

The Effect of the COVID Pandemic Lockdown Measures on Surgical Emergencies: Experience and Lessons Learned from A Greek Tertiary Hospital.

Emmanouil Pikoulis (✉ mpikoul@med.uoa.gr)

General University Hospital of Athens Attikon: Panepistemiako Geniko Nosokomeio Attikon

Nikolaos Koliakos

General University Hospital of Athens Attikon: Panepistemiako Geniko Nosokomeio Attikon

Dimitrios Papaconstantinou

General University Hospital of Athens Attikon: Panepistemiako Geniko Nosokomeio Attikon

<https://orcid.org/0000-0002-2319-4923>

Nikolaos Pararas

General University Hospital of Athens Attikon: Panepistemiako Geniko Nosokomeio Attikon

Andreas Pikoulis

General University Hospital of Athens Attikon: Panepistemiako Geniko Nosokomeio Attikon

Stavratis Fotios-Christos

General University Hospital of Athens Attikon: Panepistemiako Geniko Nosokomeio Attikon

Constantinos Nastos

General University Hospital of Athens Attikon: Panepistemiako Geniko Nosokomeio Attikon

Georgios Bagias

General University Hospital of Athens Attikon: Panepistemiako Geniko Nosokomeio Attikon

Eleni Boutati

General University Hospital of Athens Attikon: Panepistemiako Geniko Nosokomeio Attikon

Federico Coccolini

Emergency surgery unit & Trauma Center, Pisa University Hospital

Fausto Catena

Emergency and Trauma Surgery, Maggiore Hospital

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Abstract

Background: The COVID-19 pandemic caused a rise in healthcare demands and has necessitated a significant restructuring of hospital Emergency Departments. The present study aims to determine the pandemic lockdown's impact on the number of patients seeking assessment in the Surgical Emergency Department (SED) with General Surgery emergencies.

Methods: Since the start of the Covid pandemic in Greece (1 March, 2020) and up to 15 December 2020, the charts of all patients arriving at the SED of the third surgical department of the "Attikon" University Hospital (a tertiary referral center for surgical and COVID-19 cases) were retrospectively reviewed and broken down in four periods reflecting two nationwide lockdown (period A; 1/3/2020 to 30/4/2020 and period D; 16/10/2020 to 15/12/2020) and two interim (period B; 1/5/2020 to 15/6/2020 and period C; 15/9/2020 to 30/10/2020) periods. Demographic and clinical data were compared to those obtained from the same time periods of the year 2019.

Results: The total number of patients attending the SED decreased by 35.9% during the pandemic (from 2839 total patients in 2020 to 1819 in 2019). During the first lockdown, there was a statistically significant reduction of motor vehicle accidents ($p=0.04$) and torso injuries ($p=0.01$). A rise in the rate of traumatic brain injuries ($p<0.001$), abdominal pain ($p=0.04$) and hospital admissions ($p=0.002$) was also evident. During the second lockdown, there was a reduction in the number of perianal abscess cases ($p=0.04$) and hernia-related problems ($p=0.001$). An increase in the rate of fall injuries was also demonstrable ($p=0.02$).

Conclusion: The burden of the new COVID-19 disease has left a noticeable imprint in the function of emergency departments worldwide. In Greece, implemented lockdown measures significantly impacted the SED attendance rates, the clinical characteristics of the attending patients and the overall hospital admission rate. The long-term effects on national health systems remain to be seen.

Introduction

The new SARS-CoV-2 virus is responsible for a novel pneumonia affecting the lower respiratory system and is referred to as coronavirus disease 2019 (COVID-19). Since it first appeared in December 2019, it spread worldwide and was declared as a pandemic by the World Health Organization (WHO) in March 2020 [1].

The pandemic had multiple profound impacts on the affected countries' social, economic, and healthcare aspects of life. The pandemic's impact is forcing Governments across the globe to implement unprecedented confinement measures, including social distancing, avoidance of physical contact, and complete or partial lockdowns to minimize the spread of the disease. The pandemic caused a rise in healthcare demands worldwide and has necessitated a significant restructuring of hospital Emergency Departments and their function. Importantly, the emergence of the Covid-19 has posed a significant strain on hospital systems due to the large-scale increase of the hospitalizations of patients

with Coronavirus related disease [2]. Most authorities opted to postpone elective surgical cases when feasible [3, 4] in an effort to relocate resource to Covid-19 patients. However, the need for care of patients presenting with surgical emergencies continued, still necessitating urgent or emergent surgical interventions [5].

