Changing patterns of urologic emergency visits and admissions during the COVID-19 pandemic: a retrospective, multicenter, nationwide study

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Submitted: 7 July 2020; **Accepted:** 28 July 2020
Online publication: 25 August 2020

Arch Med Sci 2021; 17 (5): 1262–1276
DOI: https://doi.org/10.5114/aoms.2020.98364

Abstract

Introduction: We aimed to examine the change in the number and severity of visits to the emergency departments (EDs) and subsequent admissions for urgent urologic conditions in the early stage of the coronavirus disease 2019 (COVID-19) pandemic in Poland.

Material and methods: We evaluated data from 13 urologic centers in Poland and compared the number of visits to the EDs and subsequent admis-

sions before and after the advent of COVID-19 in 2020, and before and after the escalating national restrictions. Furthermore, data on types of urologic complaints, crucial laboratory parameters, and post-admission procedures were analyzed.

Results: In total 1,696 and 2,187 urologic visits (22.45% decrease) and 387 and 439 urologic urgent admissions (11.85% decrease) were reported in given periods in 2020 and 2019, respectively. The year-over-year difference in daily mean visits was clear (36.1 vs. 46.5; $p < 0.001$). Declines were seen in all complaints but device malfunction. In 2020 daily mean visits and admissions decreased from 40.9 and 9.6 before lockdowns to 30.9 ($p < 0.001$) and 6.9 ($p = 0.001$) after severe restrictions, respectively. There was a trend towards more negative laboratory parameter profiles in 2020, with patients who visited the EDs after severe restrictions having twice as high median levels of C-reactive protein (15.39 vs. 7.84, $p = 0.03$).

Conclusions: The observed declines in ED visits and admissions were apparent with the significant effect of national lockdowns. Our results indicate that some of the patients requiring urgent medical help did not appear at the ED or came later than they would have done before the pandemic, presenting with more severe complaints.

Key words: coronavirus, COVID-19, urology, emergency, admissions, visits.

Introduction

The pandemic of coronavirus disease 2019 (COVID-19) has had a tremendous impact on healthcare utilization worldwide, including drastically reduced patient care-seeking for medical emergencies unrelated to COVID-19. In China, Italy, the UK, and the US, initial reports suggest a decrease in visits to emergency departments (EDs) and admissions for urgent cardiac and neurological conditions [1–5]. In Italy and Portugal, there is also evidence of a decrease in ED visits and admissions for urgent urologic conditions but mostly reported in studies of a single center or a short duration [6–10].

Poland, a Central European country of 38 million people, had an initial peak of 475 COVID-19 cases on April 5, 2020 and saw its healthcare infrastructure generally less disrupted by the surge of COVID-19 cases than many other countries. However, in the early stage of the pandemic, because healthcare resources must be preserved and nosocomial and community transmission must be limited [11], the Polish National Health Fund (obligatory public insurance) and other major healthcare organizations recommended postponing routine and elective procedures [12, 13], and the Polish government introduced an initial national lockdown on March 14, 2020 and additional severe restrictions on March 25, 2020 [14, 15]. In detail, from March 14, 2020 shopping malls, sports centers, bars, cinemas, and libraries were closed. Public gatherings of 50 or more people were banned. The most severe restrictions (e.g., bans on non-essential movements outside the home and gatherings of more than two people) were applied from March 25, 2020. Nevertheless, many urgent urologic conditions, such as gross hematuria, urinary retention, and acute scrotum, require prompt interventions and if untreated can lead to serious morbidity and mortality. Patients with such conditions must seek care even during the COVID-19 era.

In this retrospective, multicenter, nationwide study, we aim to examine the change in the number and severity of visits to the ED and subsequent admissions for urgent urologic conditions in the early stage of the COVID-19 pandemic in Poland. We hypothesize that the number of visits to the ED and subsequent admissions decreased with increased severity of reported conditions.

Material and methods

In this retrospective, multicenter, nationwide study, we analyzed all emergency visits and admissions for urologic complaints at 13 urologic centers in Poland. All of the EDs in the study provided 24-hour urology service. We compared (1) the number of visits to the ED and subsequent admissions and (2) the laboratory patterns of urologic conditions for these visits and admissions before and after the advent of COVID-19 in 2020 and before and after the state of epidemic threat (initial national lockdown) in Poland on March 14, 2020, and after the most severe restrictions as implemented on March 25, 2020. The specific period of COVID-19 in this study was from February 29, 2020 to April 15, 2020 (2 weeks before to 1 month after the initial national lockdown); a pre-COVID-19 reference period was selected as from February 28, 2019 to April 15, 2019 (Figure 1).

Due to heterogeneity in coding systems across institutions, we categorized urologic conditions into eight major groups by author consensus based on initial patient complaints, brief case descriptions, and reported the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) codes: renal colic, hematuria, urinary retention, urinary tract infection (UTI), device (urinary drainage tube) malfunction (e.g., nephrostomy tube dislocation, urinary catheter obstruction), acute scrotum, trauma, and others. We additionally collected patients' demographic and laboratory data, includ-

