



Impact of COVID-19 Pandemic on Cancer Surgical Services—AIIMS, New Delhi Experience

S. V. S. Deo¹ · Sunil Kumar¹ · Mukurdipi Ray¹ · Sandeep Bhoariwal¹ · Ashutosh Mishra¹ · Jyoti Sharma¹ · Raghuram K¹ · Naveen Kumar¹ · Jyoutishman Saikia¹ · Babul Bansal¹ · Amitabha Mandal¹ · Kunal Dhall¹ · Manish Gaur¹ · Sourabh Nandi¹ · Madiwalesh Chhebbi¹ · Sushma Bhatnagar² · Seema Mishra² · Rakesh Garg² · Sachidanandji Bharti² · Nishkarsh Gupta² · Vinod Kumar²

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Abstract

COVID pandemic has impacted cancer care delivery and cancer surgical services globally. There is an urgent need to study the extent of the impact of COVID on cancer surgery and individual institutional response and strategies adopted to counter the adverse impact. A review of administrative and clinical policy changes adopted at the tertiary cancer center to combat COVID pandemic and resume cancer surgical services were performed. A retrospective comparative analysis of cancer outpatient census during COVID pandemic affected year and the preceding normal year along with cancer surgery data audit for the same periods was performed to assess the impact of the pandemic on cancer surgery. In addition, COVID infection rates among cancer surgery patients and healthcare workers were evaluated. There was approximately a 50% reduction in cancer outpatient registrations during COVID pandemic affected year. A trend of increasing footfalls was noted with decreasing COVID intensity and opening of lockdowns. There was a 33% reduction in major elective surgery and a 41% reduction in emergency surgery performed during the COVID period. As far as cancer surgeries are concerned, there was a 12–50% reduction in volumes involving different subsites. Overall COVID positivity rates among cancer surgery patients was low (8.17%), and approximately 30% of healthcare workers involved in cancer surgery were tested positive for COVID during the study period. Results of the current study indicate a significant impact of COVID pandemic on cancer surgical services. There was a significant impact on outpatient visits and cancer surgery volumes. However, a multidisciplinary-coordinated team approach, effective administrative and policy implementation, adoption of revised surgical safety and anesthesia protocols, COVID screening, and testing protocols facilitated resumption of cancer surgical services without adverse impact on surgical outcomes.

Keywords COVID · Cancer surgery

Abbreviations

WHO	World Health Organization
ICU	Intensive care unit
HICC	Hospital Infection Control Committee
PPE	Personal protective equipment
OPD	Outpatient's department
OT	Operation theatre
SOPs	Standard operating procedures

RTPCR	Reverse transcriptase-polymerase chain reaction
ASA	American Society of Anesthesiology
HIPEC	Hyperthermic intraperitoneal chemotherapy
LMIC	Low middle-income country

Introduction

The COVID pandemic has affected healthcare services globally. The first case of COVID was detected in Wuhan city of Hubei province of China on December 31, 2019 [1, 2], and subsequently, it has spread globally within 3 months [3–5]. Eventually, WHO (World Health Organization) declared the disease as a public health emergency of international concern by January 30, 2020, and as a global pandemic on

✉ S. V. S. Deo
svsdeo@yahoo.co.in

¹ Department of Surgical Oncology, Dr. BRA-IRCH, All India Institute of Medical Sciences, 110029 New Delhi, India

² Department of Onco-Anesthesia, Dr. BRA-IRCH, All India Institute of Medical Sciences, 110029 New Delhi, India

March 11, 2020 [6]. India registered the first case of COVID-19 infection in Kerala on January 27, 2020, and subsequently spread to different regions of the country [7]. The Government of India imposed a nationwide lockdown from March 24, 2020, till May 31, 2020.

