Surgical Care in Poland after COVID19 Outbreak: A National Survey.

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Abstract

Background: During COVID-19 pandemic, it is necessary to collect and analyze data concerning management of hospitals and wards to work out solutions for potential future crisis. The objective of the study was to investigate how surgical wards in Poland are managing during rapid development of the COVID-19 pandemic

Methods: An anonymous, online survey was designed and distributed to surgeons and surgery residents working in surgical departments during pandemic. Responders were divided into two groups: Group 1 (responders working in a “COVID-19-dedicated” hospital) and Group 2 (responders working in other hospitals).

Results: Overall, 323 responders were included in the study group, 30.03% of which were female. Medical staff deficits were reported by 21.15% responders from Group 1 and 29.52% responders from Group 2 ($p=0.003$). The mean number of elective surgeries performed weekly prior to the pandemic in Group 1 was 40.37±46.31 and during the pandemic was 13.98±37.49 ($p<0.001$). In Group 2, the mean number of elective surgeries performed weekly before the start of the pandemic was 26.85±23.52 and after the start of the pandemic, it was 7.65±13.49 ($p<0.001$). There were significantly higher reported levels of preparedness in Group 1 in terms of: theoretical training of the staff, equipping the staff and adapting the operating theater to safely perform procedures on patients with COVID-19. Overall, 62.23% of responders presume being infected with SARS-CoV-2.

Conclusions: SARS-CoV-2 pandemic had a significantly negative impact on surgical wards. Despite the preparations, the number of responders who presume being infected with SARS-CoV-2 during present crisis is high.

Trial registration: The study was registered in https://www.clinicaltrials.gov/ registry (NCT04368026).

Background

The SARS-CoV-2 virus outbreak began in Wuhan in December 2019. It spread quickly throughout China and other countries. Since then, the epidemic has evolved rapidly and COVID-19 was recognized by the World Health Organization (WHO) as a global pandemic in March 2020 [1]. By April the 8th, 2020 Polish Ministry of Health reported 5205 confirmed cases of SARS-CoV-2 infections in Poland with 159 deaths due to COVID-19 [2]. At that time WHO reported over 1300000 cases globally [3].

The pandemic affected all fields, especially medicine [4]. We had to re-evaluate our work and health priorities. Hospitals and wards, including surgical departments. are being reorganized globally to face the current pandemic and better prepare for potential future crisis [5, 6]. Currently, it is necessary to collect and analyze data on this subject in order to formulate better solutions for the future. There are reports from around the world, that the COVID-19 pandemic significantly affects the activity in surgical wards [7–10].

We aimed to investigate how surgical wards in Poland are managing during the rapid development of the COVID-19 pandemic.

Methods

Study design

The study was conducted under the patronage of the *The Association of Polish Surgeons* (TChP) and *Polish National Consultant in General Surgery*. An anonymous online survey was designed and published on the official website of TChP. Invitation for the study was additionally sent to all active members of TChP by email with instructions how to complete the survey. Data were collected between March 30 and April 6 of 2020. The online survey included single choice as well as open-ended questions. After data analysis the responders were divided into two groups: Group 1 (responders currently working in a “COVID-19-dedicated” hospitals, which was transformed by Polish Ministry of Health during the SARS-CoV-2 pandemic into institution designated exclusively for SARS-CoV-2 patients, including those developing symptoms and quarantined) and Group 2 (responders currently working in “non-COVID-19-dedicated” hospitals).

Inclusion and exclusion criteria

The study group included Polish surgeons and surgery residents working in surgical departments during pandemic, who granted an informed consent to participate in the study. Retired surgeons, physicians and residents with non-surgical specializations, medical interns, medical students, other health-care professionals were excluded from this study.

Survey

The survey included 44 questions and comprised four parts:

1. 1. Study group characteristics (four single choice and three open-ended questions)
2. 2. Status of surgical wards during the pandemic (three single choice)
3. 3. Impact of the pandemic on conducting surgery (eight single choice and ten open-ended questions)
4. 4. SARS-CoV-2 prevention (eight single choice and ten open-ended questions).

To assess the level of knowledge, we used a 10-point scale (from 1 to 10), where 1 meant absolute lack of knowledge and 10 meant total knowledge of the subject. To assess the level of preparedness, we used a 10-point scale (from 1 to 10), where 1 meant complete lack of preparedness and 10 meant total preparedness in particular area. The survey is presented in Appendix 1.

