



CLINICAL RESEARCH

Urgent/emergency surgery during COVID-19 state of emergency in Portugal: a retrospective and observational study

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Abstract

Background: SARS-CoV-2 virus changed society's behaviour. Population was advised to reduce unnecessary health care use to accommodate urgent cases and daily increase of COVID-19 patients. Health care facilities faced huge challenges, having to readjust their response to preserve good quality of care. In Portugal, a significant reduction in the number of admissions to the Emergency Department (ED) was reported all over the country, however the impact on the dynamics of undeferrable surgery remains to be reported. This study compares the volume and characteristics of urgent/emergency surgery during the 2020 COVID-19 pandemic with the homologous period in 2019, chronologically illustrating the national evolution of new COVID-19 cases and the social and hospital containment response.

Methods: A retrospective observational study was conducted in a tertiary hospital center located in the most affected region by COVID-19 in Portugal. Medical records of patients who underwent urgent/emergency surgery between March 1st and May 2nd of both 2020 and 2019 were examined and the volume of surgeries were compared. Also, daily national updates from Portuguese Directorate-General for Health were analysed.

Results: During the COVID-19 pandemic approximately 30% less patients underwent urgent/emergency surgery (99%CI = 0.18–0.61, $p < 0.001$). Waiting time for surgery showed no difference between both years ($p = 0.068$), but patients who did surgery during the 2020 pandemic had higher mortality rates than the ones who did it in 2019 (11.4% in 2020 and 5.9% in 2019, $p = 0.001$). Reduction in surgery volume was correlated with the increasing number of infected cases nationally.

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Conclusion: This study demonstrates decreasing numbers of urgent/emergency procedures during the COVID-19 pandemic that may be justified by the national growth number of infected cases. Preoperative mass screening strategy was implemented without compromising the efficiency of surgical service, but patients' mortality was higher. The importance of visiting the ED during COVID-19 pandemic for serious cases that cannot be managed in other settings should be highlighted.

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Introduction

The SARS-CoV-2 virus is now widely acknowledged and has become one of the most debated and studied subjects worldwide. It emerged in China in December 2019 and quickly spread to the rest of the world, including Europe.^{1,2} The first case in Portugal was announced on March 2, 2020 with increasing number of cases being reported everyday.³

On March 18, 2020, Portugal declared the state of emergency – the first of which there was memory in the country.⁴ As of that day, services considered non-essential ceased and widespread quarantine was imposed. National public health advised to reduce unnecessary health care use in order to accommodate urgent cases and daily increase of COVID-19 patients. Scheduled surgery was reduced to what was strictly necessary (namely oncological or otherwise priority surgery). Urgent/emergency surgery and traumatology, however, kept being referred, and required immediate and coordinated intervention.

Across Europe several health care systems faced unprecedented pressure, which threatened to undermine its effectiveness and sustainability. Reports from Spain, Scotland, and Italy described a dramatic reduction in the number of emergency or acute care surgeries during the peak of the COVID-19 emergency.⁵⁻⁷ In Portugal, a significant reduction in the number of admissions to the Emergency Department (ED) was reported all over the country,⁸⁻¹⁰ however, the impact on the dynamics of undeferrable surgery remains to be reported.

The authors report from a tertiary university hospital in Porto, the second largest city in Portugal and the most

affected by the virus nationally. The country has universal health coverage provided by National Health Service.

This study aims to compare the volume, characteristics, and mortality of urgent/emergency surgery in COVID-19 state of emergency with the homologous period of 2019.