This study aimed to determine the pandemic lockdown's impact on the number of patients seeking assessment in the Surgical Emergency Department (SED) with General Surgery emergencies.

Materials And Methods

An observational study and retrospective analysis was performed. The charts of all patients arriving at the surgical emergency department (SED) of the third surgical department of the "Attikon" University Hospital (a tertiary university hospital and referral center) since the beginning of the Covid-19 pandemic in Greece (March 1, 2020) and up to December 15, 2020, were reviewed in regards to their reason for presentation, the use of ambulance services and the need for hospital admission. Admitted patients were further reviewed regarding the mortality rate, length of hospital stay, ICU requirements, and peritonitis incidence. Patients using SED services during the same time period of the previous year (2019) were utilized as pre-pandemic controls.

The entire patient cohort was broken down into four time periods according to the timing of presentation; time period A included patients from 1/3/2020 to 30/4/2020, time period B from 1/5/2020 to 15/6/2020, time period C from 15/9/2020 to 30/10/2020, time period D from 16/10/2020 to 15/12/2020. Group A coincides with the duration of the first "lockdown" measures in Greece, while Group D coincides with the second "lockdown" effect during the second wave of the Covid-19 pandemic. Group B patients presented to the SED during a time period when no "lockdown" measures were in effect, and Group C patients during a time period when partial restrictive measures were applied. Patients in each of these groups were matched with patients visiting the SED during the exact same period during the year 2019. For each patient, a single chief complaint or reason for visiting the SED was registered.

All patients arriving at the SED in the designated time periods were eligible for inclusion. Cases involving consultation to other subdivisions of the Emergency Department and in-hospital referrals were excluded. Statistical analyses were performed using IBM SPSS Statistics, version 25 (SPSS Inc., Chicago, IL, USA). Non-parametric tests (chi-square, Mann-Whitney U) were used to test for group differences. A p-value lower than 0.05 was considered statistically significant.

Results

In total, 1819 patients attended the SED in the designated study periods after the start of the pandemic. These patients were matched with 2839 patients that received care from the SED during the corresponding time periods of the year 2019. Figure 1 exhibits the trend of SED attendance, in total numbers, before and after the start of the pandemic.

Regarding the reason for visiting the SED, fall injuries comprised the most commonly encountered cases both before (22.3%) and after the start of the pandemic (21.5%). During the study time period, there was a statistically significant reduction in patients seeking surgical attention for symptoms relating to a hernia compared to the pre-pandemic control group (1.3% vs. 3.7%, $p < 0.001$). The rates of traumatic brain injuries and abdominal pain were significantly elevated in the pandemic patient group (10.1% vs. 7.4% and 14.8% vs. 12.8%, respectively). Use of ambulance services before the arrival at the SED was equivalent between the compared groups. The admissions rate was higher during the pandemic period (5.9% vs. 4.7% in the control group), albeit with no statistically significant difference. Figure 2 summarizes comparative patient data regarding the reason for visiting the SED.

The time periods A and D correspond to the application of “lockdown” measures in Greece. There was a statistically significant reduction of motor vehicle accidents (13.5% vs 14.8%, $p = 0.04$) and torso injuries (2.4% vs 5.2%, $p = 0.01$) compared with the matched patient cohort during the same time periods of 2019. A significant rise in the rate of traumatic brain injuries (11.4% vs 6%, $p < 0.001$), abdominal pain (14% vs 12.4%, $p = 0.04$) and hospital admissions (7.6% vs 3.7%, $p = 0.002$) was evident. During time period D (second “lockdown”), a significant reduction in the cases of perianal abscess (2.2% vs. 4.7%, $p = 0.04$) or hernia-related complaints (1.1% vs. 5.1%, $p = 0.001$) was observed. A significant increase in the rate of false injuries was also demonstrable (28.6% vs. 22.4%, $p = 0.02$).