The pandemic along with nationwide lockdown had a significant impact on healthcare delivery including cancer care services. Hospital resources and healthcare workforce were diverted for COVID care and routine outpatient and inpatient non-COVID services were stopped in most of the hospitals including cancer care services. Patients could not travel due to lockdown and travel restrictions. An estimated 2.3 million cancer surgeries were postponed worldwide during the initial phase of the COVID19 pandemic [8]. The postponement of cancer surgery during the pandemic was due to the impact of COVID on hospital resources and the anticipated high risk of pulmonary complications associated with COVID [9–11]. Unlike surgeries for benign conditions, delaying surgery for cancer can have a major impact on prognosis and survival outcomes. Major concerns during the resumption of elective surgical services were to protect the healthcare workers from the COVID infection and optimal utilization of the critical resources such as isolation rooms, hospital and ICU (Intensive Care Unit) beds, ventilators, and personal protective equipment. Fighting against the COVID pandemic along with the resumption of surgical services is a major challenge and required a number of policy and administrative decisions to modify the workplace environment and patient care pathways.

The purpose of this article is to share our experience of the impact of COVID on cancer surgery including outpatient visits, cancer surgery volumes, and COVID positivity rates among patients and healthcare workers at a tertiary care cancer center that was at the forefront of the fight against COVID. The strategies to included administrative and policy decisions, implementation of revised cancer surgery prioritization, and surgical safety and infection control guidelines including COVID testing strategies for cancer patients [12].

Material and Methods

The setting of the study is a major comprehensive cancer center of a large autonomous tertiary care multi-specialty hospital in north India. The hospital was at the forefront of the fight against COVID with significant diversion of health care and human resources for COVID care.

Administrative decisions were taken jointly with the hospital administration division which included policy related to segregation of COVID versus non-covid patient care pathways, screening of healthcare workers and patients, optimization of patient number at outpatient and inpatient levels, and redistribution of human resources for COVID and

non-COVID services. Cancer surgery and anesthesia-related policies were taken jointly by the surgical and anesthesia teams. These guidelines and standard operating procedures included patient prioritization guidelines for cancer surgery, COVID testing protocol, surgical safety, and infection control protocols, anesthesia, post-operative, and critical care protocols which were published earlier [12]. Those patients who have completed cancer treatment and were disease-free were advised to stay at home and to take the advantage of teleconsultation services. Patients with oncosurgical emergency were treated on priority and elective cancer surgery patients were prioritized based on-site, stage, biology, type of cancer, and availability of non-surgical treatment options [12]. Oncosurgical emergency patients were triaged as high priority (P1), and surgery was performed irrespective of COVID testing status. Medium priority (P2) patients included elective or urgent cancer surgery cases where there is no effective alternative therapy, high chance of cure, delay in surgery can impact survival, and patients who have completed pre-operative Chemo/radiation. The low priority (P3) group included patients coming for staged procedures, reconstructive surgeries, and risk-reducing surgeries and patients with low-grade and benign tumors.

Data Source and Analysis

A retrospective comparative analysis of the outpatient census of the cancer center for the year 2019 prior to COVID pandemic and COVID pandemic year 2020 was performed to assess the impact of COVID on cancer patient volumes. This data included details of new patients as well as follow-up patients.

The surgical data were extracted from the prospectively maintained computerized database for the years 2019 and 2020, and a comparative analysis was performed including surgical volumes, organ-wise surgical spectrum, morbidity, and mortality to assess the impact of COVID on cancer surgery. An audit of COVID infection rates among surgical patients and healthcare workers was also analyzed to assess the effectiveness of the revised patient care pathway, infection control, and surgical safety policy implementation.

Results

Administrative and Policy Modifications Adopted to Facilitate Cancer Care Services During COVID

COVID pandemic was declared in March, and the institution was closed for outpatient and elective surgeries during the last week of March till the end of April 2020. During this period revised patient management strategies,

revised surgical safety protocols, personal protection protocols, and infection control guidelines were formulated. Healthcare workers including nurses, OT (operation theatre) technicians, anesthetists, and nurses were trained by a HICC (Hospital Infection Control Committee). Personal protective equipment (PPE) was procured, and a COVID testing facility was established in the house. Cancer patient management and surgical guidelines were formulated by a team of oncologists, surgeons, and anesthetists [12].