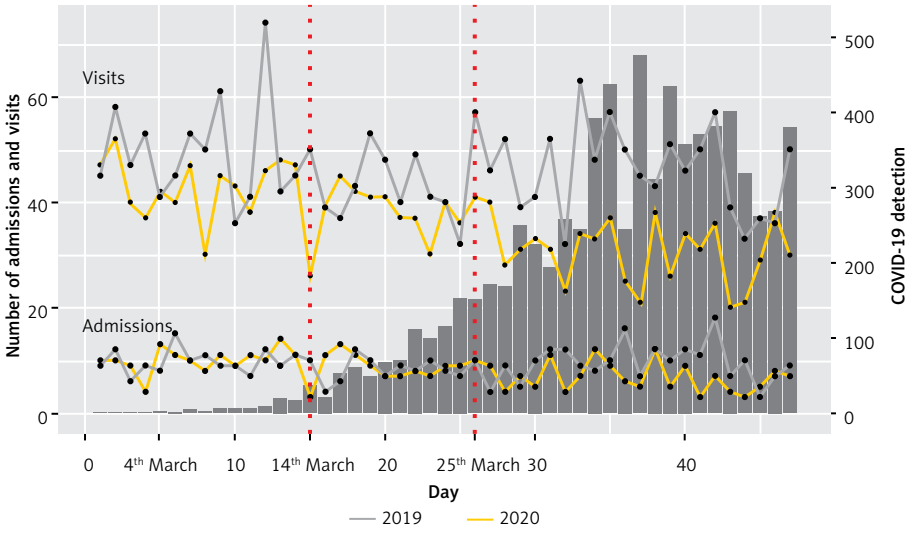

Figure 1. Emergency visits and admission in 2019 and 2020. Emergency visits and admissions due to all urological conditions in 2019 (grey) and 2020 (orange). Upper lines refers to visits, lower lines to admissions. In the background daily new COVID-19 cases in Poland. Day of introduction of the initial national lockdown (March 14, 2020) and more severe restrictions (March 25, 2020) are marked in red

ing C-reactive protein (CRP), hemoglobin (HGB), serum creatinine, and white blood count (WBC). Of note, because one center was transformed into a dedicated COVID-19 hospital on March 19, 2020, we censored data collected from this center (n = 81) up to March 18, 2019, and March 18, 2020 and did not include this center in analyzing the number of emergency visits and admissions before and after the lockdowns.

Statistical analysis

Continuous data are shown as median values with interquartile ranges (IQR) and categorical data are presented as absolute and relative frequencies (percentages), unless otherwise stated. Data were analyzed using nonparametric methods. Differences between two groups were determined using the Mann-Whitney U test. Associations between categorical variables were assessed using the χ^2 test. Two-sided p-values < 0.05 were considered statistically significant. Analyses were carried out using R software package version 4.0.1.

Results

In 47 days prior to April 15 at 13 urologic centers in Poland, we reported 1,696 ED visits for urological complaints in 2020, a 22.5% decrease from 2,187 in 2019, and 387 subsequent admissions in 2020, an 11.8% decrease from 439 in 2019. These changes corresponded to an increase in the admissions-to-ED-visits ratio from 20.1% in 2019 to 22.8% in 2020 (p = 0.04), as presented in Table I. The daily numbers of ED visits and admissions are depicted in Figure 1. Mean daily urology emergency visits decreased from 46.5 (95% confidence interval (CI): 44.0–49.1) visits in 2019 to 36.1 (95% CI: 33.8–38.4) visits in 2020 (p < 0.001). There was also a non-significant decrease in mean admissions from 9.3 (95% CI: 8.5–10.2) in 2019 to 8.2 (95% CI: 7.4–9.1) in 2020 (p = 0.13). Moreover, in 2020, a higher percentage of patients underwent urgent (within 24 h) surgical intervention after admission (72.89% vs. 81.14%, p = 0.006). In the 1 month after the national lockdown (Table II), we reported 32.8 (95% CI: 30.5–35.1) daily mean ED visits for urological complaints and 7.5 (95% CI: 6.5–8.5) mean subsequent admissions, in comparison to 40.9 (95% CI: 37.6–44.3) and 9.6 (95% CI: 8.2–10.9), respectively, in the 2 weeks before the national lockdown (p < 0.001 and p = 0.014, respectively). The declines were even greater after March 25, 2020 with daily mean visits and admissions decreasing to 30.9 (95% CI: 28.2–33.7) (p < 0.001) and 6.9 (95% CI: 5.7–8.1) (p = 0.007), respectively. Notably, despite a downtrend, no significant differences in visits or admissions were noticed before March 14, 2020 in comparison with the corresponding period (i.e., before March 14, 2019) (Table III). No significant differences in hospital length of stay were noted with a median of 4 days for all analyzed periods.

Urologic complaints reported at EDs were different between 2019 and 2020 (Table I). In our study, there was a year-over-year decrease in the absolute number of visits in renal colic (32%), hematuria (25%), urinary retention (10%), acute scrotum (18%), UTI (36%), and trauma (7%), but device malfunction, which increased by 66% (Table I). Also, consulted patients with device malfunction had higher median levels of creatinine:

Table I. Clinical characteristics of the patients in 2019 and 2020

Parameter	2019	2020	*P*-value
Admissions/visits ratio	20.10%	22.80%	0.038
Daily mean visits (SD)	46.5 (8.6)	36.1 (7.8)	< 0.001
IRR (95% CI) visits	0.78 (0.73–0.83)		
Daily mean admissions (SD)	9.3 (2.9)	8.2 (2.9)	0.13
IRR (95% CI) admissions	0.88 (0.77–1.01)		
Age (visits) median (IQR)	62 (41–73)	63 (44–74)	0.642
Sex (male)	69.45%	70,82%	0.406
Diagnosis			0.001
Renal colic	658 (34.31%)	449 (29.52%)	
Hematuria	306 (15.95%)	229 (15.06%)	
Urinary retention	206 (10.74%)	186 (12.23%)	
Acute scrotum	157 (8.19%)	128 (8.42%)	
UTI	253 (13.19%)	163 (10.72%)	
Device malfunction	119 (6.20%)	198 (13.02%)	
Trauma	28 (1.46%)	26 (1.71%)	
Others	191 (9.96%)	142 (9.34%)	
Laboratory parameters (visits):			
CRP [ng/ml]	10.00 (2.09–56.83)	11.19 (2.00–86.46)	0.171
HGB [g/dl]	13.37 (11.90–14.60)	13.21 (11.50–14.70)	0.452
WBC [K/µl]	10.08 (7.70–13.30)	10.30 (8.12–13.50)	0.161
sCR [µmol/l]	91.50 (75.14–123.76)	94.59 (73.37–126.85)	0.526
Laboratory parameters (admissions):			
CRP [ng/ml]	36.50 (6.25–123.55)	46.00 (6.87–144.12)	0.144
HGB [g/dl]	12.60 (11.00–13.86)	12.41 (10.63–14.10)	0.608
WBC [K/µl]	10.40 (7.70–14.00)	11.00 (8.32–14.10)	0.196
sCR [µmol/l]	106.08 (79.67–150.28)	106.04 (78.17–159.12)	0.724
Urgent intervention after admission	320 (72.89%)	314 (81.14%)	0.006
Type of intervention:			0.866
Endoscopic	185 (57.81%)	170 (53.50%)	
Open	39 (12.19%)	46 (14.65%)	
Percutaneous	85 (26.56%)	94 (29.62%)	
Others	9 (2.81%)	6 (1.91%)	
Hospitalization [days]	4.00 (2.00–7.00)	4.00 (2.00–7.00)	0.283