Materials and methods

After institutional approval, the authors conducted a retrospective observational study in Hospital Geral de Santo António. It is integrated in Centro Hospitalar Universitário do Porto (CHUP), a tertiary hospital and trauma center located in the Northern region of Portugal that covers a large geographical area and a population of more than 3 million inhabitants.¹¹

Electronic medical records of patients referred to urgent/emergency surgery between March 1st and May 2nd of both 2020 and 2019 were examined. Urgent/emergency surgery procedures were defined as interventions required to deal with an acute threat to life, organ, limb, or tissue caused by trauma, acute disease process, acute exacerbation of a chronic disease process, or complication of a surgical or other interventional procedure. The selected time interval matches the day before the first diagnosed case in our country and the end of emergency state imposed by the national government. Patients' demographic data, surgical specialties, waiting time for surgery (since the request for surgery until patient surgery), knowledge of COVID-19 screening test results and 30-day mortality were collected. ASA (American Society of Anesthesiologists) physical status classification system was examined as it offers

Table 1 Demographic data of patients submitted to urgent/emergency surgery in the homologous period (2019 vs. 2020). E denotes Emergency.

	All patients (n = 1100)	2019 (n = 643)	2020 (n = 457)	p-value
Age, median [IQR], years	65 [0 to 1]	63 [0 to 1]	67 [0 to 1]	0.017
Sex, n (%)				0.968
Male	629 (57.2)	368 (57.2)	261 (57.1)	
Female	471 (42.8)	275 (42.8)	196 (42.9)	
ASA-PS, n (%)				0.085
ASA I E	64 (5.8)	41 (6.4)	23 (5.0)	
ASA II E	306 (27.8)	190 (29.5)	116 (25.4)	
ASA III E	501 (45.5)	271 (42.1)	230 (50.3)	
ASA IV E	201 (18.3)	126 (19.6)	75 (16.4)	
ASA V E	28 (2.5)	15 (2.3)	13 (2.8)	

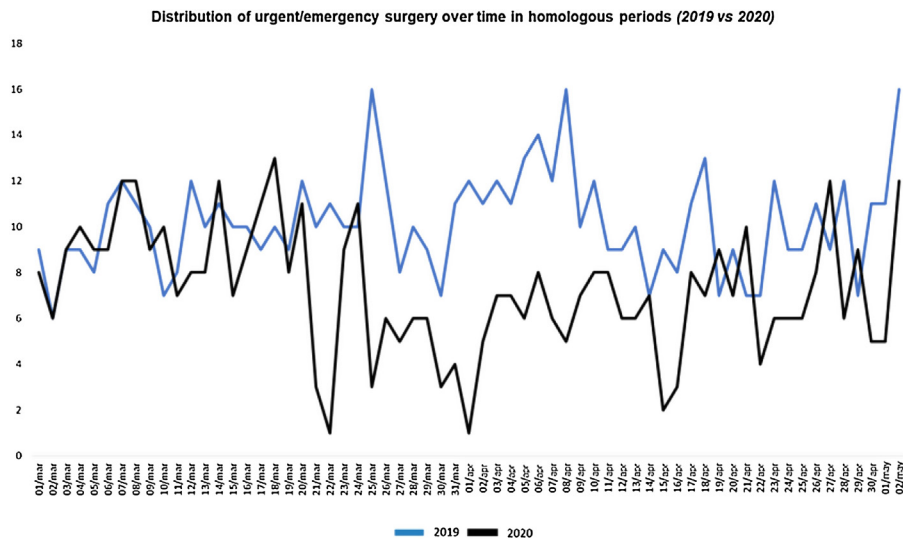


Figure 1 Distribution of urgent/emergency surgery over time in homologous periods (2019 vs. 2020).

clinicians a simple categorization of a patient's physiological status that can be helpful in predicting operative risk.¹³ National pandemic evolution and implemented government public health measures were updated daily at the Portuguese Directorate-General for Health website.¹⁴

All patient identification details were anonymized previously to the data analysis to secure personal information. Descriptive analysis, Mann-Whitney U and Chi-square tests were performed using software IBM® SPSS® Statistics v.26 (National Opinion Research Center, USA). Statistical significance was attributed to *p*-values less than 0.005. The difference of urgent/emergency surgeries between 2019 and 2020 and its cumulative sum over time was calculated. To analyze the potential correlation between the growing number of COVID-19 cases and the cumulative reduction of urgent/emergency surgery, cross-correlation with autocorrelation removed by simple pre-whitening was performed using the function "cross-correlations" of the package "analyze" in software SPSS. The effect of pre-whitening was to reduce unassociated autocorrelation and/or trends within time series prior to computation of their cross-correlation function. An auto-regressive model was fit to the two variables since both displayed first order autocorrelative relationship using the function "auto-correlations" of the package "analyze" in software SPSS. The pre-whitened variables consisted of the residuals of this fitted model.