Modifications of Patient Care Pathways, Hospital Setup Including Operation Theater Modifications

At the institutional level, a policy decision was taken to segregate COVID and non-COVID patients separately, and a dedicated COVID care facility and ICU were created. A COVID-free pathway was established for cancer patients and cancer surgery. Elective cancer care services were resumed by May 2020 and outpatient registration was opened through a screening OPD (outpatient department) with a restriction on patient numbers. Inpatient admissions were restricted to 50% of the ward capacity to maintain physical distancing. Preoperative, postoperative, and ICU areas were separately maintained and manned by different teams. Operation theater setup was modified and donning and doffing areas were created. Necessary modifications were made to airconditioning systems, and the OT ventilation was maintained at 12 exchanges per hour. During the surgeries, a face-fitting N95 mask with face shield or eye protection goggles, head cap, shoe covers, impermeable surgical gown, and double gloves were used by surgeons as well as other OT staff. In a COVID-positive patient level-3 PPE was used. A checklist for donning and doffing was designed by the HICC, and all the healthcare workers were trained for compliance with the checklist. A revised protocol with higher safety standards for handling and disposal of bio-medical waste was implemented.

Modification of Anesthesia Protocols

A checklist was maintained by the anesthesia team for clinical screening and COVID testing. All the patients were shifted to the operation theater with a surgical mask. Video laryngoscopy was used instead of direct laryngoscopy to reduce the chance of exposure to the aerosol. Intubations and extubations were performed by the experienced member of the team with universal precautions with a minimum number of personnel in OT to minimize aerosol risk. Regional anesthesia and total intravenous anesthesia were preferred whenever feasible.

Human Resource Management Policy

The workforce was divided for each designated area including screening area, OPDs, wards, minor OT, and major OT, for a fixed period to avoid cross-infection among the team members and facilitate effective contact tracing and quarantine protocols. Standby teams were kept ready in case the on-duty team gets exposed or if any member is infected and quarantined. Minimum possible human resources were utilized for specific patient care-related activities. Prompt reporting of a breach of protocols and adverse events was encouraged, and remedial measures were taken as per SOPs (standard operating procedures). All healthcare workers were encouraged to self-report health status related to COVID symptoms through google forms.

COVID Testing Strategy

Single Testing Strategy

In the initial few months (April 2020–August 2020), our policy was to perform a single pre-admission COVID-19 RTPCR (reverse transcriptase-polymerase chain reaction) test for all asymptomatic patients.

Double Testing Strategy

Due to the increasing incidence of community spread and the increasing number of cases and asymptomatic carriers, from September onwards, policy was changed to perform two COVID-19 RTPCRs, one before admission and, the second, one day before the surgery.

Those patients who tested positive before the surgery were discharged if home isolation facilities were available or shifted to the designated COVID-19 center, and surgery was rescheduled after 4–6 weeks after documenting a negative COVID-19 RTPCR report.

Phased Resumption of Major Cancer Surgical Services

Resumption of major elective surgery was undertaken in three phases. During the first phase (May 2020), we resumed relatively simple surface elective surgeries (breast cancer, soft tissue tumors, etc.) in low-risk patients (ASA grade 1—[American Society of Anesthesiology]) in limited numbers to facilitate strict implementation of revised infection control guidelines and acclimatize staff and surgeons to new working conditions. During the second phase (June–July 2020), moderately complex surgeries (gastric, colorectal, head, and neck) were resumed, and during phase three, highly complex

Table 1 Showing the number of new and follow-up cancer patients registered during 2019 and 2020

Variables	Year 2019 Non-COVID	Year 2020 COVID	Percentage reduction
Number of new cancer patients registered	13,728	6675	51.38%
Number of old/ follow-up cancer patients registered	179,500	79,800	55.54%

surgeries like thoracic, hepato-biliary, cytoreductive surgery, and HIPEC (Hyperthermic Intraperitoneal Chemotherapy) were resumed.