Analysis of patients presenting during time period B (lift of “lockdown” measures) did not reveal any statistically significant differences in reason for visiting the SED compared to their 2019 counterparts. The same holds for time period C (partial “lockdown” measures), except for hernia cases, which exhibited a significant reduction (1.6% vs. 5%, $p = 0.002$). When patients presenting during the first “lockdown” period were compared with those presenting during the second “lockdown” period, a significant reduction of perianal abscess cases was noticed in the latter group (5.9% vs. 2.2%, $p = 0.009$). Patient data and comparisons are available for review in Table 1.

Table 1

Characteristics of patients visiting the Surgical Emergency Department referral in the four different study time periods (A: First lockdown 1 March 2020 to 30 April 2020, B: 1 May 2020 to 15 June 2020, C: Partial restrictions 15 September 2020 to 30 October 2020, D: Second lockdown 16 October to 15 December 2020).

Time Period	A	p-value	B	p-value	C	p-value	D	p-value
<i>Pandemic Group vs Control Group (n, %)</i>								
Total ED patients	421 vs 842		539 vs 610		495 vs 664		364 vs 723	
Men	254 (60.3) vs 490 (58.2)	0.46	294 (54.5) vs 365 (59.8)	0.07	302 (61) vs 367 (55.2)	0.05	220 (60.4) vs 387 (53.5)	0.03
Women	167 (39.7) vs 352 (41.8)	0.46	245 (45.5) vs 245 (40.2)	0.07	193 (39) vs 297 (44.8)	0.05	144 (39.6) vs 336 (46.5)	0.03
Ambulance use	83 (19.7) vs 168 (19.9)	0.92	100 (18.5) vs 116 (19)	0.84	101 (20.4) vs 116 (17.5)	0.2	66 (18.1) vs 134 (18.5)	0.87
Fall injuries	97 (23) vs 191 (22.7)	0.88	87 (16.1) vs 115 (18.9)	0.23	117 (23.6) vs 141 (21.2)	0.33	104 (28.6) vs 162 (22.4)	0.02
Minor injuries	57 (13.5) vs 129 (15.3)	0.4	78 (14.4) vs 94 (15.4)	0.65	63 (12.7) vs 90 (13.5)	0.68	51 (14) vs 102 (14.1)	0.96
Motor vehicle accidents	45 (10.7) vs 125 (14.8)	0.04	87 (16.1) vs 101 (16.5)	0.84	71 (14.3) vs 99 (14.9)	0.78	51 (14) vs 100 (13.8)	0.93
Abdominal pain	69 (14) vs 104 (12.4)	0.04	76 (14.1) vs 83 (13.6)	0.81	66 (13.3) vs 84 (12.7)	0.72	59 (16.2) vs 92 (12.7)	0.11
Traumatic brain injuries	48 (11.4) vs 51 (6)	< 0.001	50 (9.3) vs 44 (7.2)	0.2	54 (10.9) vs 57 (8.6)	0.18	31 (8.5) vs 57 (7.9)	0.71
Torso injuries	10 (2.4) vs 44 (5.2)	0.01	36 (6.7) vs 27 (4.4)	0.09	23 (4.6) vs 24 (3.6)	0.37	11 (3) vs 33 (4.6)	0.22
Perianal abscess	25 (5.9) vs 48 (5.7)	0.86	19 (3.5) vs 29 (4.8)	0.29	26 (5.2) vs 25 (3.8)	0.22	8 (2.2) vs 34 (4.7)	0.04

Time Period	A	p-value	B	p-value	C	p-value	D	p-value
Hernia	4 (1) vs 19 (2.3)	0.1	7 (1.3) vs 16 (2.6)	0.1	8 (1.6) vs 33 (5)	0.002	4 (1.1) vs 37 (5.1)	0.001
Others	36 (8.5) vs 75 (8.9)	0.83	51 (9.5) vs 57 (9.3)	0.94	42 (8.5) vs 79 (11.9)	0.06	31 (8.5) vs 73 (10.1)	0.4
Admissions	32 (7.6) vs 31 (3.7)	0.002	33 (6.1) vs 32 (5.2)	0.64	21 (4.2) vs 42 (6.3)	0.12	22 (6) vs 28 (3.9)	0.1

Of note, there was no statistically significant difference in ambulance use rates in any of the study time periods. Furthermore, the patient admission rate was significantly elevated only during the time period A. When the entire patient cohort was compared with its pre-pandemic counterpart, no difference in the overall admission rate was observed (Fig. 3).

