POST-OPERATIVE OUTCOMES AND ASSOCIATED FACTORS OF COVID 19 DIAGNOSED PATIENTS UNDERGOING EMERGENCY SURGERY: A CROSS-SECTIONAL STUDY

BY

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A RESEARCH THESIS SUBMITTED TO DEPARTMENT OF ANESTHESIA, COLLEGE OF MEDICINE & HEALTH SCIENCES, ADDIS ABABA UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR M.Sc. IN CLINICAL ANESTHESIA.

Post-operative outcomes and associated factors of COVID-19 diagnosed patients undergoing emergency surgery: a cross-sectional study

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Addis Ababa, Ethiopia, 2021

Declaration

I, the undersigned, declare that this thesis is my original work for partial fulfillment of MSc in anesthesia and any literature used here is cited and acknowledged. And I understand plagiarism is not tolerable.

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Abbreviation and Acronyms

AOR	Adjusted Odds Ratio
CI	Confidence Interval
COR	Crude odds Ratio
COVID-19	Corona Virus Disease-2019.
CVS	Cardio vascular
EKGH	Eka Kotebe General Hospital
FMOH	Federal Ministry of Health
IRB	Institutional Review Board
OR	Odds Ratio

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Abstract

Background: Corona viruses are a group of enveloped viruses which are characterized by their non-segmented, single-stranded, and positive-sense RNA genomes. As this pandemic is new and ever evolving with a continuous increment in case load, especially in countries like ours, where people live in close contact and social distancing and isolating is near impossible.

Objective: Theaim of this study was to determine post-operative outcomes and associated factors of COVID-19 diagnosed patients undergoing emergency surgery from March 2020 – May 2021.

Method: Institutional based retrospective cross sectional study was conducted by reviewing data recorded from March 2020 – May 2021. 162 study subjects was involved, data was reviewed consecutively. Data was checked, coded and entered to SPSS for analysis. Descriptive statistic was presented using text, figures and tables. The association between variables was analyzed with bivariate and multi variable logistic regression. A statistical significance was declared at p value < 0.05, with 95% confidence interval.

Result: A total number of 162 study participants participated in the present study and the post-operative mortality status, post-operative respiratory complication and post-operative cardio-vascular complication found to be 16.7%, 43.2% and 14.8% respectively. Age(AOR=0.52 (0.14-0.89), pre-operative severi(AOR= 0.31 (0.20-0.92)), presence of comorbidity(AOR=2.37 (1.90-6.71)), post-operative respiratory status(AOR=0.17 (0.09-0.96)) and duration of surgery((AOR=0.39 (0.11-0.81) was found to be significantly associated with post-operative outcome.

Conclusion & recommendation- Age, presence of comorbidity status, pre-operative severity status, duration of surgery, post-operative respiratory status was found to be the significant predicator of post-operative outcome among COVID-19 patients undergoing emergency surgery.

We recommend early screening for old ages looking for comorbidities in turn to decrease mortality of COVID-19 patients.

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1. INTRODUCTION

1.1 Background

According to world health organization Coronaviruses make up a large family of viruses that can infect birds and mammals, including humans (1). Several outbreaks including the severe acute respiratory syndrome (SARS) pandemic of 2002-2003 and the Middle East respiratory syndrome (MERS) outbreak in South Korea in 2015 have occurred due to two strains among the six human infecting types of the viruses (1).

COVID-19 is an evolving illness caused by a novel coronavirus known as SARS-cov-2 which is a seventh strain of the corona virus family which was first identified in Wuhan city in December 2019 (2). It is by far the latest and most dangerous subtype. It is believed to originate from animal source according to the evidences that were collected (2). It is mainly transmitted through droplets produced by infected person through a close contact (3).

Symptoms of COVID-19 are variant from person to person, it may cause few or no symptoms in some people while it can result severe illness and death in others (4). COVID-19 Usually presents with fever, cough, dyspnea, myalgia and/or fatigue. 2 -14 days may take to show symptoms after being infected (5).

