-cardiac injury group. Also, comorbidities were more frequently reported in non-surviving patients [35]. The data from 5 centres about in-hospital mortality following percutaneous interventional procedures during the COVID-19 pandemic period compared to the non-pandemic period showed that it more than doubled [36]. The meta-analysis by Cannata *et al.* showed that in-hospital mortality among patients admitted with cardiovascular diseases increased compared with periods outside the pandemic, independent of co-infection with COVID-19. This effect was greater in studies with the greatest decline in admission rates, suggesting a sicker cohort of patients in this period [37].

Higher in-hospital mortality rates among palliative care unit patients and cancer patients requiring palliative care treated in other departments were confirmed in multiple observational studies [38–40].

Our study showed the organisation and work of a community hospital located in a rural region in the first months of the COVID-19 pandemic. The activities of individual departments varied, but the activity of the entire hospital, based on indicators, should be assessed positively against the background of the lack of guidelines, and lack of protective equipment and medicines. However, the present study has significant limitations. Firstly, it was a single-centre observational study – although data collection was conducted in a prospective study, the analysis was retrospective. Secondly, the population of the study consisted only of Caucasian patients. Thirdly, the structures of hospitals in terms of departments, number of beds, and number and structure of the population they care for significantly differ and are difficult to compare. It is much easier to present the activities of individual departments.

Conclusions

Based on the results of our analysis, we conclude that the COVID-19 pandemic resulted in a reduction in the number of patients in hospital and shorter stays. However, in some departments, planned treatment of patients was continued without interruption, which made it possible to perform more operations than in the previous period. Mortality was highest in departments treating patients with acute cardiovascular disorders and terminal cancer.

Our analysis becomes important in the face of a rapidly developing new wave of the SARS-CoV-2 infection pandemic, for which the health care system in our country is once again unprepared.

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Conflict of interest

The authors declare no conflict of interest.

References

1. Jiménez-García S, de Juan Pérez A, Pérez-Cañaveras RM, Vizcaya-Moreno F. Working environment, personal protective equipment, personal life changes, and well-being perceived in Spanish nurses during COVID-19 pandemic: a cross-sectional study. Int J Environ Res Public Health. 2022; 19(8): 4856.
2. Haffer H, Schömig F, Rickert M, Randau T, Raschke M, Wirtz D, Pumberger M, Perka C. Impact of the COVID-19 pandemic on orthopaedic and trauma surgery in university hospitals in Germany: results of a nationwide survey. J Bone Joint Surg Am. 2020; 102(14): e78.