Results

Table 1 describes the characteristics of patients who underwent urgent/emergency surgery during the studied period. No significant difference between patients' sex ($p = 0.968$), ASA classification ($p = 0.085$) or age ($p = 0.017$) was observed during the two periods. During the pandemic, approximately 30% less patients (99%CI = 0.18–0.61, $p < 0.001$) were admitted to urgent/emergency surgery (623 in 2019 and 457 in 2020, **Figure 1**). Waiting time for surgery showed no difference between both years (**Table 2**, $p = 0.068$).

When analyzing 30-day-mortality, patients who underwent urgent/emergency surgery during 2020 COVID-19 pandemic had higher mortality rates than the ones who did it during 2019 (11.4% in 2020 and 5.9% in 2019, $p = 0.001$).

Since the state of emergency was declared in Portugal, the reduction in volume of urgent/emergency surgery observed in our hospital accompanied the increase of newly diagnosed cases (**Fig. 2**). Actually, we estimate a correlation between these two variables (**Fig. 3**) – cross-correlation coefficient of 0.573. The strongest estimated correlation between the number of COVID-19 cases and the reduced surgical volume occurred at lag-2 days. This time-series analysis allowed for detection of a lagged relationship that probably indicates a cause-and-effect link – the impact of new COVID-19 cases in surgical volume was seen with a lag of two days.

Discussion

Urgent/emergency surgery represents a therapeutic intervention to manage acute conditions that imply clinical deterioration or potential threat to life that should be engaged in a short time. In view of this definition, it would be expected that urgent/emergency surgery could remain unchanged in the present year.

However, as described in several European reports, this study suggests that the COVID-19 pandemic caused a major reduction in demand of urgent/emergency procedures.^{5–7} In fact, this investigation proposes that the observed reduction didn't seem to be random or static and was correlated with the national growth of COVID-19 cases. This allows the authors to propose that the augmentation of national cases and the recurrent alarm of mass media may have seed the fear of contamination, reducing the visits to the ED and, consequently, the demand for urgent/emergency surgery.

Considering **Figure 2**, the increasing number of new cases forced a profound change in the National Health System. Two dates stood out as cornerstones of change. The first was March 18, when the declaration of the state of emergency