Continuous variables are presented as median (interquartile range). Dichotomous variables are presented as percentages. CI – confidence interval, CRP – C-reactive protein, HGB – hemoglobin, IRR – incidence rate ratio, IQR – interquartile range, sCR – serum creatinine, SD – standard deviation, UTI – urinary tract infection, WBC – white blood count.

Table II. Clinical characteristics of the patients before lockdowns, after March 14th 2020 and after March 25th, 2020

Parameter	Before March 14, 2020	After March 14, 2020	*P*-value*	After March 25, 2020	*P*-value*
Admissions/visits ratio	23.40%	22.70%	0.76	22.35%	0.66
Daily mean visits (SD)	40.9 (5.8)	32.8 (6.5)	< 0.001	30.9 (6.3)	< 0.001
IRR (95% CI) visits after March 14, 2020	0.8 (0.73–0.89)				
IRR (95% CI) visits after March 25, 2020	0.76 (0.68–0.84)				
Daily mean admissions (SD)	9.6 (2.3)	7.5 (2.8)	0.014	6.9 (2.8)	0.007
IRR (95% CI) admissions after March 14, 2020	0.78 (0.63–0.96)				
IRR (95% CI) admissions after March 25, 2020	0.72 (0.57–0.91)				
Age (visits)	63 (44.00–73.00)	63 (44.00–75.00)	0.199	64 (45.00–75.00)	0.201
Sex (male)	67.20%	72.54%	0.038	72.28%	0.076
Diagnosis			0.110		0.025
Renal colic	167 (33.00%)	275 (28.21%)		159 (25.94%)	
Hematuria	82 (16.21%)	139 (14.26%)		84 (13.70%)	
Urinary retention	53 (10.47%)	127 (13.03%)		82 (13.38%)	
Acute scrotum	39 (7.71%)	82 (8.41%)		53 (8.65%)	
UTI	51 (10.08%)	109 (11.18%)		77 (12.56%)	
Device malfunction	52 (10.28%)	141 (14.46%)		94 (15.33%)	
Trauma	11 (2.17%)	14 (1.44%)		10 (1.63%)	
Others	51 (10.08%)	88 (9.03%)		54 (8.81%)	
Laboratory parameters (visits):					
CRP [ng/ml]	7.84 (1.42–83.98)	13.00 (2.12–88.30)	0.059	15.39 (2.17–91.70)	0.032
HGB [g/dl]	13.21 (11.60–14.73)	13.21 (11.40–14.65)	0.886	13.30 (11.40–14.70)	0.753
WBC [K/µl]	10.05 (8.30–13.05)	10.39 (8.09–13.68)	0.291	10.67 (8.27–13.83)	0.247
sCR [µmol/l]	96.00 (76.91–127.96)	91.60 (72.49–128.05)	0.799	90.17 (72.49–130.83)	0.288
Laboratory parameters (admissions):					
CRP [ng/ml]	45.03 (3.10–137.23)	58.24 (10.60–150.00)	0.103	59.97 (13.14–150.00)	0.099
HGB [g/dl]	12.50 (10.31–14.10)	12.40 (10.80–14.12)	0.696	12.50 (11.00–14.40)	0.320
WBC [K/µl]	11.00 (8.00–14.30)	11.06 (8.49–14.06)	0.805	11.23 (8.44–14.10)	0.199
sCR [µmol/l]	108.73 (79.56–181.22)	102.00 (77.13–148.29)	0.280	99.89 (73.37–150.28)	0.777
Urgent intervention after admission	112 (79.43%)	202 (82.11%)	0.607	128 (84.21%)	0.335
Type of intervention:			0.627		0.787
Endoscopic	62 (55.36%)	106 (52.48%)		65 (50.78%)	
Open	19 (16.96%)	27 (13.37%)		20 (15.63%)	
Percutaneous	28 (25.00%)	65 (32.18%)		40 (31.25%)	
Others	3 (2.68%)	3 (1.49%)		3 (2.34%)	
Hospitalization [days]	4.00 (2.00–7.00)	4.00 (2.00–7.00)	0.508	4.00 (2.00–7.00)	0.344

**Compared to the pre-March 14, 2020 period. Continuous variables are presented as median (interquartile range). Dichotomous variables are presented as percentages. CI – confidence interval, CRP – C-reactive protein, HGB – hemoglobin, IRR – incidence rate ratio, IQR – interquartile range, sCR – serum creatinine, SD – standard deviation, UTI – urinary tract infection, WBC – white blood count.*

Table III. Comparisons of visits and admissions in 2019 vs. 2020 in periods before March 14th (**A**), periods from March 14th (**B**), periods from March 25th (**C**)

A

Parameter	28.02–13.03.2019	29.02–13.03.2020	*P*-value
Daily mean visits	47.1	40.9	0.1
IRR (95% CI)	0.87 (0.78–0.97)		
Daily mean admissions	9.6	9.6	0.91
IRR (95% CI)	0.99 (0.78–1.26)		

B

Parameter	14.03–15.04.2019	14.03–15.04.2020	*P*-value
Daily mean visits	45	32.8	< 0.001
IRR (95% CI)	0.73 (0.68–0.79)		
Daily mean admissions	9.1	7.5	0.037
IRR (95% CI)	0.82 (0.69–0.97)		

C

Parameter	25.03–15.04.2019	25.03–15.04.2020	*P*-value
Daily mean visits	46.5	30.9	< 0.001
IRR (95% CI)	0.66 (0.6–0.73)		
Daily mean admissions	9.6	6.9	0.001
IRR (95% CI)	0.72 (0.58–0.89)		

CI – confidence interval, IRR – incidence rate ratio.