3. Santos JLGD, Menegon FHA, Andrade GB, Freitas EO, Camponogara S, Balsanelli AP, Erdmann AL. Changes implemented in the work environment of nurses in the COVID-19 pandemic. Rev Bras Enferm. 2021; 75 (Suppl 1): e20201381.
4. Catania G, Zanini M, Hayter M, Timmins F, Dasso N, Ottonello G, Aleo G, Sasso L, Bagnasco A. Lessons from Italian front-line nurses' experiences during the COVID-19 pandemic: a qualitative descriptive study. J Nurs Manag. 2021; 29(3): 404-411.
5. Mattila E, Peltokoski J, Neva MH, Kaunonen M, Helminen M, Parkkila AK. COVID-19: anxiety among hospital staff and associated factors. Ann Med. 2021; 53(1): 237-246.
6. Bodilsen J, Nielsen PB, Søgaard M, Dalager-Pedersen M, Speiser LOZ, Yndigegn T, Nielsen H, Larsen TB, Skjøth F. Hospital admission and mortality rates for non-covid diseases in Denmark during COVID-19 pandemic: nationwide population based cohort study. BMJ. 2021; 373: n1135.
7. Härter M, Bremer D, Scherer M, von dem Knesebeck O, Koch-Gromus U. Auswirkungen der COVID-19-Pandemie auf die klinische Versorgung, Arbeitsprozesse und Mitarbeitenden in der Universitätsmedizin: Ergebnisse einer Interviewstudie am UKE [Impact of COVID-19-pandemic on Clinical Care, Work Flows and Staff at a University Hospital: Results of an Interview-study at the UKE]. Gesundheitswesen. 2020; 82(8-09): 676-681.
8. Ayyaz M, Butt UI, Umar M, Khan WH, Kashif MR, Hyidar Z. Effect of COVID-19 on the Working of a Tertiary Care Hospital. J Coll Phys Surg Pak. 2020; 30(10): 164-167.
9. Villani L, Pastorino R, Ricciardi W, Ioannidis J, Boccia S. Inverse correlates of COVID-19 mortality across European countries during the first versus subsequent waves. BMJ Glob Health. 2021; 6(8): e006422.
10. Ylli A, Burazeri G, Wu YY, Sentell T. COVID-19 excess deaths in Eastern European countries associated with weaker regulation implementation and lower vaccination coverage. East Mediterr Health J. 2022; 28(10): 776-780.
11. Ball S, Banerjee A, Berry C, Boyle JR, Bray B, Bradlow W, Crawley R, Danesh J, Denniston A, Falter F, Figueroa JD, Hall C, Hemingway H, Jefferson E, Johnson T, King G, Lee KK, McKean P, Mason S, Mills NL, Pearson E, Pirmohamed M, Poon MTC, Priedon R, Shah A, Sofat R, Sterne JAC, Strachan FE, Sudlow CLM, Szarka Z, Whiteley W, Wyatt M; CVD-COVID-UK Consortium. Monitoring indirect impact of COVID-19 pandemic on services for cardiovascular diseases in the UK. Heart. 2020; 106(24): 1890-1897.
12. Mazzilli S, Scardina G, Collini F, Forni S, Gianolio G, Bisceglia L, Lopalco PL, Chieti A, Onder G, Vanacore N, Bonaccorsi G, Gemmi F, Tavoschi L. Hospital admission and mortality rates for non-Covid diseases among residents of the long-term care facilities before and during the pandemic: a cohort study in two Italian regions. Z Gesundh Wiss. 2023: 1-13. doi: 10.1007/s10389-023-01925-1.
13. Albuquerque DAR, Melo MDT, Sousa TLF, Normando PG, Fagundes JGM, Araujo-Filho JAB. Hospital admission and mortality rates for non-COVID-19 respiratory diseases in Brazil's public health system during the covid-19 pandemic: a nationwide observational study. J Bras Pneumol. 2023; 49(1): e20220093.
14. Butt AA, Kartha AB, Masoodi NA, Azad AM, Asaad NA, Alhomsi MU, Saleh HAH, Bertollini R, Abou-Samra AB. Hospital admission rates, length of stay, and in-hospital mortality for common acute care conditions in COVID-19 vs. pre-COVID-19 era. Public Health. 2020; 189: 6-11.
15. McIntosh A, Bachmann M, Siedner MJ, Gareta D, Seeley J, Herbst K. Effect of COVID-19 lockdown on hospital admissions and mortality in rural KwaZulu-Natal, South Africa: interrupted time series analysis. BMJ Open. 2021; 11(3): e047961.
16. Antony J, James WT, Neriamparambil AJ, Barot DD, Withers T. An Australian response to the COVID-19 pandemic and its implications on the practice of neurosurgery. World Neurosurg. 2020; 139: e864-e871.
17. Khalafallah AM, Jimenez AE, Lee RP, Weingart JD, Theodore N, Cohen AR, Tamargo RJ, Huang J, Brem H, Mukherjee D. Impact of COVID-19 on an Academic Neurosurgery Department: the Johns Hopkins experience. World Neurosurg. 2020; 139: e877-e884.
18. Munda M, Bosnjak R, Velnar T. Problematics of neurosurgical service during the COVID-19 pandemic in Slovenia. World J Clin Cases. 2022; 10(34): 12462-12469.
19. Rasyid N, Birowo P, Parikesit D, Rahman F. The impact of the COVID-19 pandemic on urology practice in Indonesia: a nationwide survey. Urol J. 2020; 17(6): 677-679.
20. Meybodi KT, Habibi Z, Nejat F. The effects of COVID-19 pandemic on pediatric neurosurgery practice and training in a developing country. Childs Nerv Syst. 2021; 37(4): 1313-1317.
21. Yeates EO, Grigorian A, Schellenberg M, Owattanapanich N, Barmparas G, Margulies D, Juillard C, Garber K, Cryer H, Tillou A, Burruss S, Penaloza-Villalobos L, Lin A, Figueras RA, Coimbra R, Brenner M, Costantini T, Santorelli J, Curry T, Wintz D, Biffl WL, Schaffer KB, Duncan TK, Barbaro C, Diaz G, Johnson A, Chinn J, Naaseh A, Leung A, Grabar C, Nahmias J. Decreased hospital length of stay and intensive care unit admissions for non-COVID blunt trauma patients during the COVID-19 pandemic. Am J Surg. 2022; 224(1 Pt A): 90-95.
22. Seidu S, Kunutsor SK, Cos X, Khunti K. Indirect impact of the COVID-19 pandemic on hospitalisations for cardiometabolic conditions and their management: a systematic review. Prim Care Diabetes. 2021; 15(4): 653-681.
23. Kudsi OY, Kaoukabani G, Friedman A, Bou-Ayash N, Bahadir J, Gokcal F. Impact of coronavirus disease 2019 on clinical outcomes of robotic cholecystectomy. Surg Laparosc Endosc Percutan Tech. 2023; 33(6): 592-595.
24. Korun O, Yurdakök O, Arslan A, Çiçek M, Selçuk A, Kılıç Y, Altın F, Şaşmazel A, Aydemir NA. The impact of COVID-19 pandemic on congenital heart surgery practice: an alarming change in demographics. J Card Surg. 2020; 35(11): 2908-2912.
25. Seetharam A, Ghosh P, Prado R, Badman BL. Trends in outpatient shoulder arthroplasty during the COVID-19 (coronavirus disease 2019) era: increased proportion of outpatient cases with decrease in 90-day readmissions. J Shoulder Elbow Surg. 2022; 31(7): 1409-1415.
26. Park D, Jeong E, Lee SY, Kim M, Hong DY, Kwon HD, Kim MC. Behavioral and disease-related characteristics of patients with acute stroke during the coronavirus disease pandemic. Healthcare (Basel). 2022; 10(4): 604.
27. Aboueshia M, Hussein MH, Attia AS, Swinford A, Miller P, Omar M, Toraih EA, Saba N, Safah H, Duchesne J, Kandil E. Cancer and COVID-19: analysis of patient outcomes. Future Oncol. 2021; 17(26): 3499-3510.

