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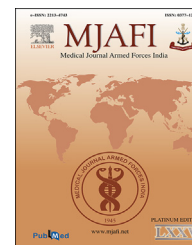
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Original Article

Non-COVID surgical load of operation theatre during COVID-19 pandemic in Armed Forces tertiary care centres: “Snapshot of two timelines”

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ARTICLE INFO

Article history:

Received 2 February 2022

Accepted 27 April 2022

Available online xxx

Keywords:

COVID-19

Surgical load

Inventory

Regional anaesthesia

ABSTRACT

Background: The global COVID-19 pandemic has led to major changes in the surgical caseloads in the operation theatres across the world. Elective surgeries have been curtailed to a great extent and the number of emergency surgeries has risen. We conducted a study to assess the changes in the surgical caseloads in two tertiary care hospitals in India during the pandemic and to assess the changes in anaesthesia techniques used.

Methods: A multicentre retrospective observational study conducted at two tertiary care centres located 1500 kms apart. Hospital A in a city with high incidence of COVID-19 and Hospital B with a lighter load of COVID-19 cases. Record of all major surgeries carried out between 01 Jul 2020 and 31 Dec 2020 were compared with the surgeries carried out between 01 Jul 2019 and 31 Dec 2019.

Results: There was a decrease of almost 53% in elective surgical workload in hospital A and 71% in hospital B. The decrease in the cases was not similar across all specialities. There was a significant increase in the percentage of emergency surgeries from 11.1% to 24% in hospital A and from 22.1% to 29.8% in hospital B in the year 2020. A statistically significant increase in regional anaesthesia and neuraxial blockade was noted in the year 2020 in both the hospitals.

Conclusion: During the COVID-19 pandemic, the number of elective surgical cases has significantly decreased in specialities like ophthalmology whereas there was no change in the surgical workload in specialities like obstetrics, oncology, orthopaedics, and neurosurgery. There was significant increase in the use of regional and neuraxial techniques of anaesthesia.

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<https://doi.org/10.1016/j.mjafi.2022.04.016>

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Introduction

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2 or COVID-19) pandemic has been around for two years now with new variants coming up at frequent intervals. Though the severity of the disease is low at present, the world has faced a huge wave of infection with the omicron variant of SARS-CoV-2 infection. More than half of the world has got infected with Omicron between November 2021 and March 2022.¹ It is a possibility that more SARS-CoV-2 variants will emerge in the future. Whether they will be more lethal or more transmissible than Delta or Omicron variant leading to more hospital admissions is hard to imagine at present.

During this pandemic, the restriction of surgical cases had to be done for one or more of the following reasons such as the shortage of personal protective equipment, like masks, gowns, and gloves, shortage of hospital personnel due to deployment in COVID care wards and intensive care units (ICUs), quarantine, and illness of self or family members at home, shortage of hospital beds, ICU beds, and ventilators, and need to maximise social distancing among patients and staff.

Despite this, surgical interventions in certain conditions were required irrespective of the prevailing pandemic. This has led to change in number and type of surgeries significantly.²⁻⁴ Accordingly, the mode of anaesthesia has also got modified with the transmissibility of the disease in mind.²

Studies have been done for neurosurgery¹ and oncology⁵ patients recently, but limited literature is available about the trend in surgical cases involving other subspecialties.

This study was planned to assess speciality wise change in the workload of surgical cases and assess the changes in the type of anaesthesia used.

Aim of the study

The aim of this study was to assess the changes in the surgical workload of the operation theatres (OTs) of two tertiary care hospitals during the COVID-19 pandemic.

Primary objective

To assess the changes in the elective and emergency surgical workload in various surgical specialities in two tertiary care hospitals.

Secondary objective

To find out the

- Surgical speciality that was least affected by the Pandemic.
- Surgical speciality that was most affected by the Pandemic.
- Changes in the anaesthetic technique used in the corresponding period.