Data analysis

Impact of COVID on Out-patient Services

Table 1 shows figures of old and new cancer patients registered at the cancer center during the years 2019 and 2020. In

2020 during COVID impacted year a total of 79,800 follow-up patients and 6675 new cancer patients were registered in the OPD of a cancer center in comparison to 179,500 follow-up patients 13,728 new cancer patients registered in the previous non-COVID year 2019. Overall there was a reduction of 55.54% in follow-up patient numbers and a 51.38% reduction in new cancer patient registrations during the year 2020 due to COVID. Figure 1 shows the pattern of resumption of OPD services including patient volumes over 12 months.

Impact of COVID on Cancer Surgeries

Table 2 shows the surgical census of major cancer surgery during 2019 and 2020 including re-exploration morbidity and mortality rates.

A total of 1055 major surgeries were performed in the Department of Surgical Oncology between January 1, 2020, and December 31, 2020, in comparison to 1591 major cancer surgeries during 2019. A reduction of 33.69% in major cancer surgeries that occurred during COVID affected year 2020. There was an impact on emergency cancer surgeries also during 2020, comprising 46 emergency surgeries

Fig. 1 Figure showing volume and pattern of outpatients coming for registration during COVID pandemic year

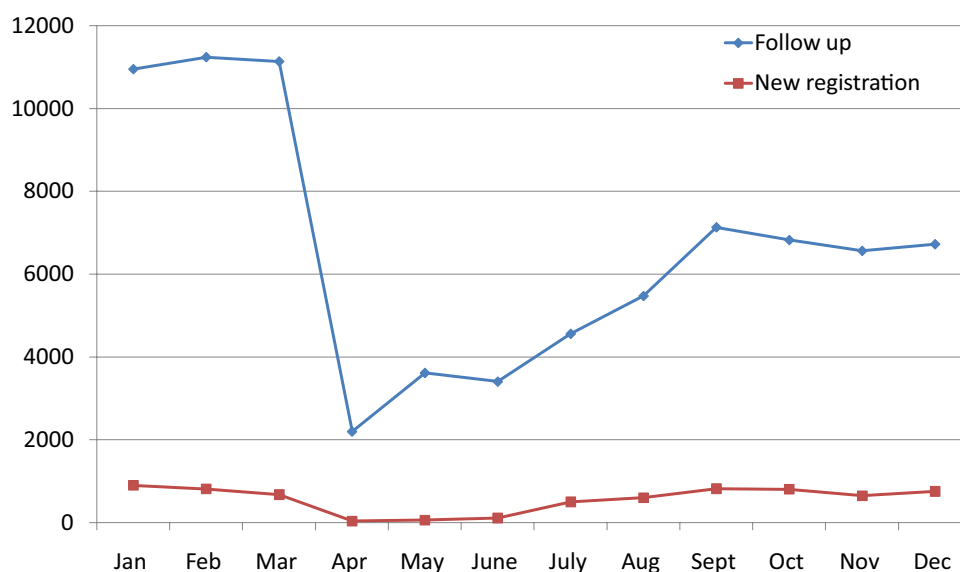


Table 2 Showing the surgical census of major cancer surgery during 2019 and 2020 including re-exploration morbidity and mortality rates

Variables	Year 2019 Pre-COVID year	Year 2020 COVID year	Percentage reduction
Number of major elective cancer surgeries	1591	1055	33.69%
Number of emergency cancer surgeries	78	46	41%
Re-exploration rates	17 (1.06%)	8 (0.72%)	0.34%
Operative morbidity (Clavien Dindo grade III/IV morbidity)	19 (1.19%)	17 (1.6%)	0.41% (Increased)
Operative mortality	18 (0.88%)	12 (0.57%)	0.31%

in 2020 in comparison to 78 in the year 2019. There was no significant difference in re-exploration rates, morbidity, and mortality between 2 years under evaluation indicating no adverse impact of COVID on perioperative outcomes.

An organ systems comparative operative census data of the years 2019 and 2020 indicate a significant reduction of complex surgeries involving thoracic, GI tract, head and neck, and peritoneal surface malignancies (Table 3), whereas breast surgery did not show a significant impact due to COVID and the number of miscellaneous surgeries increased during COVID year 2020.