Since the beginning of the outbreak in December 2019 it took almost three months for Ethiopia to report its first case on March 13th 2020 (6). The case was found in the capital city Addis Ababa on a 48 years old Japanese guy who had a travel history from japan through Burkina Faso to Ethiopia(4). Up until November 9 2020, Ethiopia has reported a total case of 274, 187 with 251, 575 recoveries and 4, 242 death (5).

Number of patients requiring surgical intervention has been increasing concomitantly with an increment in community transmission. There is an urgent need to understand the outcomes and predisposing factors of COVID-19 infected patients who undergo surgery for better and safe access of care (6).

1.2 Statement of the problem

Patients prognosis and their predisposing factors after COVID-19 infection has been well described in many literatures, but little is known about the outcomes and leading causes of those outcomes of patients who undergone surgery for different reasons. Half of the patients with perioperative SARS-COV-2 infection had developed postoperative pulmonary complications which were associated with high mortality (6). This finding shows how much effect COVID-19 has on the overall survival of patients undergoing surgery, which by itself is a risk for mortality and morbidity due to its physiological function distorting stress mechanism. Hence COVID-19 can be a crucial variable that would directly influences surgical outcomes along with other factors. Not only pulmonary complication but also ICU admission was also about 44.1% (7). Even though this particular study was conducted on a small sample size, yet it demonstrated a significant amount of correlation between COVID-19 and its adverse outcomes (8).

Not enough studies have been conducted regarding COVID-19 and surgery and even in those very few researches that I came across with, all were conducted in developed countries, which in my opinion has different demographic and life style compared to developing countries, thus the result might not represent us well. Therefore, I believe since the setup, resource availability and biogenetic markers varies from nation to nation, associated factors and outcomes of patients should be assessed on that concrete base.

As this pandemic is new and ever evolving with a continuous increment in case load, especially in countries like Ethiopia, where people live in close contact and social distancing and isolating is near impossible, the need for emergency surgical care and treatment will also increases significantly.

1.3 Significance of the study

Thus, this research to my best knowledge will be the first to be conducted in our country, it intends to distinguish patients' outcome in correlation to its specific associated factors in hope of formulating evidence based suggestion for optimal perioperative anesthetic and surgical management specific to COVID-19.

Furthermore, the information that will be obtained from this research can bring useful and practical knowledge to practitioners regarding in future risk stratification andalso could support policy makers to gain insight on how to develop a policy that can be used as a guide for clinical decision making during and after the COVID-19 pandemic.

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2. LITREATURE REVIEW

2.2 Postoperative outcome

Patients with SARS-CoV-2-infection has worse postoperative outcomes compare to pre-pandemic baseline rates of pulmonary complications and mortality(6). Before these novel virus emerged a multinational observational studies have concluded over all post-operative pulmonary complication of up to 10% and mortality up to 3% occurring after surgery (11). During this pandemic a 2020 international, multicenter, observational cohort study shows half of patients with perioperative SARS-CoV-2 infection developed post-operative pulmonary complications with overall 30 days mortality being 23.8% (6).

The 2019 NELA report showed a 30 day mortality rate of patients with high preoperative risk of death being 16.9% while its 16.8% in patients with an unexpected critical care admission and 23.4% in frail patients older than 70 years (12). Thus, patients with SARS-CoV-2-infection have an even higher mortality rate than that of the highest risk groups.

Another multicenter retrospective study done in Wuhan in 2020 tried to find out the fate of patients with SARA-COV-2 infection after surgery and it found out the most common outcome being ICU admission and mortality post ICU admission. 44.1% required postoperative ICU admission and of those patients 20.5% died(7). The study also determined the specific factors for the cause of mortality, the most common being ARDS, shock, arrhythmia and acute cardiac injury.