Materials and methods

This multicentre retrospective observational study was carried out at two tertiary care hospitals located at Panchkula city in Haryana (Hospital A) and Pune city in Maharashtra (Hospital B), respectively. Institutional Ethics committee clearance was taken prior to the study from both the hospitals. Patient consent for inclusion in study was also obtained.

All patients who underwent surgery between 01 Jul 2020 and 31 Dec 2020 (during the pandemic) were compared with all patients operated between 01 Jul 2019 and 31 Dec 2019.

Inclusion criteria

- All major elective and emergency surgical procedures done under any form of anaesthesia in the OT.

Exclusion criteria

- Diagnostic and outpatient procedures.

Statistical analysis

Demographic data were analysed using statistical package for the social sciences software-version 22.0.

Surgical workload values thus derived were reported as numbers and percentages.

Group comparisons were done with the Chi-Square test/Fisher's Exact test. Chi-square test with Yates's correction was used where any one of the cell frequencies was less than 5 in the bivariate frequency distribution.

Percentage change in the number of surgical cases, from pre-COVID to post-COVID times, was calculated by subtracting the total number of patients at T0 (number of patients in year 2019) from total number of patients at T1 (number of patients in the year 2020). This difference was then divided by total number at T0 then multiplied by 100. P values less than 0.05 was considered significant.

Results

Total number of major elective surgeries done in the pre-COVID times in the period from 01 Jul 2019 to 31 Dec 2019 was 4517 in hospital A and 5094 in hospital B.

The patients in year 2019 and 2020 were comparable in terms of gender, age, and month wise distribution of workload (Tables 1-3), however, there was a statistically significant increase in the proportion of patients with ASA III in both the hospitals in the year 2020 compared to the previous year (Table 4).

In hospital A, the overall caseload of major surgeries and procedures done inside the OT was only 39.05% of the OT workload in 2019.

Table 1 – Gender based distribution of cases.

Gender	Hospital A (n, %)			Hospital B (n, %)		
	Pre-COVID (2019)	Post-COVID (2020)	P value	Pre-COVID (2019)	Post-COVID (2020)	P value
Male	2484 (55.8%)	987 (56.3%)	>0.05	2603 (51.1%)	603 (53.9%)	>0.05
Female	2033 (43.2%)	777 (42.1%)	>0.05	2491 (48.9%)	517 (46.16%)	>0.05

Table 2 – Age wise distribution of cases.

Age wise distribution of patients	Hospital A (n, %)		Hospital B (n, %)	
	Pre-COVID (2019)	Post-COVID (2020)	Pre-COVID (2019)	Post-COVID (2020)
≤ 5 Yr	295 (6.54%)	64 (3.6%)	260 (5.1%)	57 (5.1%)
6–10 Yr	79 (1.75%)	42 (2.4%)	138 (2.7%)	18 (1.6%)
11–20 Yr	165 (3.66%)	65 (3.7%)	304 (5.9%)	40 (3.6%)
21–30 Yr	909 (20.12%)	485 (27.4%)	1180 (23.1%)	320 (28.6%)
31–40 Yr	899 (19.90%)	388 (22.5%)	818 (16.0%)	213 (19.0%)
41–50 Yr	570 (12.63%)	210 (11.9%)	681 (13.3%)	109 (9.7%)
51–60 Yr	727 (16.09%)	404 (22.9%)	329 (6.4%)	128 (11.4%)
>60 Yr	873 (19.3%)	106 (6%)	1384 (27.1%)	235 (21%)

Table 3 – Month wise distribution of surgical workload.

Month	Hospital A (n, %)		Hospital B (n, %)	
	2019	2020	2019	2020
July	743 (16.4%)	240 (13.6%)	886 (17.4%)	142 (12.64%)
August	790 (17.4%)	247 (14%)	937 (18.4%)	157 (14.0%)
Sept	731 (16.1%)	266 (15.07%)	718 (14.1%)	148 (13.23%)
October	777 (17.2%)	312 (17.68%)	825 (16.2%)	230 (20.53%)
November	757 (16.7%)	302 (17.12%)	799 (15.7%)	191 (17.12%)
Dec	719 (15.91%)	397 (22.5%)	929 (18.23%)	252 (22.5%)

In Hospital B, the surgical case load reduced to 22% compared to 2019.

