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GENERAL SURGERY

Impact of SARS-CoV-2 pandemic on emergency surgical services at Groote Schuur Hospital

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Background: The impact of the SARS-CoV-2 pandemic on emergency surgery services internationally revealed an 87.8% decrease in procedures. The aim of the study was to determine the impact of the pandemic on the number of emergency surgical operations performed at Groote Schuur Hospital, Cape Town, South Africa.
Methodology: The study was a retrospective cross-sectional study, comparing the number of emergency operations performed before the pandemic to those performed during the pandemic lockdowns at Groote Schuur Hospital in Cape Town, South Africa. The data were retrieved from the Web Surgibank and Clinicom databases.
Results: The total number of operations performed during the study period (April 2019 – March 2021) was 13 715. The most frequently performed procedure types were orthopaedics (18.6%), hands (16.3%), acute care surgery (16.5%), neurosurgery (10.5%) and trauma (10.1%). There was a 19.5% reduction which was statistically significant ($p = 0.002$) in the number of surgeries before COVID-19 and during COVID-19. The mean number of operations during the pandemic was less compared to the pre-COVID-19 period ($p < 0.001$).
Conclusion: COVID-19 significantly impacted the number of operations performed during the pandemic at Groote Schuur Hospital. This overall reduction was less compared to international centres.
Keywords: COVID-19 pandemic, emergency surgical operations, lockdown

Introduction

Once COVID-19 was declared a global pandemic,[1,2] a state of disaster was declared by the President of South Africa following a steady increase in the number of cases.[3] A series of restrictions and regulations were implemented including a lockdown. The objective of a lockdown is to limit public movement and to prevent the spread of the disease among the general population.[4] An essential aspect of the preparedness of a country is to adapt its healthcare system to make beds available and alleviate its emergency services to be able to accommodate for a surge in COVID-19 cases. Routine elective surgery and outpatients' visits were postponed and healthcare resources used for non-emergency activities were reduced. Emergency service delivery was maintained throughout the different levels of lockdown. However, during the COVID-19 pandemic, the emergency surgeon had to take into consideration several factors such as limited access to operating theatres and the risk of virus dissemination in theatre. Their objectives were to minimise virus exposure in operating theatres, decrease risk of environmental contamination, minimise occupation of operating theatre and reduce hospital stay of patients undergoing emergency surgery.[5] An international survey among the World Society of Emergency Surgery (WSES) members (98 collaborators from 31 countries) on the impact of the SARS-CoV-2 pandemic on emergency surgery services revealed an 87.8% decrease in the total number of patients undergoing emergency surgery.[6] It seems several factors were assumed that potentially reduced the emergency surgery service delivery, such as the lockdown restrictions, including patients fear of contracting the virus when attending hospitals. The purpose of this study was to explore the impact of COVID-19 pandemic and lockdown measures on the number of emergency surgical operations performed between April 2019 and March 2021 in an urban academic hospital.

Methodology

The study was a retrospective cross-sectional study, comparing the number of emergency surgical operations performed before the COVID-19 pandemic and during the COVID-19 lockdowns at Groote Schuur Hospital in Cape Town, South Africa. The pre-COVID-19 period was April 2019 to March 2020 and the COVID-19 lockdown period was April 2020 to March 2021. The data were extracted from the electronic databases of Web Surgibank and Clinicom surgical theatre module of the Groote Schuur Hospital establishment. The timing of emergency surgery was determined by the Groote Schuur Hospital emergency colour-coded triage system (Table I).

All surgical disciplines performing emergency operations were included – orthopaedics, hands, acute care surgery, neurosurgery, trauma, Ear Nose Throat (ENT), cardiothoracic, urology, ophthalmology, colorectal, vascular,

Table I: Groote Schuur Hospital emergency colour-coded triage system

Colour code	Triage category	Parameters	Recommended waiting time
Red	Immediate	Life-saving operations, resuscitation simultaneously with surgical treatment	< 1 hour
	Expedited	Limb/organ saving operation	< 2 hours
Yellow	Urgent	Non-critical, high possibility of early deterioration	< 6 hours
Green	Emergent	Non-critical, emergent	< 24 hours
Blue	Scheduled	Stable, non-elective, cannot leave hospital without operation	< 72 hours

Table II: South African COVID-19 lockdown levels and alcohol ban periods for 27 March 2020 to 31 March 2021