28. Arimappamagan A, Vilanilam G, Pandey P. Is elective neurosurgery justified during COVID-19 pandemic? Neurol India. 2021; 69(1): 21-25.
29. Khalafallah AM, Jimenez AE, Lee RP, Weingart JD, Theodore N, Cohen AR, Tamargo RJ, Huang J, Brem H, Mukherjee D. Impact of COVID-19 on an Academic Neurosurgery Department: the Johns Hopkins experience. World Neurosurg. 2020; 139: e877-e884.
30. Munda M, Velnar T, Bosnjak R, Zele T, Gradisnik L, Spazzapan P, Kos N, Kocivnik N, Benedicic M, Prestor B. COVID-19 and surgical practice in slovenia: managing the crisis in neurosurgery during the COVID-19 pandemic. Life (Basel). 2023; 13(10): 2095.
31. Sharma R, Garg K, Katiyar V, Alam I, Tandon V, Raheja A, Mishra S, Veerabhadraiah P, Suri A, Chandra PS, Kale SS. Analysis of neurosurgical cases before and during the coronavirus disease 2019 pandemic from a Tertiary-Care Centre in India. World Neurosurg. 2021; 152: e635-e644.
32. Airth A, Whittle JR, Dimou J. How has the COVID-19 pandemic impacted clinical care and research in Neuro-Oncology? J Clin Neurosci. 2022; 105: 91-102.
33. Porreca A, Colicchia M, D'Agostino D, Amenta M, Corsaro A, Zaramella S, Zegna L, Gallo F, Schenone M, Bozzini G, Calori A, Pastore AL, Al Salhi Y, Sciorio C, Spirito L, Varca V, Marenghi C, Greco F, Altieri VM, Verze P, Barba C, Antonelli A, Cerruto MA, Falabella R, Di Bello S, Leonardo C, Tufano A, Volpe A, Umari P, Parma P, Nidini M, Pini G, Borghesi M, Terrone C, Cacciamani GE, Sighinolfi MC, Busetto GM, Wennberg AM, Finocchiaro M, Falsaperla M, Oderda M, Ceruti C, Rocco B, Schiavina R, Bianchi L, Mari A, Di Maida F, Dalpiaz O, Celia A, Pirozzi M, Bove P, Iacovelli V, Cafarelli A, Cindolo L, Ferrari G, Gatti L, Pirola G, Annino F, Pucci L, Romagnoli D, Artibani W, Minervini A. Urology in the time of coronavirus: reduced access to urgent and emergent urological care during the coronavirus disease 2019 outbreak in Italy. Urol Int. 2020; 104(7-8): 631-636.
34. Autrán-Gómez AM, Tobia I, Molina RC, Covarrubias FR, Benzing F, Maruccia S, Reis LO, Lay RR, De la Reza MT, Torres FS, Porras AH, Rodríguez A. Exploring urological experience in the COVID-19 outbreak: American Confederation of Urology (CAU) Survey. Int Braz J Urol. 2020; 46 (Suppl. 1): 156-164.
35. Omar T, Karakayalı M, Perincek G. Assessment of COVID-19 deaths from cardiological perspective. Acta Cardiol. 2022; 77(3): 231-238.
36. Albani S, Vinhas H, Fuertes Ferre G, Basavarajaiah S, Khattak S, Tzanis G, Pizzato M, Toselli M, Khokhar AA, Musumeci G, Giannini F. Epidemiological findings on interventional cardiology procedures during the COVID-19 pandemic: a multi-center study. Indian Heart J. 2021; 73(5): 647-649.
37. Cannata A, Watson SA, Daniel A, Giacca M, Shah AM, McDonagh TA, Scott PA, Bromage DI. Impact of the COVID-19 pandemic on in-hospital mortality in cardiovascular disease: a meta-analysis. Eur J Prev Cardiol. 2022; 29(8): 1266-1274.
38. Moriyama D, Scherer JS, Sullivan R, Lowy J, Berger JT. The impact of COVID-19 surge on clinical palliative care: a descriptive study from a New York Hospital System. J Pain Symptom Manage. 2021; 61(3): e1-e5.
39. Linehan A, Fitzpatrick O, Cowzer D, Hennessy MA, Coyne ZL, Nolan A, Clarke M, Dhonaill RN, Hennessy BT, Morris PG, Grogan L, Breathnach O. COVID-19-related mortality in cancer patients in an Irish setting. Ir J Med Sci. 2022; 191(5): 2013-2018.
40. Lei H, Yang Y, Zhou W, Zhang M, Shen Y, Tao D, Wang L, Lei Q, Wang Y, Wu Y. Higher mortality in lung cancer patients with COVID-19? A systematic review and meta-analysis. Lung Cancer. 2021; 157: 60-65.

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