It was interesting to note that even though the actual number of emergency surgeries decreased significantly, but the proportion of emergency surgery increased (Table 5).

Compared to 2019, the increase in the percentage of emergency cases in 2020 was 13.3% in Hospital A and 7.7% in Hospital B. This was statistically significant ($p < 0.001$).

There was a statistically significant decrease in the use of general anaesthesia ($p < 0.001$) with statistically significant increase in the use of regional anaesthesia in the year 2020 in comparison to 2019 ($p < 0.001$) as shown in Table 6.

There was a statistically significant decrease in the surgical workload of specialities like ophthalmology and otorhinolaryngology. The corresponding decrease in case load in

specialities like Orthopaedics and Obstetrics was comparable in both the hospitals. (Table 7).

There was a relative increase in the proportion of surgical load in specialities of neurosurgery and oncology as shown in Fig. 1. It was observed that the percentage share out of the total surgeries done in the year 2020 was same or increased in case of specialities like orthopaedics, obstetrics, oncology, and neurosurgery.

Discussion

After the declaration of SARS-CoV-2 as a pandemic in 2020 by World Health Organisation, there have been major changes in the healthcare services and routine therapeutic practices all over the world.^{6–9} SARS-CoV-2 or COVID-19 pandemic has affected all the medical specialities in addition to the primary specialities of Intensive Care and Internal Medicine. With the recurrence of this pandemic in mind, it was felt that rationing protocols must be based on the best available evidence and data.

We compared and analysed the surgical workload in the pre-pandemic times to those during the pandemic and observed major differences.

Pune city where Hospital B is located was one of the hot-spots of COVID-19 in the country. It had a total count of patients with COVID positive reaching 3,68,447 on 31st

Table 4 – ASA status of the patients undergoing surgery.

ASA status	Hospital A (n, %)		Hospital B (n, %)	
	2019	2020	2019	2020
I	1974 (43.7%)	629 (35.6%)	2292 (45%)	405 (36.2%)
II	1951 (43.2%)	854 (48.4%)	2308 (45.3%)	555 (49.5%)
III	311 (6.9%)	258 (14.6%)	397 (7.8%)	143 (12.8%)
IV	36 (0.8%)	21 (1.2%)	66 (1.3%)	10 (0.9%)
V	9 (0.2%)	2 (0.1%)	31 (0.6%)	7 (0.6%)

Table 5 – Elective and emergency workload.

	Hospital A (n, %)			Hospital B (n, %)		
	Pre-Covid 2019	Post-Covid 2020	P value	Pre-Covid 2019	2020	P value
Elective	3616 (80.4%)	1340 (76%)	<0.01	3973 (77.9%)	784 (70.2%)	<0.01
Emergency	901 (11.1%)	424 (24%)	<0.01	1121 (22.1)	336 (29.8%)	<0.01

Table 6 – Type of Anaesthetic technique used.

Types of Anaesthesia	Hospital A (n, %)			Hospital B (n, %)		
	No of cases 2019	No of cases 2020	P value	No of cases 2019	No of cases 2020	P value
GA	2078 (46%)	561 (31.8%)	<0.01	2093 (41.1%)	314 (28.8%)	<0.01
Regional blocks	370 (8.19%)	355 (20.1%)	<0.01	570 (11.2%)	270 (24.1%)	<0.01
Spinal	1405 (31.1%)	587 (33.28%)	>0.01	1456 (28.6%)	360 (32.16%)	>0.01
Epidural	348 (7.7%)	82 (4.64%)	>0.01	458 (9%)	70 (6.28%)	>0.01
Combined spinal epidural	304 (6.74%)	177 (10.01%)	>0.01	517 (10.1%)	106 (9.46%)	>0.01

Table 7 – Distribution of all specialities.