Statistical analysis

All data were analyzed using Statistica version 13.1PL (StatSoft Inc., Tulsa, OK, USA). The normal distribution was checked using a Shapiro-Wilk test. The results are presented as number and percentage, a mean with standard deviation (SD) or median with interquartile range (IQR), when appropriate. A

comparison of quantitative data was made using Student's t-test or Mann-Whitney's test, whilst $\chi 2$ with or without Yates' correction were used for qualitative variables. Results were considered statistically significant at $p < 0.05$.

Results

Participants

Overall, 323 responders were included in the study group, 30.03% of which were female. Median age was 38 years (32-51.5). The majority of responders were specialists – 206 (63.78%).

Hospitals

There was 52 (16.10%) responders from Group 1 hospitals and 271 (83.90%) responders from Group 2 hospitals. Academic hospitals were represented by 102 (31.58%) responders, state hospitals by 60 (18.58%) responders, municipal hospitals by 146 (45.20%) responders and other types of institutions by 15 (4.64%) responders. Median number of specialists employed at responder's ward was 7 (5–10) and median number of residents was 4 (2–6) (Table 1).

Table 1
Basic characteristics.

Parameter	Total	Group 1 (COVID19-dedicated)	Group 2 (non-COVID19-dedicated)	p
	323 (100%)	52 (16.10%)	271 (83.90%)	-
Median age, years (IQR)	38 (32-51.5)	37.5 (31.75-52)	38 (32–51)	0.871*
Sex (female), n (%)	97 (30.03%)	14 (26.92%)	83 (30.63%)	0.594**
Specialist/resident, n (%)	206 (63.78%) / 117 (36.22)	33 (63.46%) / 19 (36.54%)	173 (63.84%) / 98 (36.16%)	0.958**
Type of hospital	102 (31.58%	25 (48.08%)	77 (28.41%)	0.050**
Academic, n (%)	60 (18.58%)	7 (13.46%)	53 (19.56%	
State, n (%)	146 (45.20%)	18 (34.62%)	128 (47.23%)	
Municipal, n (%)	15 (4.64%)	2 (3.85%)	13 (4.8%)	
Other, n (%)				
Median number of specialists on the ward (IQR)	7 (5–10)	8 (5.5–13)	7 (5–10)	0.020*
Median number of residents on the ward (IQR)	4 (2–6)	7 (2-12.5)	3 (1–6)	< 0.001*

* Mann-Whitney's test; **χ^2 – test

Surgical ward during the pandemic

Current hospitalization of SARS-CoV-2 positive patients was reported by 45 (86.54%) respondents from Group 1 and 102 (37.64%) from Group 2 ($p < 0.001$). Majority of respondents from Group 1 and 2 reported smaller than usual number of patients being hospitalized currently on their ward [42 (80.77%) and 237 (87.45%), respectively]. Overall, 1 (1.92%) respondent from Group 1 and 23 (8.49%) respondents from Group 2 reported usual number of patients on the ward. Full occupancy of the ward was reported by 2 (3.85%) respondents from Group 1 and 8 (2.95%) from Group 2. Additionally in Group 1, 1 (1.92%) respondent reported occupancy, which significantly exceeds the availability of beds and 1 (1.92%) reported the need to conduct a triage of patients requiring intensive care. Also, 5 (9.62%) respondents in Group 1 and 3 (1.11%) respondents in Group 2 did not know the current occupancy on their ward. Medical staff deficits were reported by 11 (21.15%) responders from Group 1 and 80 (29.52%) responders from Group 2 ($p = 0.003$) (Table 2).

Table 2
Status of surgical wards during the pandemic.