141.44 (IQR: 98.00–262.33) in 2020 vs. 108.87 (IQR: 86.00–134.03) in 2019 (p = 0.04) and higher levels of WBC: 12.47 (IQR: 9.80–15.08) in 2020 vs. 8.92 (IQR: 7.30–12.25) in 2019 (p = 0.005), as presented in Table IV. Furthermore, in patients with UTI, the median CRP level was 117.50 (IQR: 28.84–234.12) in 2020 and 79.67 (IQR: 16.00–180.30) in 2019 (p = 0.01). No significant differences between 2019 and 2020 were found in laboratory parameters in all patients visiting and admitted to urology departments, although there was a trend towards worse parameter profiles in 2020 patients (Table I).

Finally, patients visiting the EDs after the lockdowns (Table II) had a higher level of CRP: 7.84 (IQR: 1.42–83.98) before, 13.00 (IQR: 2.12–88.30) after the initial lockdown (p = 0.06), and 15.39 (IQR: 2.17–91.70) after the introduction of severe restrictions (p = 0.03). Importantly, patients admitted after the initial lockdown for renal colic had a significantly higher level of CRP – 32.60 (IQR: 6.75–97.00) compared to patients admitted before the lockdown – 7.77 (IQR: 1.30–83.37) (p = 0.02) (Table V). After the initial lockdown patients consulted due to hematuria had due to hematuria had borderline significantly lower median HGB levels – 11.60 (IQR: 10.10–13.65) compared to patients visiting before the initial lockdown – 12.70 (IQR: 10.90–14.40) (p = 0.05).

Discussion

In this study, we report a 22.5% year-over-year decrease in the number of visits to the EDs for urgent urologic conditions after the advent of COVID-19 but a 2.7 percentage points (p.p.) year-over-year increase in the number of the admissions-to-ED-visit ratio. Also, in 2020 there were 20% and 24% decreases in the number of visits to the ED and 22% and 28% decreases in the number of subsequent admissions for urgent urologic conditions after the initial lockdown and after further severe restrictions, respectively. Considering laboratory parameters, there was a trend towards more negative laboratory parameter profiles in 2020, and patients who visited the EDs after implementation of the most severe restrictions had almost twice as high median levels of CRP. Furthermore, in 2020 there was an 8 p.p. increase in patients requiring surgical intervention within 24 h after admission.

To our knowledge, we present the largest, multi-center, nationwide study delineating urologic ED visits and urgent admissions during the COVID-19 era, with the subsequent impact of escalating national lockdowns. Furthermore, our study is the first one that has directly aimed to examine the impact of the pandemic on patients

Table IV. Crucial laboratory parameters in patients visiting EDs and admitted in 2019 and 2020

Parameter	Visits																					
	All diseases 2019 vs. 2020		Renal colic			Hematuria			Urinary retention			Acute scrotum			UTI			Device malfunction			Trauma			Others		
	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*
CRP [ng/ml]	10.00 (2.09–56.83)	11.19 (2.00–86.46)	0.171	3.85 (1.38–19.52)	4.42 (1.30–28.00)	0.788	10.70 (3.20–41.28)	7.20 (2.10–42.38)	0.516	21.90 (4.20–76.33)	19.00 (3.80–89.00)	0.644	24.10 (4.93–117.99)	40.55 (1.53–147.63)	0.562	79.67 (16.00–180.30)	117.50 (28.84–234.12)	0.012	28.59 (5.08–123.48)	80.05 (16.30–167.00)	0.073	5.70 (0.99–25.24)	13.10 (4.24–46.20)	0.366	13.30 (2.75–64.15)	8.11 (2.03–54.53)	0.264
HGB [g/dl]	13.37 (11.90–14.60)	13.21 (11.50–14.70)	0.452	13.90 (12.80–14.90)	13.90 (12.60–15.08)	0.895	12.30 (10.42–13.90)	12.24 (10.40–13.98)	0.715	12.58 (11.00–13.93)	12.90 (11.70–14.50)	0.194	14.40 (13.40–15.30)	14.66 (13.40–15.80)	0.261	12.60 (11.30–13.70)	12.00 (10.58–13.59)	0.052	12.86 (11.00–13.80)	10.70 (9.30–12.06)	0.004	12.90 (11.16–14.66)	12.50 (10.30–14.25)	0.521	12.75 (10.95–14.34)	13.20 (11.50–14.60)	0.558
sCR [µmol/l]	91.50 (75.14–123.76)	94.59 (73.37–126.85)	0.526	89.00 (74.00–114.92)	94.15 (72.00–113.15)	0.825	93.70 (77.45–123.88)	91.00 (74.13–123.76)	0.228	113.19 (85.00–182.00)	92.00 (75.57–170.46)	0.369	83.10 (76.00–97.24)	84.50 (70.72–93.62)	0.362	95.03 (72.75–136.80)	101.66 (79.67–183.65)	0.06	108.87 (86.00–134.03)	141.44 (98.00–262.33)	0.035	88.40 (74.26–117.46)	90.00 (79.56–125.53)	0.405	94.00 (76.02–140.22)	88.84 (70.72–167.94)	0.682
WBC [K/µl]	10.08 (7.70–13.30)	10.30 (8.12–13.50)	0.161	10.23 (8.13–13.09)	10.20 (8.43–12.84)	0.919	8.87 (6.87–11.70)	9.03 (7.00–11.57)	0.639	9.10 (7.40–11.73)	10.02 (7.25–13.02)	0.465	10.70 (8.62–15.45)	11.10 (8.15–15.30)	0.503	11.01 (8.30–15.01)	12.06 (9.30–16.20)	0.140	8.92 (7.30–12.25)	12.47 (9.80–15.08)	0.005	9.66 (7.09–13.30)	15.43 (11.42–18.40)	0.05	9.60 (7.53–13.46)	10.20 (8.07–12.93)	0.792

Table IV. Cont.