	Hospital A (n, %)		P Value	Hospital B (n, %)		P Value
	2019	2020		2019	2020	
General surgery	242 (5.3%)	122 (6.9%)	0.017	314 (6.16%)	163 (14.5%)	<0.0001
Neurosurgery	120 (2.6%)	78 (4.4%)	0.0003	205 (4.02%)	79 (7.0%)	<0.0001
Urology	229 (5.0%)	178 (10.0%)	<0.0001	344 (6.75%)	59 (5.2%)	0.06
Maxillofacial surgery	60 (1.3%)	27 (1.5%)	0.53	63 (1.2%)	19 (1.6%)	0.22
Orthopaedics	867 (19.1%)	318 (18.0%)	0.28	353 (6.92%)	117 (10.4%)	<0.0001
GI Surgery	309 (6.8%)	78 (4.4%)	0.0003	151 (2.96%)	35 (3.1%)	0.77
Oncosurgery	171 (3.7%)	125 (7.0%)	0.0001	164 (3.21%)	61 (5.4%)	0.0003
Plastic surgery	246 (5.4%)	103 (5.8%)	0.54	286 (5.6%)	64 (5.7%)	0.88
Paediatric surgery	157 (3.4%)	48 (2.7%)	0.13	188 (3.69%)	29 (2.5%)	0.06
Obstetrics	507 (11.2%)	300 (17%)	<0.0001	966 (18.96%)	290 (25.8%)	<0.0001
Otorhinolaryngology	170 (3.7%)	67 (3.7%)	1	252 (4.94%)	41 (3.6%)	0.06
Ophthalmology	1350 (29.8%)	267 (15.1%)	<0.0001	1730 (33.96%)	93 (8.3%)	<0.0001
Vascular surgery	89 (1.9%)	53 (3%)	0.013	78 (1.5%)	70 (6.2%)	<0.0001

December 2020, in comparison to only 19,748 COVID positive cases in the city of Chandigarh where Hospital B is located.^{10,11} The objective behind taking two major hospitals that were 1500 km apart from each other with extreme variation in COVID cases was to assess the effect of the intensity of the pandemic on the surgical workload. Despite huge difference in the number of COVID-19 cases, there was no significant difference in the quantum of decrease in the surgical workload between the two hospitals. Most probable reason could be the similarity in infrastructure, demography and the number of patients, with both being service hospitals under the same organisation.

The case load of major elective surgeries decreased significantly ($p < 0.01$) in the year 2020 in both the centres compared to 2019. The same observation was made in the neurosurgical patients by Sudhan et al.¹² where there was significant decrease in elective spine surgery. There was associated significant increase in surgery for stroke ($P = 0.008$) and hydrocephalus ($P < 0.001$). No significant difference was observed in the overall incidence of emergency surgeries undertaken during the two time periods (28 emergency surgeries out of 62 in 2020 and 29 emergency surgeries out of 74 in 2019). Similar observations were noted by Bartlett et al. for Oncosurgery patients.⁵ Mathiesen et al. during a survey of

neurosurgical activities observed that there were unexpectedly large differences in the availability of resources (neurosurgical beds) and indications for surgeries like craniotomies already before the pandemic.⁶ Neurosurgical beds and neuro-intensive care beds were significantly decreased from December 2019 to March 2020. The utilisation of resources decreased via less demand for care of traumatic brain injuries and subarachnoid haemorrhage as there was a huge reduction in the number of road traffic accidents due to strict lockdowns, postponement of surgery and changed surgical indications as a method of rationing resources. Twenty departments (80%) reduced activity extensively, and the same proportion stated that they were no longer able to provide care according to required medical needs.⁶ These studies were limited to neurosurgery and oncosurgery unlike our study which involved all the subspecialties available in tertiary care hospital as mentioned above.