Parameter	Total	Group 1 (COVID19-dedicated)	Group 2 (non-COVID19-dedicated)	p
N (%)	323 (100%)	52 (16.10%)	271 (83.90%)	-
Number of responders currently working in institutions hospitalizing patients with COVID-19:				< 0.001*
Yes, n (%)	147 (45.51%)	45 (86.54%)	102 (37.64%)	
No, n (%)	137 (42.41%)	7 (13.46%)	130 (47.97%)	
I do not know, n (%)	39 (12.08%)	0	39 (14.39%)	
Current number of patients on the ward:				< 0.001*
Smaller than usual, n (%)	279 (86.38%)	42 (80.77%)	237 (87.45%)	
As usual, n (%)	24 (7.43%)	1 (1.92%)	23 (8.49%)	
Occupancy full, n (%)	10 (3.1%)	2 (3.85%)	8 (2.95%)	
Exceeds the availability of beds, n (%)	0	0	0	
Significantly exceeds the availability of beds, n (%)	1(0.31%)	1 (1.92%)	0	
Triage of patients requiring intensive care, n (%)	1 (0.31%)	1 (1.92%)	0	
I do not know, n (%)	8 (2.48%)	5 (9.62%)	3 (1.11%)	
Deficits of medical staff:				0.003*
Yes, n (%)	91 (28.17%)	11 (21.15%)	80 (29.52%)	
No, n (%)	229 (70.9%)	39 (75%)	190 (70.11%)	
I do not know, n (%)	2 (0.62%)	2 (3.85%)	0	

*χ^2 - test

Impact of the pandemic on conducting surgery.

The mean number of elective surgeries performed weekly prior to the pandemic in Group 1 was 40.37 ± 46.31 and during the pandemic it was 13.98 ± 37.49 ($p < 0.001$). In Group 2, the mean number of elective surgeries performed weekly before the start of the pandemic was 26.85 ± 23.52 and after the start of the

pandemic it was 7.65 ± 13.49 ($p < 0.001$). The mean number of emergency surgeries performed weekly prior to the pandemic in Group 1 was 12.12 ± 9.67 and after the start of the pandemic it was 5.38 ± 6.13 ($p < 0.001$). In Group 2, the mean number of emergency surgeries before the pandemic was 8.74 ± 6.97 and after the start of the pandemic it was 6.74 ± 5.61 ($p < 0.001$) (Fig. 1). Overall, 50 (96.15%) responders from Group 1 and 254 (93.73%) responders from Group 2 reported canceling/postponing general surgery procedures ($p = 0.496$). For oncological surgery, 29 (55.75%) responders from Group 1 and 23 (8.49%) responders from Group 2 reported canceling/postponing operations ($p < 0.001$). In case of the bariatric surgery, 33 (63.46%) responders from Group 1 and 79 (29.15%) responders from Group 2 reported canceling/postponing procedures ($p < 0.001$). Vascular surgery procedures were cancelled/postponed by 15 (28.85%) responders from Group 1 and 69 (25.46%) responders from Group 2 ($p = 0.610$) and plastic surgery operations were cancelled by 19 (36.54%) responders from Group 1 and 61 (22.51%) responders from Group 2 ($p = 0.032$). In case of general surgery, during the pandemic, responders reported performing on average 40.1% ± 43.9% of the normal number of procedures. For oncological surgery study group participants reported performing 41.9%± 39.1% of the normal number of operations, for bariatric surgery 31.9% ± 45.9%, for vascular surgery 31.6% ± 45.3% and for plastic surgery 27.9% ± 40.5%. Comparison of above mentioned percentages between Group 1 and 2 is presented on Fig. 2.

Responders from Group 1 had more frequently a chance to operate on SARS-CoV-2 positive patients [35 (67.31%) vs. 42 (15.5%), $p < 0.001$] (Appendix 2). The most commonly reported procedures performed on SARS-CoV-2 positive patients were emergency surgery – 38 (49.35%) and oncological operations 12 (15.58%) (Table 3). Overall, a group of1 57 (48.61%) surgeons participating in our study preferred laparoscopic access during COVID-19 pandemic and 160 (49.54%) believed it was a safe choice on a SARS-CoV-2 positive patients - (Appendix 3).

Table 3
Reported operations performed on SARS-CoV-2 infected patients.

Parameter	Total	Group 1 (COVID19-dedicated)	Group 2 (non-COVID19-dedicated)	p
	77 (100%)	35 (45.45%)	42 (54.55%)	-
Emergency surgery, n (%)	38 (49.35%)	20 (57.14%)	18 (42.86%)	< 0.001*
Oncological surgery, n (%)	12 (15.58%)	7 (20%)	5 (11.9%)	< 0.001*
Trauma surgery, n (%)	7 (9.09%)	3 (8.57%)	4 (9.52%)	0.051*
Neurosurgery, n (%)	6 (7.79%)	3 (8.57%)	3 (7.14%)	0.023*
Amputation of the lower limb, n (%)	5 (6.49%)	2 (5.71%)	3 (7.14%)	0.143*
Drainage of pneumothorax, n (%)	5 (1.55%)	2 (3.85%)	3 (1.11%)	0.143*
Cholecystectomy, n (%)	4 (1.24%)	3 (5.77%)	1 (0.37%)	< 0.001*
Gynecological surgery, n (%)	4 (1.24%)	4 (7.69%)	0	< 0.001*
Urological surgery, n (%)	1 (0.31%)	1 (1.92%)	0	0.022*