Lockdown	Level 5	Level 4	Level 3	Level 3 (modified)*	Level 2	Level 1	Level 3	Level 3 (modified)#	Level 1
Dates	27 Mar–30 Apr 2020	1 May–31 May 020	1 Jun–12 Jul 2020	13 Jul–17 Aug 2020	18 Aug–20 Sep 2020	21 Sep–28 Dec 2020	29 Dec–1 Feb 2021	2 Feb–28 Feb 2021	1 Mar–31 Mar 2021
Alcohol ban	Complete ban 1		Partial ban 1	Complete ban 2	Partial ban 2		Complete ban 3	Partial ban 3	No ban

* Complete second ban on alcohol sales was re-implemented but lockdown level 3 maintained.
\# The third complete ban on alcohol sales was lifted but lockdown level 3 maintained.

hepatobiliary (HPB), maxillofacial, plastics, transplant, upper gastrointestinal (UGI) and endocrine. The number of emergency surgical cases performed in each surgical department during the above-mentioned study period was identified.

From 27 March 2020 to 31 March 2021, there were five lockdown levels restricting social movement. In addition, there were different restrictions on alcohol sales throughout these periods. The different lockdown levels and corresponding alcohol bans are illustrated in Table II. Two periods of level 3 lockdown were implemented in South Africa from 1 June 2020 until 17 August 2020 and 29 December 2020 until 28 February 2021. However, the alcohol bans during those periods were different, hence the time periods were divided between level 3 and level 3 (modified).

The data were analysed using SPSS version 28. Descriptive statistics using frequencies, means and standard deviations were used to analyse the number of operations in different surgical departments across the whole study period. Independent sample t-tests were used to compare the mean number of operations across, before and during the lockdown while univariate analysis of variance ANOVA was used to compare the number of operations during the various stages of lockdown and alcohol bans. The threshold for significance was set at $p < 0.05$. A univariate ANOVA was performed to analyse the differences in the number of operations performed in the different surgical specialties before the pandemic and during the different stages of lockdown.

Results

The total number of operations performed during the study period (March 2019 – April 2021) was 3 715, with a mean (standard deviation) of 806.8 (SD = 812.7). The most frequently performed operations were orthopaedics (18.6%), hands (16.3%), acute care surgery (16.5%), neurosurgery (10.5%) and trauma (10.1%). Transplants, UGI and endocrine operations accounted for smaller proportions of the operations performed during the study period – 0.8%, 0.3% and 0.2%, respectively. The different types of operations performed are presented in Table III.

Table III: Summary of descriptive statistics of all operations performed during the whole study period

Speciality	Operations *n*	Mean (SD)	Proportion (%)
Orthopaedics	2549	106.2 (20.9)	18.6
Hands	2236	93.2 (34.1)	16.3
Acute care surgery	2262	94.2 (17.9)	16.5
Neurosurgery	1439	59.9 (11.4)	10.5
Trauma	1381	57.5 (21.3)	10.1
Ear Nose Throat	575	24.0 (8.6)	4.2
Cardiothoracic	496	20.7 (9.4)	3.6
Urology	617	25.7 (8.4)	4.4
Ophthalmology	471	19.6 (7.0)	3.4
Colorectal	422	17.6 (6.4)	3.1
Vascular	407	17.0 (8.0)	3.0
Hepatobiliary	288	12.0 (8.1)	2.1
Maxillofacial	242	10.1 (5.4)	1.8
Plastics	151	6.3 (3.9)	1.1
Transplant	107	4.5 (3.7)	0.8
Upper gastrointestinal	42	1.7 (1.4)	0.3
Endocrine	30	1.2 (1.3)	0.2
Total	13715	806.8 (812.7)	100

The number of operations was reduced from 7 598 between April 2019 and March 2020 to 6 117 between April 2020 and March 2021, showing a decrease of 19.5% in the total number of operations performed ($p = 0.002$). Figure 1 depicts a bar graph comparing the total number of operations before COVID-19 to during COVID-19.

There were no statistically significant differences in the number of operations between the different levels of lockdown. The patterns of increases and decreases fluctuate between the levels. From level 5 to level 4, the number of operations decreases by 29 (6.7%) despite the lifting of restrictions and further decrease by 40% from 1 245 in level 3 to 736 in level 2. From level 2 to level 1, there is a 119.0% increase (the number of procedures increases from 736 to 1 612). Lastly, from level 1 to level 3 there is a 55.5% decrease.