In 2020 multicenter cohort study undertaken in UK showed, Hip fracture surgery in COVID-19-positive patients was associated with increased length of hospital stay, more admissions to the critical care unit 61%, higher risk of perioperative complications 89%, and increased mortality rates 30.5% compared to COVID-19-negative patients(8).

In 2020 one meta-analysis revealed that the global prevalence of perioperative mortality among surgical patients with COVID-19 was 20% (9).

A 2021 retrospective cohort study of hospital discharge data from the Vizient Clinical Data Base study showed that COVID19 positive patients had more than double the

number of deaths compared to non COVID 19 positive patients with a statistical value of 14.8% vs. 7.1% respectively(10).

2.1 Associated factors

A 2020 multicenter cohort study done in a covid19 era showed patients whose age is greater than 70, those with comorbidities, male gender, those having cancer surgery and those needing emergency or major surgery with SARS-CoV-2 infection are at higher risk of developing postoperative pulmonary complications and mortality. These study established 30 days mortality rate for each risk factors of which major surgery accounting for the highest mortality rate of 26.9%, followed by emergency patients 25.6%, elective patients 18.9% and 16.3% in patients having minor surgery(6).

A 2020 study done in Wuhan, which retrospectively analyzed 34 patients showed being older, having underlying comorbidities, undergoing more difficult surgeries and perioperative severe laboratory abnormalities are the associated risk factors for postoperative ICU admission and mortality(7).

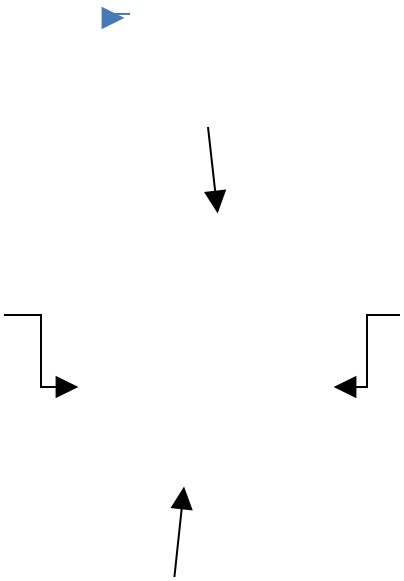
A 2020 multicenter cohort study that included 340 COVID-19-negative patients versus 82 COVID-19-positive patients undergoing surgical treatment for hip fractures across nine NHS hospitals in Greater London, UK showed positive smoking status and multiple (greater than three) comorbidities being the risk factors for increased mortality in patients with COVID-19 undergoing surgery(8).

A 2020 meta-analysis that included Twenty-three articles with 2947 participants showed higher mortality status is associated with an emergency surgery(9).

A 2021 retrospective cohort study of hospital discharge data from the Vizient Clinical Data Base study suggest that COVID-19 infection positivity is an independent risk factor for surgical mortality(10).

Thus, from all those findings that was available, SARS-COV-2 has undeniable and concerning effect on the outcomes of patients undergoing surgery. These effect would be even worse in countries like ours, with low socioeconomic status and poor medical service availability yet no known study have been done to determine the associated factors and outcomes specific to our setup and resource.

Conceptual framework



A conceptual frame work adapted from reviewing different literatures with little modification (10, 11).

3. OBJECTIVES

3.1. General objective

To determine post-operative outcomes and associated factors of COVID-19 diagnosed patients undergoing emergency surgery from March 2020 - May 2021.

3.2. Specific objectives

- To determine magnitude of post-operative outcomes of COVID-19 patients undergoing emergency surgery.
- To determine factors associated with post-operative outcomes of COVID-19 patients undergoing emergency surgery.