Parameter	All diseases 2019 vs. 2020			Admissions																	
				Renal colic			Hematuria			Urinary retention			Acute scrotum			UTI			Device malfunction			Trauma			Others		
	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*	2019	2020	*P*
CRP [ng/ml]	36.50 (6.25–123.55)	46.00 (6.87–144.12)	0.144	21.00 (2.68–58.92)	27.50 (3.61–89.53)	0.328	24.00 (6.96–83.40)	15.00 (3.95–94.11)	0.674	77.60 (69.00–116.30)	21.00 (3.44–74.10)	0.094	118.68 (19.53–170.75)	107.00 (40.30–171.60)	0.987	154.47 (77.70–239.40)	168.80 (94.10–272.00)	0.265	34.05 (8.85–123.91)	146.29 (16.71–229.03)	0.079	6.00 (3.19–7.01)	74.10 (16.30–127.20)	0.194	24.24 (5.80–64.00)	18.27 (5.35–81.80)	0.985
HGB [g/dl]	12.60 (11.00–13.86)	12.41 (10.63–14.10)	0.608	10.98 (12.24–14.50)	11.00 (12.23–14.35)	0.543	10.98 (8.87–12.68)	11.00 (8.90–12.70)	0.721	12.20 (10.80–13.55)	13.80 (11.65–15.33)	0.243	13.60 (13.05–14.70)	13.15 (12.20–15.30)	0.559	12.04 (10.73–13.38)	11.55 (10.68–12.89)	0.446	12.61 (10.68–13.50)	10.30 (8.88–11.67)	0.007	13.60 (10.95–14.89)	11.40 (9.70–13.18)	0.174	11.85 (10.31–14.65)	12.08 (10.00–14.70)	0.961
sCR [µmol/l]	106.08 (79.67–150.28)	106.04 (78.17–159.12)	0.724	99.95 (79.56–133.71)	106.04 (78.23–135.44)	0.563	106.52 (85.97–150.28)	89.28 (74.04–146.30)	0.11	248.40 (108.51–429.62)	125.97 (78.39–359.13)	0.415	88.40 (80.00–106.08)	92.00 (78.68–106.08)	0.907	123.76 (85.75–176.80)	119.34 (81.33–194.04)	0.867	119.08 (100.78–155.36)	216.44 (136.36–301.67)	0.0613	97.24 (77.79–116.19)	163.10 (117.13–293.27)	0.055	93.26 (74.92–210.17)	90.58 (70.72–253.49)	0.986
WBC [K/µl]	10.40 (7.70–14.00)	11.00 (8.32–14.10)	0.196	10.13 (7.70–13.15)	10.25 (8.57–12.69)	0.51	9.40 (6.50–11.81)	9.10 (6.95–12.20)	0.943	10.91 (9.00–13.43)	8.85 (6.69–10.83)	0.088	15.00 (10.00–21.00)	13.59 (9.91–16.95)	0.42	12.02 (8.93–16.42)	13.25 (10.15–17.69)	0.301	10.75 (7.15–12.32)	12.11 (9.37–15.80)	0.128	10.05 (7.14–11.83)	17.80 (15.47–23.08)	0.031	9.88 (7.63–14.00)	11.00 (7.80–12.93)	0.721

Continuous variables are presented as median (interquartile range). CRP – C-reactive protein, HGB – hemoglobin, sCR – serum creatinine, UTI – urinary tract infection, WBC – white blood count.

Table V. Crucial laboratory parameters in patients visiting EDs and admitted before the initial lockdown and in those after the initial lockdown

Parameter	Visits before and after March 14, 2020																					
	All diseases, before vs. after the LD			Renal colic			Hematuria			Urinary retention			Acute scrotum			UTI			Device malfunction			Trauma			Others		
	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*
CRP [ng/ml]	7.84 (1.42–83.98)	13.00 (2.12–88.30)	0.059	3.60 (1.10–21.00)	4.72 (1.40–31.13)	0.318	4.10 (1.80–61.90)	10.00 (2.10–42.00)	0.611	27.00 (2.59–88.75)	27.25 (4.28–90.25)	0.762	16.40 (1.13–99.83)	52.00 (1.60–151.30)	0.290	113.00 (46.10–243.08)	145.00 (20.50–231.00)	0.749	110.27 (13.03–157.43)	59.58 (16.68–168.15)	0.936	8.36 (1.57–13.10)	46.20 (9.75–113.93)	0.171	7.15 (0.94–34.23)	11.16 (3.20–75.71)	0.210
HGB [g/dl]	13.21 (11.60–14.73)	13.21 (11.40–14.65)	0.886	13.70 (12.40–14.99)	14.00 (13.00–15.10)	0.110	12.70 (10.90–14.40)	11.60 (10.10–13.65)	0.051	12.90 (10.13–14.38)	12.90 (11.80–14.25)	0.564	15.15 (12.55–15.90)	14.40 (13.40–15.47)	0.470	12.17 (10.90–14.03)	11.60 (10.40–12.90)	0.109	10.31 (8.70–11.60)	11.12 (9.60–13.40)	0.151	12.30 (11.24–13.18)	13.50 (10.20–14.50)	0.935	13.25 (10.67–14.60)	13.16 (11.60–14.58)	0.891
sCR [µmol/l]	96.00 (76.91–127.96)	91.60 (72.49–128.05)	0.291	92.38 (71.70–114.48)	94.00 (72.49–114.04)	0.998	90.58 (80.86–125.50)	88.40 (72.49–123.76)	0.182	114.00 (80.90–216.58)	88.40 (75.14–162.06)	0.367	97.24 (79.56–106.08)	82.21 (70.72–87.70)	0.012	101.66 (82.65–144.16)	103.87 (79.56–195.14)	0.686	154.72 (106.96–223.21)	152.05 (84.34–285.09)	0.909	125.53 (98.44–183.65)	83.98 (79.56–101.66)	0.126	88.40 (70.72–181.22)	89.64 (71.15–143.36)	0.630
WBC [K/µl]	10.05 (8.30–13.05)	10.39 (8.09–13.68)	0.799	10.30 (8.60–12.62)	10.15 (8.30–12.98)	0.568	8.90 (7.30–11.50)	9.10 (6.97–11.43)	0.682	9.12 (6.86–12.00)	10.09 (7.90–13.30)	0.415	9.06 (7.20–14.70)	11.80 (8.59–15.30)	0.364	12.52 (9.75–16.50)	11.88 (9.17–15.56)	0.935	13.00 (11.10–14.72)	11.92 (9.70–15.50)	0.758	14.12 (11.15–18.86)	15.59 (12.24–16.80)	0.832	9.67 (8.06–12.69)	11.14 (8.06–13.53)	0.547

Table V. Cont.

