

Table 2(a): Procedures done along with their pre and post-operative course in COVID-19 positive patients (Group A)

Diagnosis	Age in	Details of procedure	Year	Co-morbidities	APACHE II Score	Mechanical ventilation and duration	CT Thorax findings (CTSI)	Postoperative complications
	years							
Perforation peritonitis	20	Modified graham's patch repair	2020	None	4	No	GGOs with bilateral pleural effusion and atelectasis (2)	Pleural effusion
Suspected appendicular abscess	50	Appendectomy	2020	HTN, IHD	4	No	GGOs with bilateral pleural effusion and atelectasis (4)	Pleural effusion
Perforation peritonitis	22	Primary repair of ileal perforation with loop ileostomy	2020	None	3	Yes; 2 days	Not done	None
Perforation peritonitis*	50	Primary repair of ileal perforation and appendectomy	2020	None	2	Yes; 6 days	GGO with bilateral pleural effusion (8)	Pneumonia, immediate ventilator >48hrs
Perforation peritonitis*	33	Ileostomy	2020	None	30	Yes; 5 hours	Consolidation and GGO in upper lobe. Calcified mediastinal nodes and bronchiectatic changes (7)	Post operative respiratory failure needing endotracheal intubation
Perforation peritonitis*	55	Primary repair of jejunal perforation	2020	DM, HTN	32	Yes; 2 days	Consolidation and cavitation in left upper lobe. GGOs in left lower lobe. Bilateral pleural effusion (8)	Post operative respiratory failure needing endotracheal intubation, immediate ventilator >48hrs
Acute intestinal obstruction*	66	Diversion loop colostomy	2020	DM, HTN	17	Yes; 2 days	Not done	Post operative respiratory failure needing endotracheal intubation, immediate ventilator >48hrs
Gall stone ileus*	45	Retrieval of gall stone from jejunum after enterotomy and primary closure of enterotomy	2020	DM	7	No	Not done	Post operative respiratory failure needing endotracheal intubation

Superior mesenteric artery thrombosis*	54	Ileal resection and anastomosis with ileostomy	2020	DM, IHD	7	Yes; 10 days	Consolidation with cavity formation in bilateral upper lobes with GGOs (12)	Burst abdomen requiring re-exploration, immediate ventilator >48hrs
Perforation peritonitis due to stab injury	23	Primary repair of ileal perforation	2020	None	5	No	Lung atelectasis with bilateral GGOs (2)	None
Acute appendicitis#	57	Open appendectomy with drainage of appendicular abscess	2020	None	6	No	Not done	None
Perforation peritonitis	30	Modified graham's patch repair	2021	None	5	No	Consolidation with GGOs in bilateral upper lobes and bilateral pleural effusion (1)	None
Perforation peritonitis*	52	Primary repair of ileal perforation	2021	None	8	Yes; 5 days	Not done	Pneumonia, post operative respiratory failure needing endotracheal intubation, immediate ventilator >48hrs
Perforation peritonitis in a case of diverticulitis	49	Peri-colic abscess drainage and transverse loop colostomy	2021	DM	4	No	Bilateral GGOs with subpleural fibrotic bands involving both the lower lobes (4)	None
Perforation peritonitis	26	Modified graham's patch repair	2021	None	4	No	Bronchiectatic changes with bilateral GGOs (4)	Superficial SSI
Acute obstruction with sigmoid colon mass	30	Transverse colostomy	2021	Abdominal Koch's, Retroviral disease	8	No	GGOs in the left lung (1)	None
Perforation peritonitis	60	Resection and anastomosis of ileum with proximal loop ileostomy	2022	Abdominal Koch's	5	No	Not done	Prolapsed stoma requiring re-exploration

Perforation peritonitis*	16	Primary repair of ileal perforation	2022	Abdominal Koch's	9	Yes; 3 days	Not done	Septic shock
Hemoperitoneum	56	Resection and anastomosis of sigmoid colon with diverting ileostomy	2022	None	8	No	Not done	Acute renal failure needing dialysis
Ruptured hepatic abscess with peritonitis	27	Evacuation and drainage of intraperitoneal pus	2022	None	8	No	Bilateral pleural effusion with atelectasis (8)	Burst abdomen requiring re-exploration

*: Mortality

#: Done under Spinal anaesthesia (Others were done under General anaesthesia)

DM: Diabetes mellitus

HTN: Hypertension

IHD: Ischemic heart disease

CT: Computed tomography

CTSI: Computed tomography severity index

GGO: Ground glass opacities

SSI: Surgical site infection

Table 2(b): Procedures done along with their pre and post-operative course in COVID-19 negative patients (Group B)