Charts of patients admitted to the hospital were further reviewed for each study time period separately (Table 2). There were no significant differences encountered in the admission rates for peritonitis, the ICU admission rate, mortality rate, or length of hospital stay in any of the study periods.

Table 2
Admission related parameters during the various phases of the pandemic.

Time Period	A	p-value	B	p-value	C	p-value	D	p-value
<i>Pandemic Group vs Control Group (n, %)</i>								
Admissions for peritonitis	6 (18.7) vs 5 (16.1)	0.27	7 (21.2) vs 5 (15.6)	0.58	4 (19) vs 9 (21.4)	0.82	5 (22.7) vs 7 (25)	0.84
ICU admissions	2(6.2) vs 3 (9.7)	0.61	4 (12.1) vs 3 (9.3)	0.35	2 (9.5) vs 3 (7.1)	0.74	0 vs 1 (3.6)	0.36
Mortality	3 (9.3) vs 2 (6.5)	0.42	3 (9) vs 2 (6.2)	0.66	3 (14.3) vs 2 (4.8)	0.18	2 (9) vs 1 (3.6)	0.41
Length of hospital stay (mean ± SD)	6.9 ± 6.2 vs 11 ± 17.9	0.39	6.8 ± 6 vs 9.6 ± 11.8	0.22	7 ± 9.3 vs 7 ± 6.7	0.91	6.3 ± 4.2 vs 7.4 ± 4.7	0.37

Discussion

The Covid-19 epidemic is the first pandemic in the modern era, currently affecting most countries worldwide. Its spread and quick diffusion around the globe is unprecedented, involving many European countries like Italy[6], Spain [7], and France[8]. Following the paradigm of the United Kingdom, many countries adopted a more lax strategy to fight the virus' spread, but soon after implemented social distancing policies [9]. On the other hand, Greece adopted such measures quickly, from the beginning of March 2020, and employed a rather aggressive strategy involving timely closure of educational institutions, recreational facilities, and businesses in an effort to minimize the spread of the virus and ease the load imposed on its healthcare system. The rapid adoption of emergency measures in Greece in all aspects of life (healthcare, education, economy) prevented hospitals from being overwhelmed. In the SED, every aspect of the patient pathways was changed to minimize the disease's spread. Outpatient clinics have dramatically decreased and, in some cases, ceased completely, in order to control the cross-infection. Elective non-cancer surgery has been canceled, first to allocate staff, particularly anesthesiologists, to help with the Covid-19 patients, and secondly to free up operating rooms with valuable ventilators in case of need. However, emergency surgery is an essential service that cannot and was not interrupted during the lockdowns and continues to run in full capacity, and it is the objective of this study.

Looking at the amount of patients reviewed by General Surgery in the Emergency Department during the different periods of the pandemic in comparison to the same periods of 2019, the number of patients decreased by 35,9% (from 2839 in 2019 to 1819 in 2020). The time periods A and D correspond to the application of "lockdown" measures in Greece. There was a statistically significant reduction of motor vehicle accidents (13.5% vs 14.8%, $p = 0.04$) and torso injuries (2.4% vs 5.2%, $p = 0.01$) compared with the matched patient cohort during the same time periods of 2019. A significant rise in the rate of traumatic brain injuries (11.4% vs 6%, $p < 0.001$), abdominal pain (14% vs 12.4%, $p = 0.04$) and hospital admissions (7.6% vs 3.7%, $p = 0.002$) was evident. During time-period D (second "lockdown"), a significant reduction in the cases of perianal abscess (2.2% vs. 4.7%, $p = 0.04$) or hernia-related complaints (1.1% vs. 5.1%, $p = 0.001$) was observed. A significant increase in the rate of false injuries was also demonstrable (28.6% vs. 22.4%, $p = 0.02$).

Analysis of patients presenting during time-period B (lift of "lockdown" measures) did not reveal any statistically significant differences in reason for visiting the SED compared to their 2019 counterparts. The same holds for time-period C (partial "lockdown" measures), except for hernia cases, which exhibited significant reduction (1.6% vs. 5%, $p = 0.002$). When patients presenting during the first "lockdown" period were compared with those presenting during the second "lockdown" period, a significant reduction of perianal abscess cases was noticed in the latter group (5.9% vs. 2.2%, $p = 0.009$).