*χ^2 - test

SARS-CoV-2 prevention

Overall, 34 (65.38%) responders from Group 1 and 148 (54.61%) responders from Group 2 reported, that their institution introduced measures to prevent SARS-CoV-2 staff infection before admitting first SARS-CoV-2 positive patients. Training of the staff concerning the treatment of infected patients was reported more frequently in Group 1 (86.54% vs. 61.25%, $p < 0.001$). There was no significant difference between Group 1 and Group 2 in terms of reported level of knowledge concerning the COVID-19 pandemic (5.92 ± 1.71 vs. 6.07 ± 1.73, $p = 0.565$) and the treatment of infected patients (4.71 ± 2.24 vs. 4.34 ± 2.12, $p = 0.247$). However, Group 1 reported significantly higher level of knowledge concerning preparation for surgery on a patient with suspected / confirmed COVID-19 and provision of the appropriate personal protective equipment (PPE) during the procedure (6.62 ± 2.35 vs. 5.33 ± 2.48, $p < 0.001$). There were significantly higher reported levels of preparedness in Group 1 in terms of: theoretical training of the staff (4.77 ± 2.26 vs. 3.36 ± 2.46, $p < 0.001$), equipping the staff with appropriate PPE (5.21 ± 2.66 vs. 3.07 ±

2.21, $p < 0.001$) and adapting the operating theater to safely perform procedures on patients with suspected / confirmed COVID-19 (5.85 ± 2.57 vs. 3.02 ± 2.32, $p < 0.001$). Overall, 95 (29.41%) responders reported, that their institution introduced changes in the protocol of conduct in the operating theater, 66 (20.43%) responders reported, that their institution introduced changes in the peri-operative care protocol and 236 (73,07%) responders reported, that their institution introduced changes in the protocol of conduct on the surgical ward. Comparable percentage of responders from Group 1 and Group 2 believed that they will contract the disease at work during the pandemic.(51.92% vs. 64.21%, $p = 0.317$) (Table 4) (Appendix 4).

Table 4
Most commonly reported adjustments introduced during COVID-19 pandemic.

Adjustments introduced in the operating theaters		**Adjustments introduced in the perioperative care protocols**		**Adjustments introduced in the protocol of conduct on the surgical ward**	
Adjustment	No respondents (%)	Adjustments	No respondents (%)	Adjustments	No respondents (%)
Additional PPE for operating theater staff, n (%)	30 (9.29%)	Additional PPE for staff attending the patient in the perioperative period, n (%)	13 (4.02%)	Shift work system, n (%)	129 (39.94%)
Division of operating rooms into COVID-19 (+) and COVID-19 (-), n (%)	26 (8.05%)	Limiting the length of stay, n (%)	9 (2.79%)	Limiting the number of people working at the surgical ward, n (%)	60 (18.58%)
Adapting the anesthesiological protocol, n (%)	10 (3.1%)	Taking additional epidemiological questionnaire, n (%)	6 (1.86%)	Additional PPE for surgical ward staff, n (%)	10 (3.1%)
Limiting the number of people working in the operating theater, n (%)	4 (1.24%)	Obligatory SARS-CoV-2 testing, n (%)	3 (0.93%)	Temporarily closing the surgical ward, n (%)	2 (0.62%)
		Additional imaging prior to hospitalization, n (%)	2 (0.62%)	Transferring patients to other wards / hospitals, n (%)	2 (0.62%)

Discussion

We observed significant changes in functioning of surgical wards, both in terms of occupancy of beds as well as in the number of performed operations. It is important to notice, that our results concerning the preparation and security of personnel are not optimistic. This study was conducted during the sudden outbreak of the COVID-19 pandemic.