Diagnosis	Age	Details of procedure	Year	Co-morbidities	APACHE II Score	Mechanical ventilation and duration	CT Thorax findings	Postoperative complications
	(years)						(CTSI)	
Anastomotic leak post Resection and anastomosis for carcinoma sigmoid colon	73	Redo resection and anastomosis with transverse Colostomy	2020	None	5	Yes; 4 days	Not done	Septic Shock, Pneumonia, Post operative Respiratory Failure needing Endotracheal Intubation, Immediate Ventilator >48hrs
Perforation peritonitis	18	Modified Graham's patch repair	2020	None	2	No	No abnormalities (0)	None
Burst abdomen in an operated case of appendicectomy	40	Right hemicolectomy with ileotransverse anastomosis and proximal loop ileostomy	2020	None	8	No	Not done	Post operative bleeding needing transfusion

Citation: Aishwarya Dutt, Ajay Bhandarwar, Girish Bakhshi, Nikhil Dhimole, Harshal Padekar, Snehal Dandge, Kaushal Lahoti, Advait Chetan, Apoorva Raichur. Explorations Gone Viral: A Comparative Study of Emergency Laparotomies in COVID-19 Positive vs COVID-19 Negative Patients at A Tertiary Care Hospital during the COVID-19 Pandemic. Archives of Clinical and Biomedical Research. 7 (2023): 510-521.

Perforation peritonitis	33	Worm retrieval and Modified Graham's patch repair	2020	None	4	No	Not done	None
Acute intestinal obstruction	44	Ileal segment resection and anastomosis with Proximal ileostomy	2020	None	6	No	Not done	None
Acute intestinal obstruction	44	Adhesiolysis	2021	None	3	No	Not done	None
Perforation peritonitis	20	Primary Repair of Ileal Perforation	2021	None	2	No	Not done	None
Perforation peritonitis	42	Primary repair of sigmoid perforation with Ileostomy	2021	Abdominal Koch's and retroviral disease	7	No	Not done	SSI(Burst Abdomen)
Perforation peritonitis	63	Modified Graham's patch repair	2021	None	6	No	Not done	Renal Insufficiency
Foreign body insertion per rectum	27	Enterotomy with retrieval of foreign body	2021	None	5	No	Not done	None
Perforation peritonitis	22	Modified Graham's patch repair	2022	None	4	No	Not done	None
Acute intestinal obstruction with colon mass	26	Extended right hemicolectomy with ileostomy	2022	None	6	Yes; 1 day	Not done	Post operative bleeding needing transfusion
Perforation peritonitis*	65	Adhesiolysis with Primary repair of jejunal perforation(Previous roux-en-y surgery)	2022	Diabetes Mellitus	10	Yes; 1 day	Not done	Septic Shock
Acute intestinal obstruction	40	Segmental ileal resection and anastomosis with proximal loop ileostomy	2022	None	5	No	Not done	None

SMA thrombosis with ileal necrosis	35	Ileal resection with double barrel stoma	2022	Hypertension	7	Yes; 2 days	Not done	Immediate Ventilator <48hrs
Emphysematous cholecystitis with liver abscess	58	Subtotal cholecystectomy with drainage of liver abscess	2022	Diabetes Mellitus, Hypertension	8	Yes; 2 days	Not done	Septic Shock
Acute intestinal obstruction	32	Right hemicolectomy with ileotransverse anastomosis and proximal loop ileostomy	2022	None	7	Yes; 1 day	Not done	Post operative bleeding needing transfusion
Burst abdomen in an operated case of primary repair of ileal perforation	32	Segmental ileal resection and anastomosis with loop ileostomy	2022	None	8	Yes; 1 day	Not done	Septic Shock, Post operative bleeding needing transfusion
Intra-abdominal and perianal abscess	59	Drainage of intra-abdominal and perianal abscess	2022	Diabetes Mellitus, Ischaemic Heart Disease	7	Yes; 1 day	Not done	Superficial SSI, Septic Shock, Pneumonia
Acute intestinal obstruction	27	Right hemicolectomy with ileotransverse anastomosis and proximal loop ileostomy	2022	None	5	Yes; 1 day	Not done	Post operative bleeding needing transfusion