Parameter	Admissions before and after March 14, 2020																					
	All diseases, before vs. after the LD			Renal colic			Hematuria			Urinary retention			Acute scrotum			UTI			Device malfunction			Trauma			Others		
	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*
CRP [ng/ml]	45.03 (3.10–137.23)	58.24 (10.60–150.00)	0.103	7.77 (1.30–83.37)	32.60 (6.75–97.00)	0.021	4.10 (2.30–135.00)	15.75 (4.45–93.63)	0.874	3.44 (2.87–90.63)	21.00 (6.50–74.10)	0.853	116.75 (90.48–131.25)	107.00 (29.65–189.90)	0.911	185.20 (124.40–264.00)	165.90 (76.85–276.35)	0.596	179.70 (72.75–264.23)	80.05 (21.81–193.55)	0.526	8.25 (4.23–12.28)	127.20 (100.65–145.10)	0.149	18.90 (6.25–83.30)	25.64 (6.01–82.80)	0.948
HGB [g/dl]	12.50 (10.31–14.10)	12.40 (10.80–14.12)	0.696	13.60 (12.30–14.66)	12.40 (10.80–14.12)	0.010	11.50 (9.13–12.93)	10.63 (8.90–12.50)	0.584	12.90 (9.02–13.70)	14.35 (13.15–15.58)	0.155	12.57 (11.70–15.14)	13.40 (12.50–15.30)	0.526	11.20 (10.50–13.05)	11.60 (10.80–12.84)	0.599	8.70 (8.25–9.55)	11.00 (9.81–12.16)	0.018	12.50 (11.40–12.95)	9.50 (7.90–11.75)	0.663	12.40 (9.80–14.52)	12.04 (10.35–14.68)	0.964
sCR [µmol/l]	108.73 (79.56–181.22)	102.00 (77.13–148.29)	0.280	108.22 (72.30–138.73)	103.43 (79.12–135.13)	0.756	95.12 (82.88–167.96)	88.40 (73.37–129.29)	0.233	216.58 (108.00–622.34)	111.38 (78.00–150.28)	0.349	106.08 (87.78–119.04)	86.05 (72.71–96.14)	0.248	101.66 (85.75–193.60)	126.41 (80.44–192.71)	0.670	221.88 (166.63–302.33)	211.00 (121.11–287.30)	0.751	202.44 (163.10–262.99)	114.92 (97.24–357.46)	0.513	103.40 (76.25–254.81)	83.54 (69.88–241.55)	0.646
WBC [K/µl]	11.00 (8.00–14.30)	11.06 (8.49–14.06)	0.805	10.30 (8.60–14.00)	10.45 (8.43–12.53)	0.384	8.92 (7.05–13.78)	9.10 (6.90–12.00)	0.806	6.28 (5.20–8.40)	10.00 (7.94–11.70)	0.104	15.30 (10.00–17.80)	13.57 (10.52–14.50)	0.698	12.60 (8.42–14.50)	13.70 (10.65–18.90)	0.128	13.11 (12.65–18.10)	10.60 (9.11–15.70)	0.245	20.00 (17.72–22.69)	15.60 (11.06–19.85)	0.517	10.00 (7.37–12.80)	11.96 (8.20–13.54)	0.466

Continuous variables are presented as median (interquartile range). CRP – C-reactive protein, HGB – hemoglobin, LD – lockdown, sCR – serum creatinine, UTI – urinary tract infection, WBC – white blood count.

complaining about all urologic conditions by analyses of daily mean visits and admissions, crucial laboratory parameters, post-admission procedures, and hospital length of stay.

Our analyses revealed lower (22.5%) year-over-year decreases in urologic ED visits, compared to recently published Italian and Portuguese studies, which found over 50% declines during the COVID-19 period [7–10]. In Poland, the changes were slightly more comparable to more affected countries after the introduction of more severe restrictions on March 25, 2020, with declines up to 34% (Table III). This has been also seen in another Polish study of Legutko *et al*., who evaluated pre-COVID-19 and COVID-19 periods (all 2020) in terms of coronary angiography and percutaneous coronary interventions for myocardial infarctions. The authors also found smaller decreases in emergency cases after the lockdown (30%) when compared to the US (38%), Spain (40%), or Austria (39%) [4]. There are several possible explanations for smaller declines in Poland. From the end of February, following massive outbreaks in Italy, France, Spain, and Germany, in Poland the fear and expectance of a COVID-19 outbreak were present. As the first expected COVID-19 case in Poland (March 4, 2020), with subsequent logarithmic case growth, appeared later (Figure 1) when compared to the abovementioned countries, early precautions were taken, leading to a lower, stable COVID-19 incidence ratio, more smoothly manageable for healthcare [16]. Therefore, we speculate that Poland serves as an example of a country where the possible changes in emergency visits and admissions were not due to impaired access to emergency health care but were mainly related to the escalating restrictions (including isolations and limited access to urologic and other specialization outpatient services) followed by fear or patients' perception of hospitals as COVID-19 reservoirs [17, 18]. Further, as fewer doctors in Poland, compared to countries more affected by COVID-19, were directly engaged in managing COVID-19 patients, greater availability and unparalleled popularity of telemedicine consultations could have led to fewer urgent and sometimes unnecessary visits. Finally, cultural differences, media coverage, and population fear level, which varies significantly among nations (e.g. lower COVID-19 fear level in Eastern Europeans), may also have played a role in our lower declines in ED attendance [19–21].