Responders most often reported a smaller than usual number of patients on the ward. Deficiency of the medical staff was reported by over 21% of responders in Group 1 and 29% of responders in Group 2. It is important to notice that Poland at this point has not reached the peak of pandemic and this country was not hit by the pandemic as hard as, for instance Italy, Spain or USA [11]. According to our results, COVID-19-dedicated hospitals were less overwhelmed with the total number of hospitalized patients and less frequently reported deficits of the medical personnel. This results from discontinuing majority of admissions concerning non-COVID-19 patients and transferring them to other institutions. Surgeons working there had significantly more chances to operate on infected patients, including emergency and oncological operations.

Management of a hospital and a surgical ward during COVID-19 pandemic needs to quickly adapt to new set of challenges [12]. Bed capacity, especially on intensive care units can be rapidly depleted [13]. Additionally, providing continues coverage in terms of medical staff on infectious wards can challenging, not only due to the staff absence from contracting COVID-19 at work but also due to additional circumstances [14].

Additionally, our results present a major drop during the pandemic in mean number of performed elective surgeries weekly (28.99 vs. 8.69), which was not observed for emergency surgery (9.42 vs. 6.49). Oncological surgery was less frequently postponed, than bariatric, vascular or plastic operations. This results seem to be consistent with current recommendations [15]. By reducing the admissions and number of operations, we reduced the risk of patients being infected. On the other hand, it is not known for how long it is necessary to delay those operations. After the pandemic, there will be a very large number of patients waiting to be operated on.

Currently, multiple guidelines, reviews and directives are being published to improve the quality of care during the pandemic [16–20]. Cohen et al. propose, that among COVID-19 positive patients we should postpone elective surgery until the patient has recovered [21]. Unfortunately, not every kind of procedure can be postponed indefinitely. When it comes to oncological procedures – time is of the essence. Postponing procedures can possibly result in increased mortality, although reasonable delay, for example in case of colon cancer is acceptable [22, 23]. In our study, most commonly performed operations on SARS-CoV-2 positive patients were emergency and oncological operations, which is consistent with available guidelines [24].

Overall, 48.61% of responders preferred using laparoscopy during the COVID-19 pandemic and 49.54% believed it is safe to perform on a SARS-CoV-2 positive patient. Although there is no scientific consensus, there are suspicions that laparoscopy, due to using pressured gas can potentially increase the risk of

transmission of an aerosolized virus from infected patient to the operating theater staff [25]. These reports may have decreased surgeons trust in safety of laparoscopic procedures.

Majority of responders from both Group 1 and Group 2 reported, that measures to prevent staff infection with SARS-CoV-2 were introduced before admitting the first patients with COVID-19 (65.38% and 54.61%, respectively). Division of hospitals into COVID-19-dedicated and non-COVID-19 dedicated was a surprise. It was difficult to conduct appropriate preparations in time. COVIDSurg Collaborative advices to undertake pandemic preparations as part of routine hospital planning, before the emergence of crisis [26]. A recent report by Hasan et al. emphasizes the need to start training medical staff prior to the local start of the pandemic [14]. According to Al-Nsour et al. training programs should cover rapid response teams, points of entries, contact tracing, lab and sample management, infection control, cases management, and other processes [27]. Standardized training is immensely helpful in time of crisis by improving the clinical abilities of practitioners, which is reflected in better preparation for dealing with emergencies [28].

In this study, the level of knowledge about diagnosis and conservative treatment of COVID's -19 patients was comparable between groups, but responders from Group 1 had higher level of knowledge concerning surgical treatment. Moreover, participants of Group 1 reported higher levels of preparedness in terms of theoretical training, equipping staff with appropriate PPE and adapting the operating theater to safely perform procedures on patients with COVID-19. This is consistent with strategy of Polish Government - COVID-19-dedicated hospitals had a better access to appropriate equipment and other resources. They were supposed to be the first-line of defense during the fight with COVID-19 pandemic. However, at the beginning of epidemic in Poland, SARS-CoV-2 positive patients were also hospitalized and operated in other hospitals. Responders from Group 1 were significantly better prepared to treat infected patients. This may have resulted from training, which was conducted more often in those centers. Unfortunately, present crisis has shown, that global stockpile of PPE is insufficient [29]. Nevertheless, preventive measures are key and using PPEs (gloves, medical masks, goggles, etc.) appropriately is absolutely essential to decrease the risk of infecting individuals in health-care, including those working on surgical wards [30].

Despite the preparation and training we observed that a worrisome percentage of responders believe they will be infected with SARS-CoV-2 because of working on a surgical ward during this pandemic, which was higher in non-COVID-19-dedicated centers (51.92% vs. 64.21%). This probably resulted from a limited access to PPE as we mentioned above.