There was a decrease of almost 53% in elective surgical workload in hospital A and 71% in hospital B. This is similar to the multinational survey done among World Society of Emergency Surgery members, where a 17-item web survey was distributed to emergency surgeons around the world in June 2020. It investigated the impact of SARS-CoV-2 pandemic on patients requiring emergency surgery. 87.8% respondents

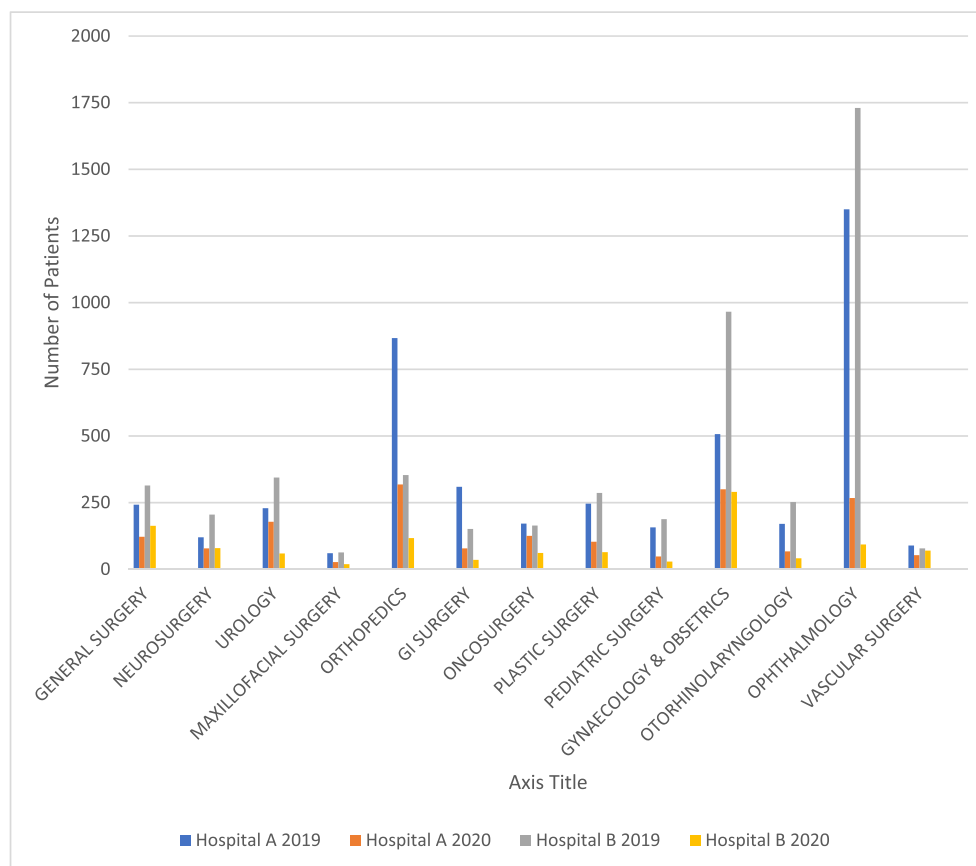


Fig. 1 – Bar diagram showing the comparison of the surgical workload before and after the COVID-19 Pandemic.

reported a decrease in the total number of patients undergoing emergency surgery. They also observed an increase in more severe sepsis in patients undergoing surgery for diseases such as Acute Appendicitis and Cholecystitis. It was attributed to a fear of contracting COVID-19 infection amongst patients and which lead to a delay in reporting to the hospitals.¹³

The proportion of emergency surgeries increased from 11.1% to 24% in hospital A and from 22.1% to 29.8% in hospital B in the year 2020 compared to 2019. This increase was statistically significant. Hesitancy to visit hospitals during COVID-19 pandemic could have been the main reason leading to delays in reporting to the hospitals and elective surgeries turning into emergencies.

We noticed that there was a statistically significant decrease in the use of general anaesthesia in the year 2020 (from 46% to 31.8% in Hospital A and from 41.1% to 28.8% in Hospital B). Due to the absence of any definite consensus on the management of patients in COVID-19 pandemic scenario, it was presumed that this was due to the anaesthesiologists' concern to avoid aerosol generating procedures. Presence of COVID-19 was the major factor governing change in anaesthesia technique. With that as the background, detailed discussion and counselling was carried out between surgical team and the patient. Only after the patient's consent, the choice of anaesthesia was decided. Regional anaesthesia techniques increased from 8.19% to 20.1% in Hospital A and from 11.2% to 24.1% in Hospital B in the year 2020 compared to 2019.