COVID Positivity Rates Among Patients Undergoing Cancer Surgery and Healthcare Workers

COVID Positivity Rates Among Cancer Surgery Patients

Overall 8.17% of patients who planned for surgery tested positive for COVID-19, the majority (7.58%) during the pre-operative period, and the remaining tested positive during the hospital stay. Among those who tested positive 2% were picked up during the single test phase, and 5.58% tested positive during the double testing phase. All these patients were asymptomatic and recovered completely and had a subsequent uneventful surgery and post-op recovery. Only 3 patients (0.58%) tested positive during the postoperative period. All three patients developed COVID-19 pneumonia and were treated in a dedicated COVID intensive care facility. Two out of 3 patients died of COVID.

COVID Positivity Rates Among Healthcare Workers

There were 149 healthcare workers including surgeons, anaesthetists, nurses, OT technicians, resident doctors, and ICU staff who were involved in the surgical care of cancer patients. A total of 44 (29.53%) healthcare workers tested positive for COVID-19 during the entire study period. The

COVID positivity rate among surgeons was 32.4%, 17% for anaesthetists, 37% for nursing staff, and 36.8% for other support staff (Table 4).

Discussion

COVID pandemic affected global healthcare services in an unprecedented fashion during the year 2020. Reasons for disruption of healthcare services include rapidly spreading COVID infection overwhelming healthcare infrastructure and workforce. Lack of effective mitigation strategies against COVID and implementation lockdowns to control the spread of infection aggravated the healthcare crisis. COVID has a major adverse impact on cancer care delivery globally. Unlike other diseases, delay in treatment can impact prognosis and survival among cancer patients. Healthcare systems all over the world reacted to the unprecedented challenge and evolved strategies to counter COVID and continue caring for critical diseases like cancer. However, there seems to be a major impact on cancer care delivery and outcomes of cancer patients leading to a potential increase in advanced cancer patient burden and mortality. There is a need to audit data of major institutions especially in low- and

Table 4 COVID positivity rate among healthcare workers

Healthcare worker category	Total number	Number of HCW-tested positive	Percentage
Surgeon	37	12	32.4%
Anaesthetist	47	8	17%
Nursing staff	27	10	37%
Other support staff	38	14	36.8%
Total	149	44	29.53%
Overall COVID positivity rate among the patients			8.17%

Table 3 Showing the organ system-wise comparative data of the operative census during year of 2019 and 2020

Organ system-wise cancer surgery spectrum	2019 Pre-COVID	2020 COVID	Percentage reduction
Breast	441	387	12.24
Head and neck	295	170	42.37
GI tract	261	124	52.49
Thoracic	128	71	44.53
Gynae oncology	145	62	57.24
Uro-oncology	39	25	35.89
Sarcoma	111	50	54.95
Peritoneal surface malignancies	52	32	38.46
Skin cancer	32	27	15.62
Miscellaneous	88	107	21.59 (Increased)
Total	1592	1055	33.73

middle-income countries (LMIC) to assess the extent of the impact.

As per COVIDSURG collaborative data during the COVID pandemic, more than 28 million operations were canceled worldwide [8]. COVID can have an adverse impact on cancer patients due to increased susceptibility to COVID due to immunocompromised state, increased severity of COVID infection in cancer patients, more COVID-related complications, and increased mortality among surgical patients and hematological malignancies [13, 14]. Even though various surgical societies developed guidelines for the treatment of cancer patients during the COVID pandemic, there is a need to develop guidelines based on local factors including COVID and cancer burden and availability of resources [15–21].

In the current study center, a swift response was mounted by hospital administration and clinical departments to devise effective strategies for managing COVID and non-COVID patients. Treatment guidelines to treat cancer patients during the COVID pandemic appropriate for LMIC were prepared by a joint team of surgeons, anesthesiologists, and hospital administrators and were implemented effectively at the treating center [12].