This study is associated with several limitations. The study group consisted only of 323 responders, exclusively from Poland. Therefore, it is difficult to generalize our results to other countries. The study was conducted before the pandemic has reached its peak in Poland, therefore situation could have change. The survey used an unvalidated questionnaire. Due to rapid development of pandemic using a validated survey was impossible. Major limitation was also self-assessment of knowledge by participants in the study. The survey did not include a question concerning the institution of the respondent. It was omitted due to the possibility, that respondents would possibly be inclined to paint a

more positive picture of the current state in their hospitals. Future studies should be conducted on larger and more diverse study groups.

Conclusions

Although vast majority of surgeons participating in this study reported usual or smaller then usual number of surgical patients on the ward, deficiency of medical staff was reported by a relatively large number of responders. SARS-CoV-2 pandemic had a significantly negative impact on the number of surgical procedures, which got postponed. Unfortunately, despite the preparation, the number of responders who presume being infected with SARS-CoV-2 during present crisis is over 60%.

Abbreviations

World Health Organization - WHO

The Association of Polish Surgeons - TChP

Standard deviation - SD

Interquartile range IQR

Personal protective equipment – PPE

Declarations

Ethics approval and consent to participate

The designed survey was fully anonymous. Personal data of participants collected during study, was not disclosed at any stage. The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments (Fortaleza). Participants were informed about the aim of the study and informed consent was obtained electronically prior to the beginning of the survey. The study was approved by the Bioethics Committee of the Jagiellonian University (1072.6120.103.2020). The study was registered in https://www.clinicaltrials.gov/ registry (NCT04368026).

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the

corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

TS: Conceptualization, Methodology, Formal analysis, Investigation and Writing - Original Draft, Visualization. JR and MW: Formal analysis, Investigation and Writing - Review & Editing. JSz, GW, MP and MN: Conceptualization, Methodology, Investigation and Writing - Review & Editing. PM: Conceptualization, Methodology, Investigation, Writing - Review & Editing, Supervision and Project administration.