In 2020, problems with device malfunctions increased by 66%, while all other groups of urologic problems subsided. The distribution of diseases was significantly different between 2019 and 2020 (p = 0.001), which was also noted in a study of Novara *et al.* (n = 399), although in their cohort declines were seen in all disease groups (p = 0.04) [9]. Conversely, in another study from Porto, Portugal (n = 385), a higher proportion of patients visited the ED for administrative and clinical reasons and due to device malfunctions (n = 12 (9.8%) in 2020 and 15 (5.7%) in 2019) [8]. These results can be related to ours, as more patients with device malfunction were noted in EDs, presumably due to limited access to regular outpatient care.

The initial reports from outbreak regions indicate higher general mortality, which cannot be directly linked to COVID-19 deaths [1, 18, 22]. As mortality rates in urologic emergencies are relatively very low, we believe crucial laboratory parameters could substantiate the patients' condition. In our cohort, there were no significant differences between tested laboratory parameters between 2019 and 2020, in either consulted or admitted patients, although a clear more negative tendency was noticed. Requiring particular attention are the higher levels of creatinine, CRP, and WBC in the device malfunction group in 2020, which were either significant or borderline significant for both consulted and admitted patients. In 2020 patients visiting EDs due to UTI had significantly higher levels of CRP. After the lockdowns, compared to the pre-lockdown period, all the visiting patients had approximately twice as high median CRP level and patients consulted due to hematuria had borderline significantly lower HGB levels. All these results may somewhat mirror the delayed care-seeking in 2020 and ED avoidance in milder cases. The only study that evaluated laboratory parameters during the COVID-19 pandemic in urologic emergencies, particularly in renal colic patients (n = 80), was conducted by Flammia *et al.* [10]. Surprisingly, the patients visiting during the COVID-19 era had non-significantly lower WBC levels (p = 0.052), but significantly higher serum creatinine levels (p = 0.026), which we did not observe in our cohort. Nevertheless, after lockdowns, we found significantly higher median levels of CRP in admitted renal colic patients (Tables V and VI).

The admissions-to-ED-visit ratio was significantly higher in 2020 compared to 2019, which indicates that presumably in general more "mild" visits were avoided in 2020. On the other hand, in 2020 a higher percentage of admitted patients underwent urgent intervention after admission with general stable absolute numbers of operations between 2019 and 2020, which could indicate a more severe condition of admitted patients. No differences in hospitalization time were noted, which could also be due to a general tendency to shorten patients' hospital length of stay during the COVID-19 pandemic, as also observed in other countries [19]. In a study conducted by the Italian AGILE group, there was an over 50% decline in the ureterorenoscopy (and/

Table VI. Laboratory parameters in patients visiting and admitted before March 14th, 2020 and in those after March 25th, 2020 (severe lockdown)

Parameter	VISITS before March 14, 2020 and after March 25, 2020																					
	All diseases, before vs. after the LD		Renal colic		Hematuria		Urinary retention		Acute scrotum		UTI		Device malfunction		Trauma		Others					
	Before the LD	After the LD	Before the LD	After the LD	Before the LD	After the LD	Before the LD	After the LD	Before the LD	After the LD	Before the LD	After the LD	Before the LD	After the LD	Before the LD	After the LD	Before the LD	After the LD	*P*			
CRP [ng/ml]	7.84 (1.42–83.98)	15.39 (2.17–91.70)	0.032		3.60 (1.10–21.00)	4.42 (1.72–36.88)	0.160		4.10 (1.80–61.90)	10.30 (2.55–37.75)	0.538		27.00 (2.59–88.75)	37.65 (2.91–91.95)	0.697		16.40 (1.13–99.83)	55.65 (1.53–147.63)	0.403		113.00 (46.10–243.08)	119.45 (19.48–230.70)	0.971		110.27 (13.03–157.43)	32.00 (16.30–167.00)	0.742		8.36 (1.57–13.10)	74.10 (18.30–127.20)	0.095		7.15 (0.94–34.23)	13.60 (2.10–40.10)	0.365
HGB [g/dl]	13.21 (11.60–14.73)	13.30 (11.40–14.70)	0.753		13.70 (12.40–14.99)	14.02 (13.10–15.20)	0.068		12.70 (10.90–14.40)	11.40 (10.20–13.70)	0.085		12.90 (10.13–14.38)	12.70 (11.80–14.25)	0.594		15.15 (12.55–15.90)	14.60 (13.40–15.85)	0.867		12.17 (10.90–14.03)	12.00 (10.53–13.01)	0.237		10.31 (8.70–11.60)	11.20 (10.18–14.18)	0.069		12.30 (11.24–13.18)	12.15 (10.03–14.50)	0.796		13.25 (10.67–14.60)	13.21 (12.06–14.78)	0.666
sCR [µmol/l]	96.00 (76.91–127.96)	90.17 (72.49–130.83)	0.247		92.38 (71.70–114.48)	94.29 (72.27–114.92)	0.943		90.58 (80.86–125.50)	88.40 (73.37–118.90)	0.231		114.00 (80.90–216.58)	88.40 (76.07–162.06)	0.372		97.24 (79.56–106.08)	79.56 (70.72–88.40)	0.013		101.66 (82.65–144.16)	101.66 (73.37–200.10)	0.876		154.72 (106.96–223.21)	152.05 (94.06–276.25)	0.859		125.53 (98.44–183.65)	86.19 (79.56–104.98)	0.175		88.40 (70.72–181.22)	89.64 (70.93–132.15)	0.941
WBC [K/µl]	10.05 (8.30–13.05)	10.67 (8.27–13.83)	0.288		10.30 (8.60–12.62)	10.40 (8.17–13.03)	0.682		8.90 (7.30–11.50)	9.10 (7.15–12.38)	0.788		9.12 (6.86–12.00)	10.50 (8.95–13.35)	0.158		9.06 (7.20–14.70)	12.55 (8.90–14.70)	0.353		12.52 (9.75–16.50)	11.76 (9.18–15.30)	0.919		13.00 (11.10–14.72)	12.06 (9.50–14.69)	0.679		14.12 (11.15–18.86)	15.60 (12.20–18.23)	0.948		9.67 (8.06–12.69)	11.55 (8.29–13.38)	0.429

Table VI. Cont.