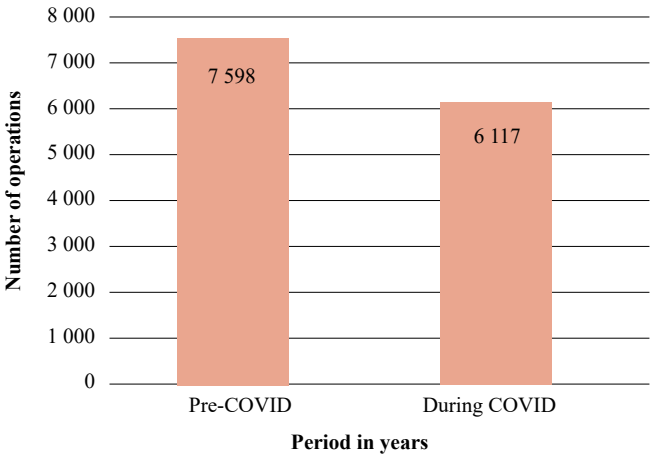

Figure 1: Number of operations before COVID-19 compared to during COVID-19

While there were reductions in number of operations performed, these were not the same across all disciplines. Some conditions declined, while others increased. The highest decreases were observed in transplants, urology and trauma emergency operations that had a 55.4%, 44.4% and 41.1% decrease, respectively. The largest increases were observed in HBP, ENT and UGI with increases of 103.2%, 37.1% and 33.3%, respectively. Figure 2 shows the number of operations performed before and during the pandemic according to the different surgical disciplines.

There was a statistically significant difference in the number of operations performed across the different stages of the alcohol bans. A univariate ANOVA showed that during the second partial ban, there was a significantly higher number of operations, ($p < 0.001$). Table IV summarises the mean number of operations across this period.

The types of operations performed during the different periods of alcohol bans depicted the patterns observed before COVID-19. Orthopaedic, hands and acute care surgery operations accounted for the largest proportion of the operations performed. The increases and decreases varied across different surgical specialities. From the first full ban (March to May 2020) to the first and second partial ban (June to July 2020), the numbers of emergency operations in 13 out of the 17 surgical specialities continued to decrease, while they increased in three specialities. The types of operations that increased between the complete and partial ban were trauma (increased by 70.4%), ENT (increased by 41.1%), ophthalmology (increased by 68.5%) and hands (increased by 3.4%). From the second complete ban to the second partial ban the number of emergency operations in all specialities increased. Except for transplants and endocrine, the number of operations increased more than 65%. Between the third complete ban and the third partial ban all emergency operations decreased except hands, HPB, maxillofacial and transplants. The changes in the number of operations between the last partial ban and normal were minimal. Table V summarises the percentage changes in operations in different specialities performed across the different stages of alcohol bans.

Discussion

Overall, this study found a 19% decline in the number of operations compared to pre-COVID-19 levels. This decline was significantly less than the declines reported in international studies. Similar findings were published by O'Connell et al.[7] from the Republic of Ireland,Patriti et al.[8] from Italy and Tarim et al.[9] from Turkey showing 42.8%, 25.4% and 32.3% reduction in emergency surgical admissions, respectively. Further studies from Turkey, Spain and Scotland found a reduction in 60%, 65.4% and 58.3% in either emergency outpatient visits or emergency operations.[10-12]

Table IV: Mean number of operations performed across the different stages of alcohol bans

Alcohol Ban	Mean	Standard deviation	Minimum	Maximum
Complete ban 1	48.6	55.71	1.00	183.0
Partial ban 1	41.2	46.6	0.00	140.0
Complete ban 2	33.0	39.8	1.00	125.0
Partial ban 2	137.7	136.0	5.00	426.0
Complete ban 3	37.4	32.6	2.00	114.0
Partial ban 3	32.1	31.2	0.00	114.0