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Figures

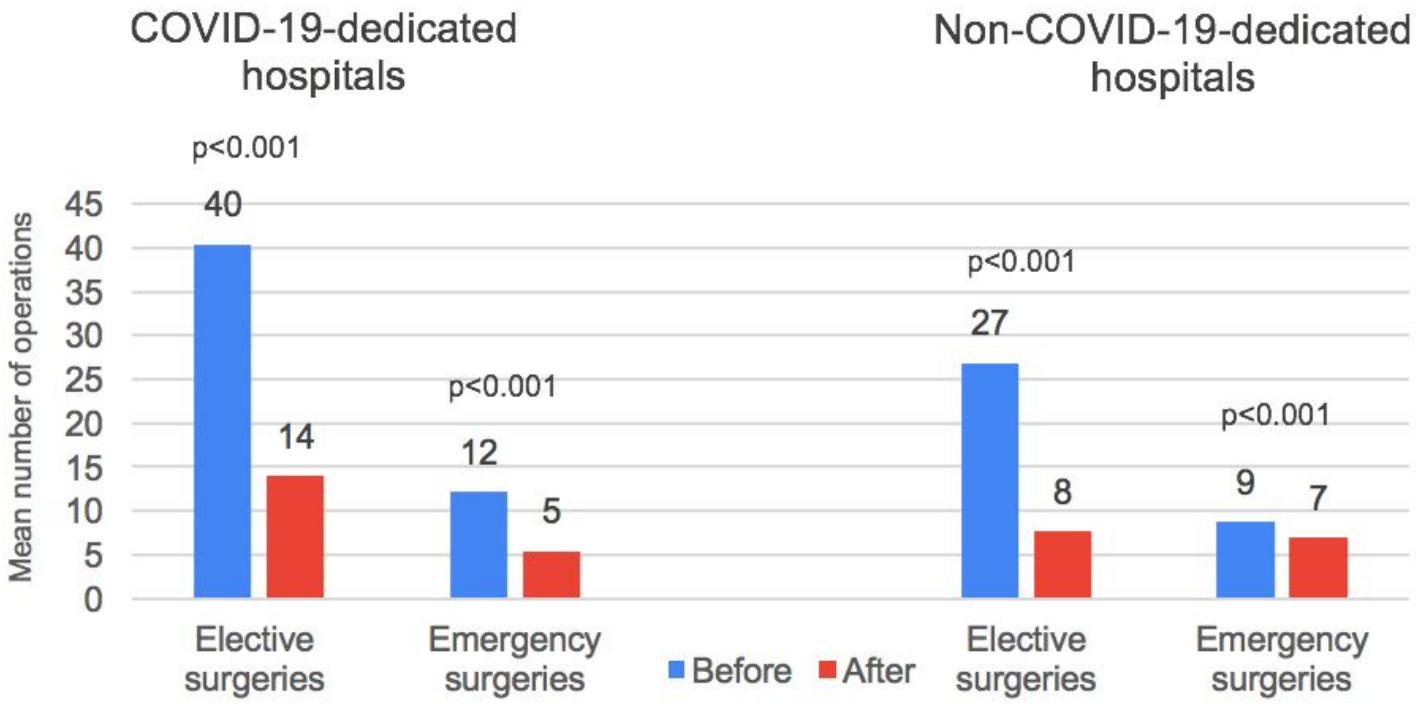

Figure 1

Mean number of elective and emergency procedures performed weekly in Group 1 and 2 before and during the COVID-19 pandemic (comparison between number of surgeries before and after was done with Student's t-test for paired samples).

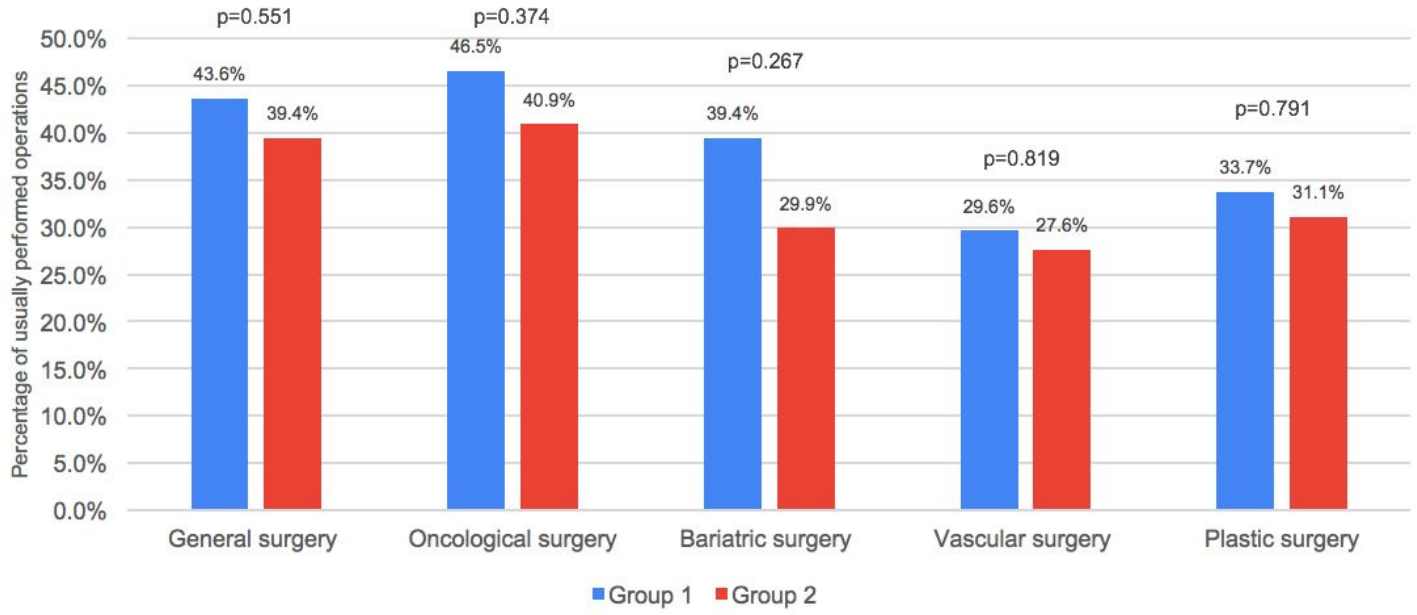

Figure 2

Mean percentage of the norm performed during pandemic, for various types of surgery (Group 1 – COVID19-dedicated hospitals; Group 2 – non-COVID19-dedicated hospitals; Student's t-test was used to

compere Group 1 and 2).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix4.docx
- Appendix3.docx
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