Throughout the lockdown, evidently, the patients avoided visiting the hospital in fear of getting infected with the Covid-19 virus and not wanting to overload an already stretched service. With the directives to the citizens being of not leaving their home in order to protect the national public health system and save lives by social distancing, may have been misleading to the general population to think that they may not leave their homes at any cost and put greater pressure to an already overwhelmed health system. Many

may likely have feared becoming infected by the Coronavirus and encountered life-threatening situations such as myocardial infarctions or accidents at home. Other symptoms, such as abdominal or perianal pain, must have been managed at home[10]. General Practitioners must have played a significant role in treating patients with acute conditions, such as acute cholecystitis, with conservative antibiotic treatment and phone follow-ups. De Simone et al. [11] reported that non-operative treatment could be applied in acute appendicitis, acute cholecystitis, adhesive bowel obstructions, and incarcerated hernias in the period of the pandemic. East et al. [12] reported that a manual reduction of incarcerated hernias under analgesia or sedation is a useful first treatment in situations where surgical management is not immediately available, including the Covid-19 pandemic. Simultaneously, a reasonable decrease in road traffic accidents was encountered due to the population's traffic limitations.

We were expecting the patients to present with a delayed and more severe presentation of symptoms during the Covid-19 period. However, no significant differences were encountered in the admission rates for peritonitis, the ICU admission rate, mortality rate, or length of hospital stay in any of the study periods. A plausible explanation of this fact is that there might be an increasing unknown number of patients suffering from acute abdominal conditions staying at home. Additional research is necessary, as data from the outpatient clinic were not available at the time of the pandemic.

Deciding to perform emergency surgery in the current environment is a significant one and requires planning and involving senior surgeons. All patients should be considered as infected until proven otherwise. In our hospital, as a preoperative screening protocol, each patient is undergoing an RT-PCR Covid-19 test. This is following the SCOUT study [13] that found at least 1 in every 100 asymptomatic patients undergoing any surgery (elective or emergency) being infected with the SARS-CoV-2 virus and suggests that patients undergoing surgery should be screened with RT-PCR. Despite early recommendations against minimally invasive surgery [14, 15], there is little evidence about laparoscopy's aerosolization potential and thus virus dissemination. The most recent policy is to minimize the free release of insufflated gas [16, 17]. This is the policy that we have adhered to since the beginning of the pandemic, maintaining the usual overall rate of laparoscopic surgeries in patients admitted from the SED while adhering to proposed international surgical practice guidelines and directives [18].

The main limitation of this study is its single-center retrospective design. The results may not apply to all the hospitals. Many patients may have been admitted to less risky peripheral hospitals. Moreover, the after-effects of the reduction of SED patients cannot be accurately measured and the overall impact it will bear on Greek national health system remains as yet unknown.

Conclusion

Ultimately, the Covid-19 pandemic has led to a review of national health systems around the world. It is valuable to evaluate this pandemic's effects on surgical patients admitted to the SED in the post-pandemic period. Maybe new algorithms are needed for these particularly unusual situations, which may assist with preparing a national plan for possible future outbreaks.

Abbreviations

SED; Surgical Emergency Department

ICU; Intensive Care Unit

RT-PCR; Real Time Polymerase Chain Reaction

Declarations

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and materials: The datasets used and/or analysed 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

Study design: Emmanouil Pikoulis, Nikolaos Koliakos, Federicco Coccolini, Fausto Catena