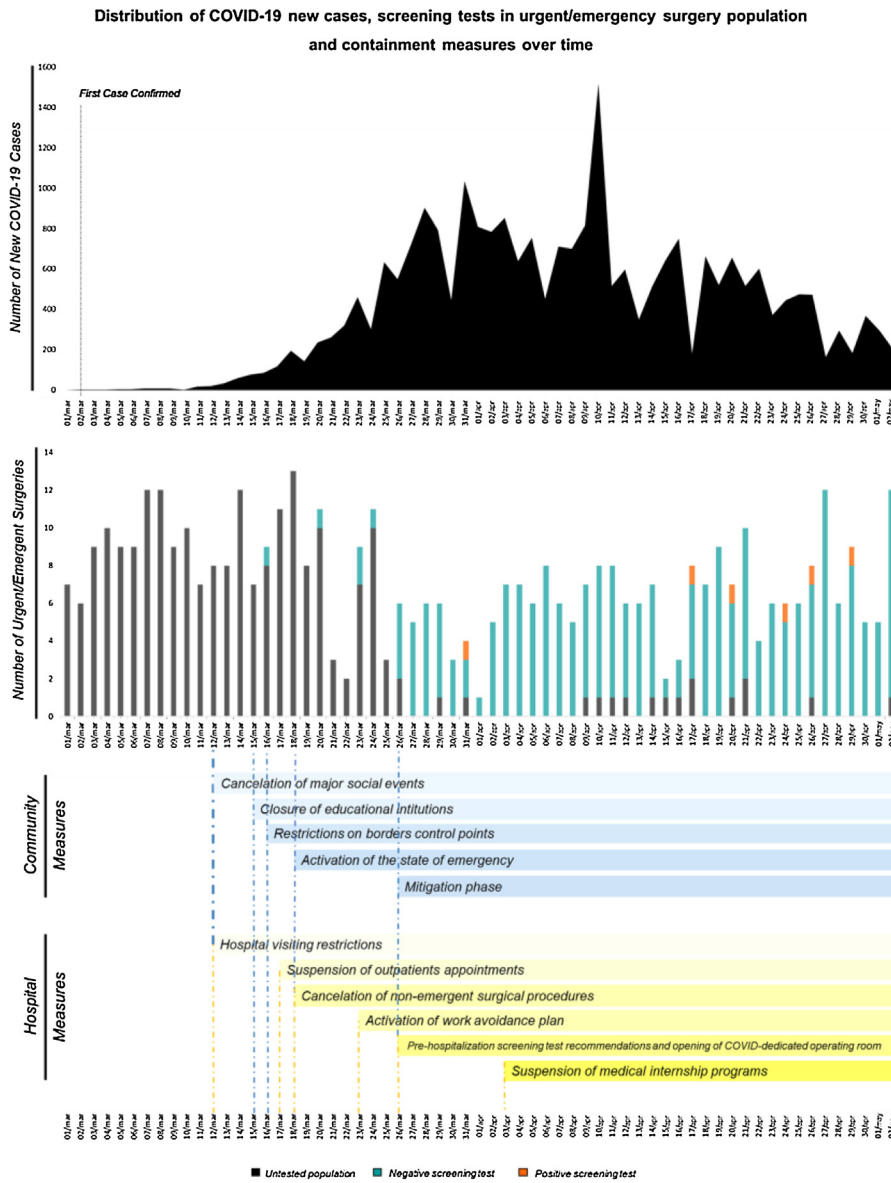


Figure 2 Shows the number of new infected cases reported nationally, the containment measures that were imposed by the government and the reorganization of our hospital over time. Also, on a daily scale, the number of urgent/emergency procedures and the application of screening tests in the period under study is presented.

by the government marked the beginning of quarantine measures. The second referred to the acknowledgment of mitigation phase, when preoperative screening test availability was guaranteed, and the COVID-19 operating theatre (OT) was established. From March 27 all patients undergoing urgent surgery were tested and allocated to COVID-19 or non-COVID-19 areas, except for 16 patients who required emergency surgical care. All 16 patients were allocated to COVID-19 OT until knowledge of the test result.

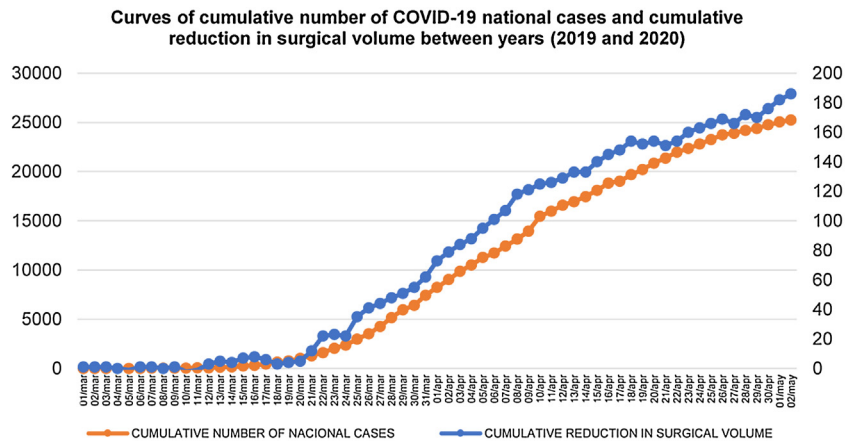
Screening recommendations led to changes in admission for urgent/emergency surgery and the need to ensure appropriate waiting times for surgery was a concern for surgical services. However, this study shows that there was no significant difference in the waiting time for surgery. This result can be understood based on an institutional