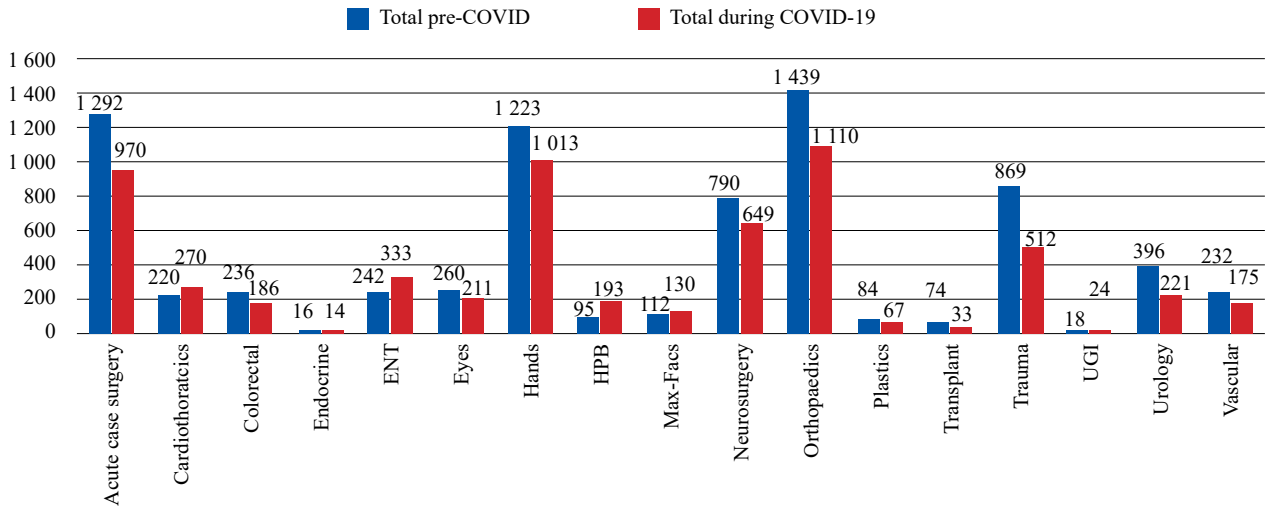

Figure 2: Number of operations performed according to discipline pre-COVID 19 and during COVID-19.
*ENT – Ear Nose Throat, HPB – Hepatobiliary, Max-Facs – Maxillofacial, UGI – Upper gastrointestinal

Table V: Summary of percentage changes by operation type over the different periods of the alcohol bans

Speciality	1st complete to 1st partial ban	2nd complete to 2nd partial ban	3rd complete to 3rd partial ban	3rd partial to no alcohol ban
Acute care Surgery	45.4	65.4	24.4	0.04
Cardiothoracic	42.9	84.2	65.1	1.00
Colorectal	70.8	75.0	0.0	0.32
Endocrine	100.0	80.0	100.0	0.00
ENT	41.5	58.2	11.1	1.97
Ophthalmology	68.8	92.4	40.0	0.17
Hands	3.4	70.7	11.7	0.21
HPB	68.5	78.8	87.5	1.60
Max-Facs	10.0	76.6	11.8	1.74
Neurosurgery	3.2	87.4	37.5	1.43
Orthopaedics	10.3	73.7	0.0	0.34
Plastics	40.0	94.3	57.1	10.00
Transplant	70.0	40.0	200.0	0.67
Trauma	70.5	84.7	2.0	0.92
UGI	100.0	28.6	50.0	2.00
Urology	21.2	77.3	18.5	0.68
Vascular	11.1	85.1	48.6	0.00

Red – decreases, Blue – increases
*ENT – Ear Nose Throat, HPB: Hepatobiliary, Max-Facs – Maxillofacial, UGI – Upper gastrointestinal

The declines observed in this study are also lower than the ones reported in other South African studies. A retrospective study that compared trauma to non-trauma admissions found that trauma-related admissions decreased by 53% while non-trauma related admissions decreased by 44%.[13] Another South African study that focused on orthopaedic admissions found a reduction of 44% in orthopaedics-related admissions during level 5 lockdown compared to pre-COVID-19.[14] The reasons for the differences in the reported declines are attributed to the fact that the other studies compared pre-lockdown levels to the first few months of the COVID-19 pandemic while this study tracks intermittent increases and decreases over a period of one year. While there are differences in the extent of the decline in emergency operations between this study and studies conducted in other settings, the overall decline in emergency operations is still congruent with existing literature that demonstrates a decrease in the number of procedures.