Data collection: Stavratis Fotios-Christos, Nikolaos Koliakos, Georgios Bagias

Statistical analysis: Dimitrios Papaconstantinou, Andreas Pikoulis

Manuscript Drafting: Nikolaos Pararas, Constantinos Nastos, Eleni Boutati

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Figures

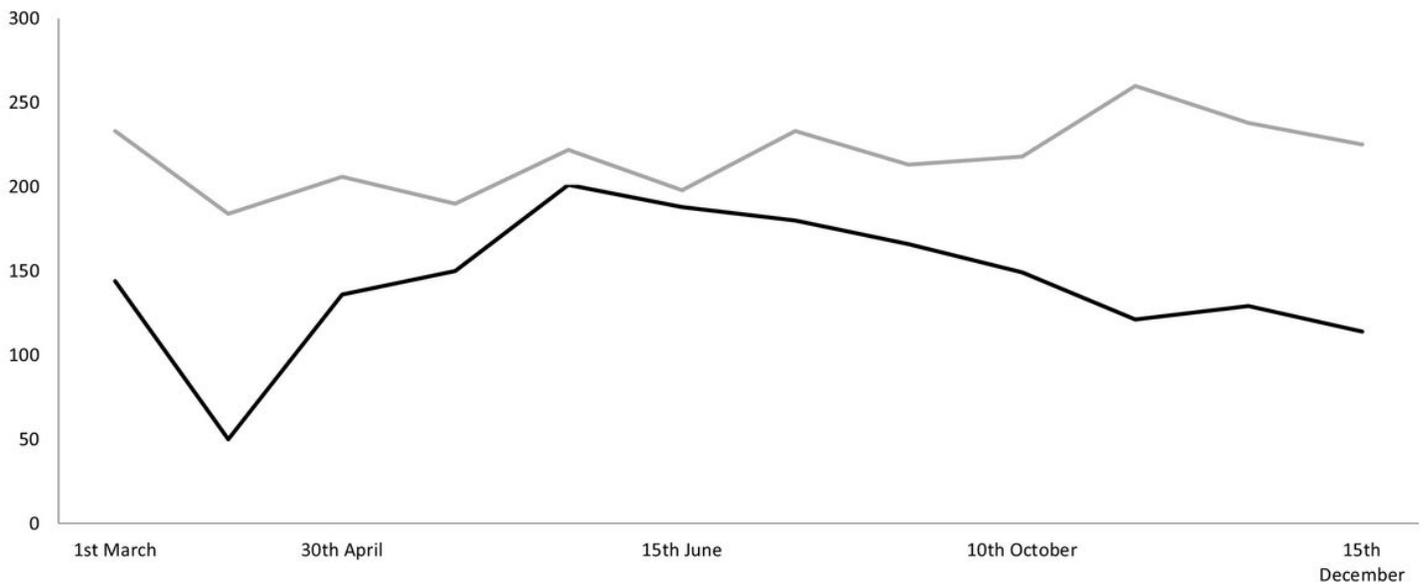


Figure 1

SurgicalEmergency Department patients during and before the outbreak of the COVID-19 pandemic.