screening strategy that gave priority to patients in need of urgent/emergency surgery. At that time there were no available rapid tests in our hospital (made in 60 minutes), so patients had to wait about 4 hours to have an available screening test result. On the other hand, the significant reduction in the surgical volume may have contributed to the greater efficiency of surgical services.

Analyzing the population in both periods, the patient demographics, ASA classifications, and characteristics of procedures were similar. However, during the pandemic period mortality was higher, reaching almost double from previous year.¹² This finding supports data introduced by a Portuguese study presenting evidence of excess mortality during the COVID-19 lockdown, 3.5 to 5-fold higher than what can be explained by the official national COVID-19

Table 2 Distribution of urgent/emergency surgical specialties and waiting time for surgery in the homologous period (2019 vs. 2020).

	All patients (n = 1100)	2019 (n = 643)	2020 (n = 457)	p-value
Waiting time until surgery, n (%)				0.068
Less than 1 day (< 24 hours)	957 (87.0)	541 (84.1)	416 (91.0)	
More than 1 day	143 (13.0)	102 (15.9)	41 (9.0)	
Distribution of surgeries per surgical area, n (%)				0.030
Orthopedic surgery	299 (27.2)	187 (29.1)	112 (24.5)	
General surgery	281 (25.5)	177 (27.5)	104 (22.8)	
Vascular surgery	269 (24.5)	133 (20.7)	136 (29.8)	
Neurosurgery	119 (10.8)	72 (11.2)	47 (10.3)	
Urology	79 (7.2)	46 (7.2)	33 (7.2)	
Gastroenterology	15 (1.4)	7 (1.1)	8 (1.8)	
Ophthalmology	15 (1.4)	10 (1.6)	5 (1.1)	
Maxillofacial surgery	12 (1.1)	5 (0.8)	7 (1.5)	
Ear, Nose, and Throat surgery	9 (0.8)	4 (0.6)	5 (1.1)	
Plastic surgery	2 (0.2)	2 (0.3)	0 (0.0)	

**Figure 3** Curves of cumulative number of COVID-19 national cases and cumulative reduction in surgical volume between years (2019 vs. 2020).

deaths. Additionally, as reported by other European countries, a greater severity of pathologies or delayed use of ED could be pointed out as plausible explanations for the increase in mortality.⁵⁻⁷

The authors recognize that the study has several limitations, namely, those inherent to its retrospective nature. Additionally, as waiting time for urgent/emergency surgery may determine its outcome, it would have been more accurate to present it in hours instead of days. As it is a recent and still ongoing situation, a relatively short period was analyzed and may not be representative. Considering the size of the population sample and the fact that is a single-centered study, the findings may not describe national reality, although, as mentioned above, CHUP covers a wide geographical area that cannot be ignored.

As a second wave of COVID-19 pandemic spreads through Europe, it is extremely important to highlight learning points from the past. Even maintaining adequate testing strategies and similar waiting times for surgery, the mortality rates increased. In view of this findings, health care systems

should provide guidance to help patients to choose the best place to receive care and to ensure that those with serious illnesses and injuries continue going to ED, without fear of inefficiency or contamination. Otherwise, delayed diagnosis can imply potential life-threatening outcomes.

Conclusion

This study suggests that the COVID-19 pandemic caused a reduction in urgent/emergency procedures that can be correlated with the national growth of COVID-19 cases. Preoperative mass screening test strategy for urgent/emergency patients was implemented without compromising the efficiency of surgical services. Despite the similar characteristics of population and procedures, a higher mortality was observed during the pandemic.

Conflicts of interest

The authors declare no conflicts of interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.bjane.2021.01.003>.

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