Similar observation was made in the study done during management of 67 neurosurgical patients by Sudhan et al. where they found an increased incidence of the use of monitored anaesthesia care techniques during emergency and essential neurosurgical procedures by the anaesthesia team in the year 2020 ($p < 0.001$).¹³

This highlights the fact that inventory must ensure the availability of ultrasound machine, nerve stimulator, peripheral nerve block needles and other regional anaesthesia equipment, if such a scenario arises in the future.

The Royal College of Anaesthetists and Association of Anaesthetists have advocated the use of local or regional anaesthesia whenever possible to preserve valuable drugs that are needed and can be in shortage during the care of critically ill patients in ICU.¹⁴ Advantage with use of regional anaesthesia when compared to general anaesthesia would be improved postoperative analgesia, minimal contact with care givers and early discharge. Spinal anaesthesia that also offers similar advantages like regional anaesthesia was found to be delivered safely in patients with active COVID-19 infections, majority of whom underwent caesarean sections.¹⁴

There was a statistically significant decrease in the surgical workload of subspecialties like Ophthalmology (from 29.8% to 15.1% in Hospital A and from 33.96% to 8.3% in Hospital B). With resource management being the biggest challenge during the pandemic, the idea of this study was to recognise as to which are the departments that might continue to need the

same amount of manpower and material resources despite the pandemic.

In the year 2020, there was a relative increase in the surgical work load in specialities of Obstetrics (from 11.2% to 17% in Hospital A and from 18.96% to 25% in Hospital B), Orthopaedics (from 6.92% to 10.4% in Hospital B), Neurosurgery (from 4.02% to 7% in Hospital B), Oncosurgery (3.7%–7% in Hospital A), urology (5%–10% in Hospital A) and Vascular Surgery (1.5%–6.2% in Hospital B) with P values less than 0.0001 in all of them. Sudhan et al. found that there was a significant decrease in neurosurgical workload in the COVID-19 lockdown period in 2020; however, the relative proportion between emergency and essential surgeries remained the same as compared to the previous year.¹⁰ The urgency of obstetrics, orthopaedics, neurosurgical and oncosurgical interventions for some specific diseases is unavoidable; therefore, the proportional surgical workload out of total surgical workload was uniform or increased in these specialities irrespective of the ongoing pandemic. Both being the tertiary care hospitals with a similar set of authorised manpower and medical resources, manpower and medical resources inventory was not compared between the two.

Limitations

Patients undergoing outdoor anaesthesia for procedural and diagnostic purposes could not be included in the study because of data collection issues.

The role of human factors on surgical workload could not be evaluated. Surgeons who themselves or their family members contracted COVID-19 performed lesser surgeries in comparison to other surgeons who did not contract COVID. Non-availability of surgeons due to organisational requirements like temporary duty or permanent move also could not be assessed. This could have been one of the reasons for change/decrease in the type of surgeries.

COVID positive patients who underwent surgeries during this period were included as part of the emergency surgery, which were done in the OT dedicated for patients with unknown status or known COVID positive status. The number of COVID positive patients who underwent emergency surgery was eight and twelve in Hospital A and Hospital B, respectively.

This study was limited to estimating the change in the OT workload and outcomes of the surgeries was not considered.

Conclusion

During the COVID-19 pandemic, the total number of surgical cases decreased significantly especially in specialities such as ophthalmology, whereas there was a relative increase in the surgical workload in specialities such as obstetrics, orthopaedics, oncology and neurosurgery. This reduction was irrespective of the intensity of COVID pandemic in the city. There was a significant increase in the use of regional anaesthesia techniques possible due to the anaesthesiologists

concerns about the risks of aerosol generating procedures such as Intubation.

Disclosure of competing interest

The authors have none to declare.

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