While there has been a decline in number of operations performed, these required additional preparation and demanded more resources compared to before the pandemic due to requirements for preparation and COVID-19 protocols.[15] In addition, studies of patient groups attended to during these periods found no differences in the proportions of patients undergoing surgery, patient demographics and length of stay.[12] This suggests that despite the declines in numbers, the demand for resources, and the need for facilities to prepare may still be at pre-COVID-19 levels. While it was beyond the scope of the current study to explain the declines in hospital visits, previous studies suggest that the reduction in the number of cases was due to guidelines that reduce the capacity for elective and non-COVID emergency patients,[16] patients being treated non-surgically, and patients not presenting in emergency wards due to fear of infections.[17] Although there were intermittent increases and decreases with changing COVID-19 restrictions, these changes were not statistically significant; this is expected given that the number of operations remains significantly lower than pre-COVID-19 levels even when lockdown restrictions were lifted.

While the number of operations declined, the pattern of conditions or types of operations done did not change significantly. Orthopaedics, hands and acute care surgery operations were the leading indications for surgery before COVID-19 and across different levels of lockdown. This suggests that the decline in numbers may not be indicative of changes in the disease profile but reduced number of patients coming to the hospital. Furthermore, the increases and decreases varied across different conditions. The highest decreases were observed in transplants, urology, and trauma emergency operations while increases were observed in cardiothoracic, ENT, HBP, UGI and maxillofacial procedures. The differences in the pattern across operations may be related to the hospital prioritising certain conditions, such as symptomatic cancer patients requiring emergency operation and trauma patients. A multicentre South African study on how surgical practices changed during the first phases of lockdown found that 71% of hospitals continued cancer operations.[18]

When it comes to alcohol restrictions, the overall levels of decline are like the ones observed in the analysis of different levels of lockdown. However, the types and changes in numbers of procedures done according to the different conditions varied. When the alcohol complete ban was lifted for the first time, the number of emergency operations for most conditions continued to decline despite a change in the restrictions except ENT, ophthalmology, hands, and trauma. During that phase, the biggest change was a 70% increase in trauma related admissions when the complete ban was lifted. This is congruent with findings of several studies in South Africa which found trauma presentations in South Africa to be significantly less during periods of the lockdown that had alcohol bans.[19,20] The trend of increases in trauma cases continues between the second complete ban and the second

partial lockdown. This finding is congruent with findings of a single-centre study that found the number of trauma volume to have increased by 250% during the second partial lockdown.[21] Overall, all studies of patient loads show significant increases in trauma cases during periods of partial alcohol bans.[19,22] This highlights the burden of alcohol-related trauma incidents in South Africa. Interestingly, the number of emergency surgical procedures performed did not all increase between the third complete ban of alcohol and its lifting to partial restrictions. In fact, the numbers of emergency operations decreased for all conditions except hands, HPB, maxillofacial, UGI and transplants. For most of the intermittent banning and lifting of alcohol sales these conditions did not follow the same trends.

Strengths and limitations

This study provides a snapshot of the number of emergency operations performed during the COVID-19 lockdown which is important for understanding how a South African tertiary hospital coped with the COVID-19 pandemic. This will be important for health services planning should there be another pandemic. Many of studies that describe the utilisation of health services are from high income countries. This study provides evidence from a low- to middle-income perspective, especially given the high incidence of emergency trauma. Notwithstanding these contributions, this study was subject to a few limitations. First, the study is limited to describing the landscape of emergency operations during COVID-19, further research should examine the impact of the reduced performance of emergency operations on clinical outcomes of patients. Secondly, this study did not examine whether the reasons for the reductions were due to hospital policies that prioritised COVID-19, patients not presenting or due to COVID-19 alcohol bans. An exploration of these reasons and the extent to which they have contributed to the reduction is crucial for informing health services planning. Lastly, the study is based on secondary data (hospital records); additional research that uses primary data, such as interviewing or surveying emergency surgery staff or collecting written feedback from patients, can be useful should another pandemic occur to aid with planning and allocation of resources.

Conclusion

COVID-19 significantly impacted the number of operations performed during the pandemic at Groote Schuur Hospital. In addition, the alcohol ban significantly impacted the pattern of operations performed in our institution. This overall reduction was less compared to international centres. The lesser reduction is likely due to high incidence of trauma in South Africa as well as local hospital policy to avoid total collapse of the surgical system.

Conflict of interest

The authors declare no conflict of interest.

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Ethical approval

Ethical approval was obtained from the University of Cape Town Human Research Ethics Committee (Ref: 442/2021).

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