Preparation of the hospital care setup and healthcare workers to fight COVID took 4–6 weeks including the creation of dedicated COVID care facilities, procurement of PPEs, and establishing COVID testing labs. The preparation of COVID management guidelines and training of all sections of healthcare workers also happened during this period. Subsequently, preparations were made in the cancer center to treat cancer patients and resume surgical services. The important lessons learned during this phase was the importance of teamwork, coordination among diverse specialties and groups of healthcare workers, adopting dynamic and flexible health policy approach, and effective leadership.

Creating COVID-free pathways for cancer care services enables the system to effectively deliver cancer care but heavily depends on the physical and human resources available at your disposal [22]. The rate of pulmonary complications, COVID infection, and mortality is lower in COVID-free surgical pathways [22]. Because of the scale of infrastructure and size of human resources and liberal financial support from the government, we could rapidly establish dedicated COVID care facilities and COVID free setup for cancer care.

Results of the current study indicate a significant impact on out-patient registration of cancer patients. On average 1000 new cancer patients and 10,000 follow-up patients visit the cancer center every month before the pandemic which was reduced to less than 50% at the beginning of the pandemic, and patient attendance picked up slowly over few months with a decrease in COVID pandemic intensity

and opening of lockdown. The outpatient numbers never returned to the pre-COVID status during the entire year.

As far as the cancer surgery census is concerned, there was a significant impact on the volumes during the early part of the pandemic due to various factors. Our experience has proved that a phased resumption of surgical services helps in preparing the new system, adopt revised guidelines, and helps in staff acclimatization to the new normal of operating under the constant threat of COVID risk and operating with enhanced and less ergonomic PPE. It is also prudent to plan the resumption of surgery based on the complexity of the surgery. Less complex surgeries involving fit patients can be easily performed during the initial phase, and once the team gains confidence and the system stabilizes, more complex cases can be taken up for surgery. However, this strategy can have an adverse impact on patients with complex surgical challenges. In the current study, the impact on moderate to highly complex surgery was more than simple surface surgeries. There was no significant difference among re-exploration rates, morbidity, and mortality rates for cancer surgeries in COVID and non-COVID years, highlighting the fact that effective implementation of cancer surgery and perioperative care guidelines is crucial for good surgical outcomes.

Another important issue of concern is COVID infection rates among cancer patients and healthcare workers. Multiple factors including community burden of COVID, lockdown status, testing strategy, and adoption of COVID appropriate behavior can influence the COVID infection rate among patients and healthcare workers. Results of our study indicate that if appropriate screening guidelines, testing strategies, and infection control protocols are implemented, COVID infection rates among surgical patients are low and manageable. The COVID positivity rate among cancer surgery patients was 8.17%. This figure is encouraging and may help to increase the confidence of treating teams and facilitate the expansion of surgical services rapidly. Two out of 3 patients tested positive during the post-operative period died in the current study, indicating the adverse impact of COVID infection on postoperative outcomes. Approximately 20–30% of the healthcare workforce was tested positive for COVID during the entire study period, and the most likely source of infection is community spread as they were working in exclusive COVID-free hospital areas. Fortunately, there was no mortality among healthcare workers involved in cancer surgery in our study.

The real impact of COVID on cancer care is still evolving, and the true picture will emerge if efforts are made to collate the hospital-based data and cancer mortality data at regional and national levels. Simultaneously all efforts have to be made to bring back cancer care delivery to pre-COVID pandemic capacity as soon as possible.

Conclusion

Results of the current study indicate a significant impact of COVID pandemic on cancer surgical services. There was a significant impact on outpatient visits and cancer surgery volumes. However, a multidisciplinary coordinated team approach, effective administrative and policy implementation, adoption of revised surgical safety and anesthesia protocols, COVID screening, and testing protocols facilitated resumption of cancer surgical services without adverse impact on surgical outcomes.

Authors' Contributions All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by Amitabha Mandal, Madiwalesh Chhebbi, and Manish Gaur. The first draft of the manuscript was written by SVS Deo, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Data Availability Data may be produced on demand.

Code Availability Not applicable.

Declarations

Ethics Approval Obtained.

Consent to Participate Not applicable.

Consent for Publication Not applicable.

Conflict of Interest The authors declare no competing interests.

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