*: Mortality

CT: Computed tomography

CTSI: Computed tomography severity index

SSI: Surgical site infection

mortalities amongst the patients without comorbidities in Group B, as compared to one amongst the five (20%) with comorbidities. The age groups between 40-59 years had the highest mortalities, with five of the nine mortalities within this age group and from Group A. Six of the eight (75%) deaths from Group A were above 40 years of age, while two (25%) deaths were below 40 years of age. The p-value was calculated to compare Group A and B with respect to age, pulmonary complication, and mortality. There was no significant difference between the two groups with regards to pulmonary complications. Group A patients were seen to have a significantly greater mortality in the age groups

between 40-60 years compared to Group B(p-value:0.017). Group B had one mortality which was above 60 years of age. All 31 discharged patients (12 from Group A and 19 from Group B) were followed up after one month. Complaints were reviewed, and patients examined (Table 3a and b). Two patients from Group A had mild breathlessness on exertion, relieved on taking rest. No patients from Group B had any respiratory complaints and no respiratory compromise was seen in any of the discharged patients after one month. Three patients (one from Group A and two from Group B) had a postoperative surgical site infection which was treated with daily dressings.

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Table 3(a): One month Follow Up in Group A Patients

Diagnosis	Respiratory complaints	Abdominal complaints	Examination	Co-morbidities
Prepyloric Perforation	None	None	Normal	None
Appendicular tip Perforation	Breathlessness on exertion	None	Normal	Hypertension, Ischaemic Heart Disease
Ileal Perforation	None	None	Normal	None
Ileal Perforation due to Stab injury	None	Abdominal Pain	Normal	None
Acute Appendicitis	None	None	Normal	None
Prepyloric Perforation	Breathlessness on exertion	None	Normal	None
Peri-colic abscess secondary to diverticulitis	None	None	Normal	Diabetes Mellitus
Prepyloric Perforation	None	Surgical site wound	Surgical site infection	None
Sigmoid Colon Adenocarcinoma with Metastasis	None	None	Normal	Abdominal Koch's, Retroviral disease
Distal Ileal Obstruction with Ileal Perforation	None	None	Normal	Abdominal Koch's
Hemoperitoneum with Sigmoid colon laceration	None	None	Normal	None
Ruptured hepatic abscess	None	Abdominal Pain	Normal	None

Table 3(b): One month Follow Up in Group B Patients

Diagnosis	Respiratory complaints	Abdominal complaints	Examination	Co-morbidities
Anastomotic leak post Resection and Anastomosis	None	None	Normal	None
Prepyloric Perforation	None	None	Normal	None
Burst Abdomen post appendectomy	None	None	None	None
Duodenal perforation with worm infestation	None	None	Normal	None
Acute Intestinal obstruction	None	None	Normal	None
Acute Intestinal obstruction	None	None	Normal	None
Ileal Perforation	None	None	Normal	None
Sigmoid Perforation	None	Surgical site wound	Surgical site infection	Abdominal Koch's, Retroviral disease
Prepyloric Perforation	None	None	Normal	None
Foreign body insertion per rectum	None	None	Normal	None
Prepyloric Perforation	None	None	Normal	None
Adenocarcinoma of transverse colon	None	None	Normal	None
Acute Intestinal obstruction	None	None	Normal	None
SMA thrombosis with ileum necrosis	None	Abdominal Pain	Normal	Hypertension
Emphysematous cholecystitis with liver abscess	None	Abdominal Pain	Normal	Diabetes Mellitus, Hypertension
Acute Intestinal obstruction	None	None	Normal	None
Burst abdomen post Primary repair of Ileal Perforation	None	None	Normal	None
Intra-abdominal and perianal abscess	None	Surgical site wound	Surgical site infection	Diabetes Mellitus, Ischaemic Heart Disease
Acute intestinal obstruction	None	None	Normal	None

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Discussion

COVID-19 is known to cause a number of complications such as acute respiratory distress syndrome, gastrointestinal disturbances, acute cardiac injury, acute kidney injury and secondary infections [9]. The increase in reactive oxygen species and activation of the renin–angiotensin–aldosterone system causes insulin resistance and hyperglycaemia. There is an increase in fibrinogen and D-Dimer, increasing the blood viscosity and vascular endothelial damage and, hence, the associated cardiovascular events, thromboembolism and disseminated intravascular coagulation [10]. The present study determines the difference in outcomes in patients undergoing emergency laparotomy with SARS-CoV-2 infection compared to those unaffected. Infected patients had a significantly higher (p-value: 0.008) number of preoperative respiratory complaints as compared to those without the infection. Although there was no significant difference between patients with or without the infection for the requirement of postoperative ventilation (p-value: 0.34) or ICU care (p-value: 0.75), pulmonary complications were significantly higher in patients with COVID-19 infection (45%) as compared to those without the infection (15%) and undergoing emergency laparotomies (p-value: 0.047). The study showed that patients with comorbidities such as DM and hypertension had a worse outcome compared to those without them. There was a higher incidence of postoperative complications (COVID-19 positive: 66.67% vs 36.3% and COVID-19 negative: 40% vs 6.67%) and mortality (COVID-19 positive: 55.56% vs 27.27% and COVID-19 negative: 20% vs 0%) in those with comorbidities in both groups. The use of antivirals did not correlate to a reduction in postoperative mortality. APACHE-II score, for indicating postoperative outcomes, was not sensitive as scores ranged between 2 to 32 in the patients with eventual mortality. It did not show a significant increase in COVID-19 positive patients as well (p-value: 2.11). However, despite lacking sensitivity, all patients with an APACHE-II score of more than 30 had a fatal outcome.