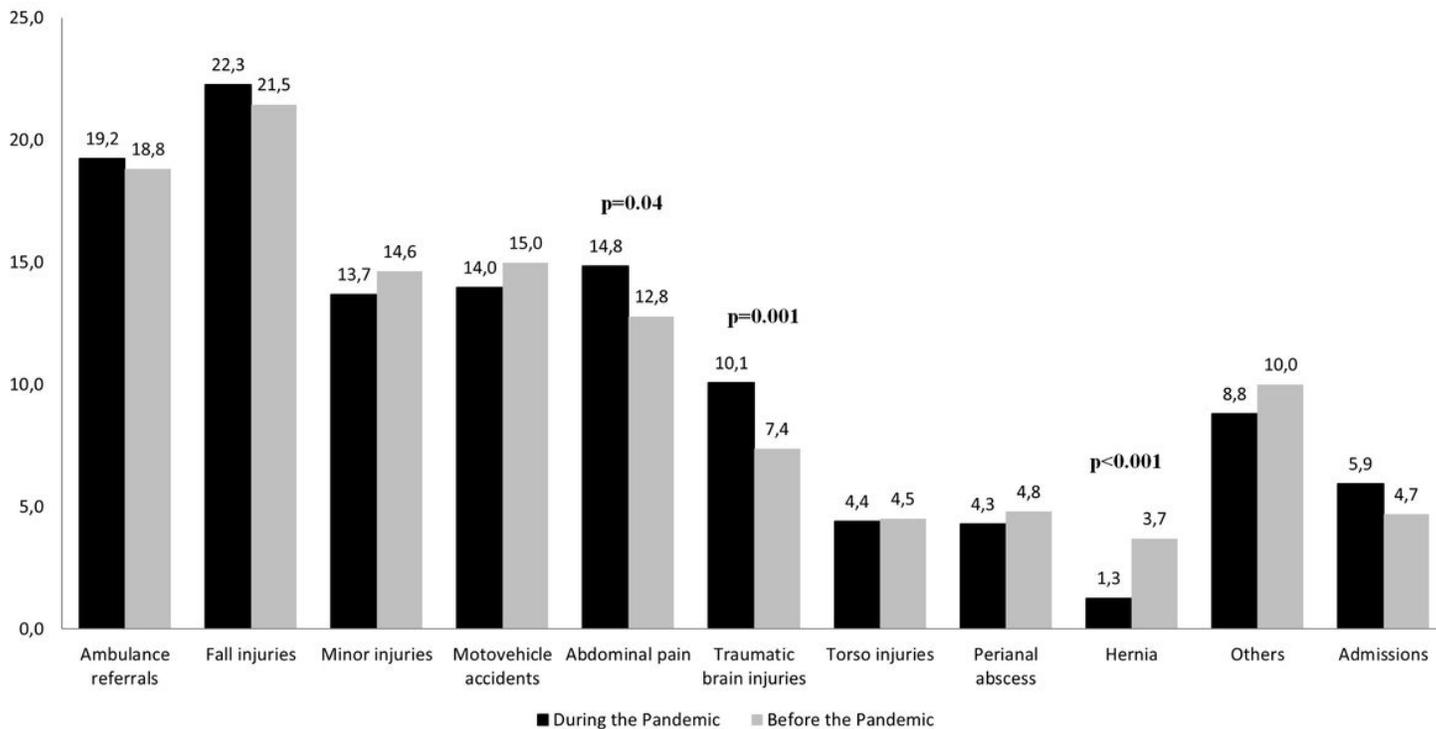


Figure 2

Reasons for visiting the surgical Emergency Department before and after the break out of the COVID-19 pandemic. Data are presented as percentages on the y-axis.

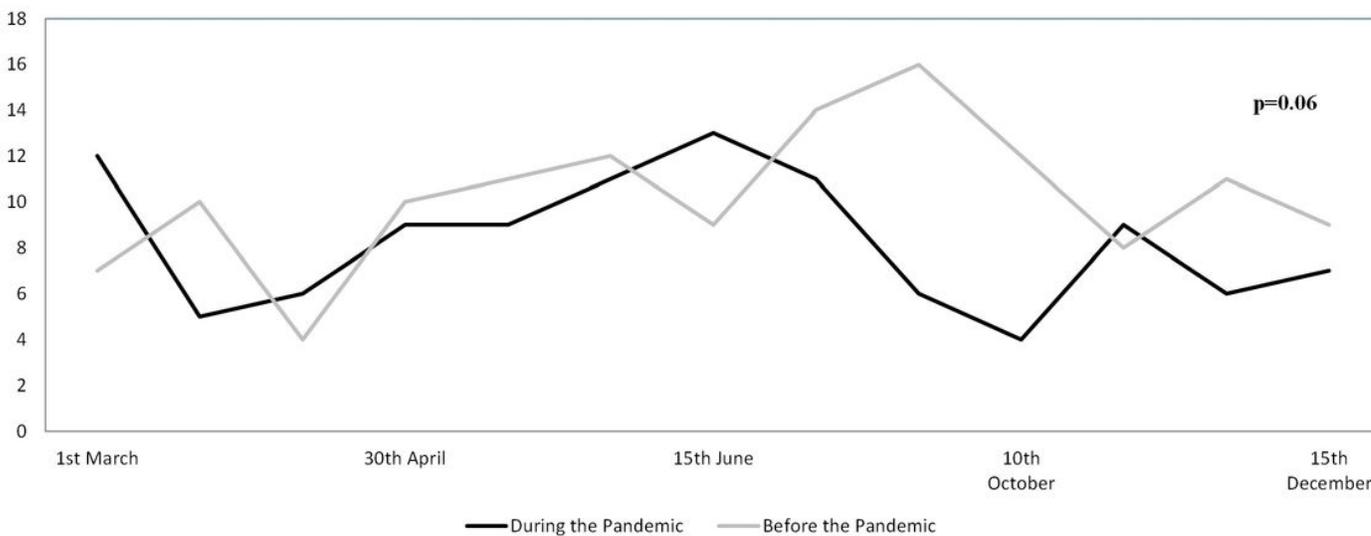


Figure 3

Total number of hospital admission from the Emergency Department.