Parameter	Admissions March 14, 2020 and after March 25, 2020																					
	All diseases, before vs after the LD			Renal colic			Hematuria			Urinary retention			Acute scrotum			UTI			Device malfunction			Trauma			Others		
	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*	Before the LD	After the LD	*P*
CRP [ng/ml]	45.03 (3.10–137.23)	59.97 (13.14–150.00)	0.099	7.77 (1.30–83.37)	38.10 (22.58–98.85)	0.017	4.10 (2.30–135.00)	15.00 (5.70–76.63)	0.689	3.44 (2.87–90.63)	4.05 (1.58–26.98)	0.596	116.75 (90.48–131.25)	71.00 (14.35–144.05)	0.725	185.20 (124.40–264.00)	168.80 (96.20–276.20)	0.791	179.70 (72.75–264.23)	80.05 (21.81–219.31)	0.798	8.25 (4.23–12.28)	127.20 (100.65–145.10)	0.1489	18.90 (6.25–83.30)	18.27 (6.93–76.20)	0.835
HGB [g/dl]	12.50 (10.31–14.10)	12.50 (11.00–14.40)	0.320	13.60 (12.30–14.66)	12.10 (10.63–14.30)	0.009	11.50 (9.13–12.93)	11.00 (9.20–13.00)	0.886	12.90 (9.02–13.70)	15.80 (14.70–15.80)	0.037	12.57 (11.70–15.14)	14.60 (12.95–16.20)	0.277	11.20 (10.50–13.05)	11.60 (10.98–12.70)	0.458	8.70 (8.25–9.55)	11.00 (10.30–11.92)	0.017	12.50 (11.40–12.95)	9.50 (7.90–11.75)	0.663	12.40 (9.80–14.52)	13.70 (12.00–14.70)	0.803
sCR [µmol/l]	108.73 (79.56–181.22)	99.89 (73.37–150.28)	0.199	108.22 (72.30–138.73)	103.00 (73.81–134.63)	0.553	95.12 (82.88–167.96)	88.40 (75.36–117.79)	0.232	216.58 (108.00–622.34)	78.00 (77.79–79.56)	0.144	106.08 (87.78–119.04)	88.40 (74.70–95.03)	0.221	101.66 (85.75–193.60)	132.60 (79.56–200.10)	0.633	221.88 (166.63–302.33)	229.84 (150.28–287.30)	0.886	202.44 (163.10–262.99)	114.92 (97.24–357.46)	0.513	103.40 (76.25–254.81)	79.56 (70.72–175.92)	0.522
WBC [K/µl]	11.00 (8.00–14.30)	11.23 (8.44–14.10)	0.777	10.30 (8.60–14.00)	10.20 (8.18–12.17)	0.348	8.92 (7.05–13.78)	8.90 (6.90–11.57)	0.575	6.28 (5.20–8.40)	10.30 (10.03–13.30)	0.06	15.30 (10.00–17.80)	13.57 (10.16–14.50)	0.651	12.60 (8.42–14.50)	14.08 (11.48–19.05)	0.111	13.11 (12.65–18.10)	10.09 (9.01–14.61)	0.222	20.00 (17.72–22.69)	15.60 (11.06–19.85)	0.513	10.00 (7.37–12.80)	12.01(8.80–12.80)	0.377

Continuous variables are presented as median (interquartile range). CRP – C-reactive protein, HGB – hemoglobin, LD – lockdown, sCR – serum creatinine, UTI – urinary tract infection, WBC – white blood count.

or ureteral stenting), transurethral resection of bladder tumor, and testicular detorsion between a pre-COVID period in 2020 and during the massive outbreak in Italy [6]. In our cohort, the distribution of the interventions was non-significantly different with an 8% decrease in absolute numbers of endoscopic procedures in 2020. At the same time, we noted a higher number of open and percutaneous interventions in 2020 and a higher proportion of percutaneous interventions after the lockdowns.

Our results illustrate a distressing tendency that some of the patients who truly needed urgent medical help and/or hospitalization were not seen at urologic EDs or came later than they would have done before the COVID-19 era. In our opinion, the Polish case may arise in other developed countries, after the pandemic stabilizes and in a case of local outbreaks with maintained access to urologic EDs. Lastly, our paper underlines the necessity for adjustment of urology centers during the COVID-19 pandemic. Primarily, despite the unprecedented integration of telemedicine in outpatient clinics, more meticulous patients' qualifications for in-person visits should be implemented. Given the presumable scenario with the COVID-19 pandemic lasting for an unknown period, maintaining regular face-to-face access for needy patients should become a critical aim of health care providers. Additionally, we believe that broader and easily available information provision concerning current epidemiological status should be immediately implemented to both EDs and outpatient service, which could partly mitigate patients' fear and uncertainty.

There are some limitations of our study. Firstly, this is a time-limited, retrospective, single-country study. However, the majority of our 13 study centers have high-volume urology departments, thus providing a robust national sample. Second, there were missing demographic, ICD-10 and laboratory data on ED visits at one center and some missing laboratory data due to a lack of clinical indication. Lastly, we did not control for confounding factors that might have influenced laboratory results in our analyses.

In conclusion, our study compiled several important and exclusive aspects of urology ED visits and admissions during the COVID-19 pandemic, in a country with barely impaired access to emergency medicine. Declines in urologic emergency visits and admissions were apparent, especially after the introduction of restrictions, with alarming trends indicating that some of the patients requiring urgent medical help did not appear at the ED, or came later than they would have done before the pandemic, presenting worse laboratory profiles.

Acknowledgments

AJC is supported by the European Union through the European Social Fund (POWR.03.02.00-00-I029).

Conflict of interest

The authors declare no conflict of interest.

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