Postoperatively, respiratory complaints increased which signified a possible subtle presentation which flared up after surgical and anaesthetic trauma. Mortality was most commonly due to respiratory failure in cases with COVID-19 infection (87.5%) as compared to those not infected (0%). This also corresponded to the higher CTSI in the patients with mortalities. The mortality in COVID-19 positive patients was also seen to be significantly higher (p-value: 0.008). As we progressed onwards with our experience with COVID-19 emergencies and improved knowledge about the disease we could see an improvement in outcomes of the patients. This was confirmed with the decrease in mortality as seen in the second and third wave. Initial high mortality rates

could also be due to delayed presentations to the hospital due to lack of transportation and referral facilities during the peak of lockdown imposed around our district. As these facilities were made available later, patients were able to report to facilities promptly and get the necessary treatment. Aggressive use of steroids also helped with decreasing mortality over the months. Few studies have been done to detect the effect of SARS-CoV-2 on surgical procedures and its increased morbidity and mortality associated with it. A study by COVIDsurg collaborative was done on mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection during the first wave of the pandemic [11]. This cohort study covered 235 hospitals with 1128 patients who had undergone surgeries, of which 373 had undergone gastrointestinal surgeries like the present study. It showed that emergency surgeries had a higher incidence of mortality compared to elective surgeries (25.6% [214 of 835] vs 18.9% [53 of 280]). The present study showed similar results with a high mortality seen in the patients operated on emergency basis for exploratory laparotomy with COVID-19 infection as compared to patients without the infection (40% vs 5%). Pulmonary complications related to COVID-19 infection such as pneumonia, pleural effusion and ventilatory requirement was recorded in both studies as well. Handaya et al conducted a study consisting of four cases that underwent emergency laparotomy surgeries in COVID-19 positive patients with gastrointestinal emergencies [5]. All the patients underwent emergency laparotomy, received postoperative care, and were discharged from the hospital. After one month follow-up, one patient had no complaints, two patients had surgical site infections, and one patient died because of acute respiratory distress syndrome due to lung metastasis. Compared to the present study the mortality was seen to be less. With similar follow up periods, surgical site infections were seen in both studies. Acute respiratory distress, however, was not seen as a delayed presentation in the present study. Antiviral treatment has been studied extensively with multiple trials attempting to bring about better outcomes. It has been seen that antiviral medication, alone or in combination with other medications, did not show an increase in survival. However, increased survival has been associated with low molecular weight heparin and tocilizumab [12]. The effect of antivirals or additional medications required perioperatively in emergency surgeries in COVID-19 needs further research. The present study involved the enrolment of consecutive cases in a single centre which provided results of a consistent and uniform management protocol. This helped in reducing the varied outcomes due to different surgical techniques practiced in different set ups. At the same time the evolving concepts of COVID-19 infection management brought a heterogeneity in the management of the cases over the months. The limitation of the study was loss to follow up of the patients beyond a

month after discharge. This caused a difficulty in recording any delayed presentations of the cases. It was seen in the present study that patients with comorbidities like DM, hypertension and ischemic heart disease (IHD) were at a higher risk for mortality in patients operated for exploratory laparotomy with COVID-19 infection. It was seen that the surgical and anaesthetic insult in COVID-19 infected individuals can cause unfavourable results and high risk of mortality compared to non-infected individuals undergoing emergency laparotomy. As our understanding of the disease improved the percentage of mortality decreased in the second and third wave as compared to the first wave.

Conclusion

Emergency operations can be taken up in COVID-19 positive patients with adequate precautions, after judging the benefits of surgery, due to increased chances of postoperative pulmonary complications and mortality. Patients with comorbidities like DM, hypertension and IHD are at a higher risk of having adverse postoperative outcomes. Radiological studies such as CT are helpful in detecting the severity and the mortality. Antivirals may not have an effect in the treatment for these patients. High index of suspicion of pulmonary complications helps in early detection. This predisposes to early introduction of steroid and aggressive management that helps in the reduction of mortality.

Conflict of Interest: None

References

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