4. METHODS AND MATERIALS

4.1. Study area

The study was conducted in Addis Ababa at Eka Kotebe General Hospital and St Peter hospital. The former being currently functioning COVID-19 centers with full emergency operation service. It is a five floor building with 150 beds for services of mental health ad 200 beds for general medical services. Since it began operation in 2017, the hospital has provided health services for 116,029 patients, of which 25% are mental disabled persons and the rest includes emergency, psychotherapy, rehabilitation care, surgery, social services and family planning services. It is currently designated as a treatment center for covid 19 pandemic since March 13, 2020.

4.2. Study design and study period

Institutional based retrospective cross-sectional study was conducted from May 01 to May 15, 2021 by reviewing data's of COVID-19 patients who undergone emergency surgery from March 2020 – May 2021.

4.3. Population

4.3.1. Source population

All COVID-19 positive patients who undergone emergency surgery at COVID-19 centers in Addis Ababa, Ethiopia.

4.3.2. Study population

All COVID-19 positive patients who undergone emergency surgery at selected COVID-19 center hospitals during the study period.

4.4 Eligibility criteria

4.4.1 Inclusion criteria

All confirmed COVID-19 patients undergoing emergency surgery at selected COVID-19 center hospitals during the study period.

4.4.2. Exclusion criteria

Confirmed COVID-19 patients with missing/incomplete data were excluded from the study. And COVID-19 patients with elective surgery were also excluded.

4.5 Sample size determination and sampling procedure

4.5.1 Sample size determination.

We choose not to calculate sample size using a formula due to its newly emerging and ongoing nature of the disease, enough sample size cannot be obtained. Thus all COVID-19 operated patients during the study period will be included.

4.5.2 Sampling procedure

All COVID-19 patients who undergone emergency surgery at EKGH and St Peter hospital during the study period was included consecutively. 130 patients profile was reviewed from Eka Kotebe General Hospital and 32 patients profile was reviewed from St Peter hospital.

4.6. Study variables

4.6.1. Dependent variable

- 30 days Post-operative outcomes
    - Primary outcome- 30 days mortality
    - Secondary outcome- 30 days respiratory and cardiovascular complications

4.6.2. Independent variables

- Socio demographic characteristics: age and sex
- ASA physical status
- Severity of COVID-19 infection
- Preoperative surgical diagnosis
- Duration of surgery and
- Duration of anesthesia in minute

4.7 Operational definition

Mortality- Patients' status for the consecutive thirty days following surgery which mainly measures weather the patient is dead or alive will be recorded once per 24 hrs.

CVS and respiratory complication – Post-operative need for CVS and respiratory support will be documented to determine the factors leading to it.

4.8 Data collection tools and procedures

The data was collected by three BSc holder Anesthetists and one supervisor (MSc holder anesthetist) through reviewing secondary data's using structured questionnaire.

4.9 Data quality control

A half-day training and orientation was given by the principal Investigator for the data collectors and supervisor on the objective and significance of the study, how to collect and record the appropriate information, procedures of data collection techniques, the whole contents of the questionnaire.

During data collection time close supervision and monitoring were made every day by the supervisor and principal investigator to ensure the quality of the data.

4.10. Data processing and analysis

The completeness of the questionnaire was checked before data entry and the data was coded, entered and analyzed using SPSS software version 20. Descriptive statistics was presented using text, table and figure. The association of independent variables with the outcome variables was investigated using binary logistic regression analysis. The variables that showed an association with the outcome variables at the bivariate analysis with p value <0.2 were entered into the final multivariate analysis to control for potential confounders. Adjusted odds ratio (AOR) along with 95 % confidence interval were estimated to assess the strength of association and a P value <0.05 was considered to declare the statistical significance in the multivariate analysis. Assumptions like model fitness was checked to be satisfied using Hosmer and lemeshow p-value (which should not be significant, i.e. p – value > 0.05).

4.11 Ethical considerations

Ethical clearance letter was obtained from school of medicine department of

anesthesia after the proposal is approved by the institutional review board. After receiving ethical clearance, permission to conduct the research will be obtained from the institutional review board of Eka Kotebe General Hospital and St Peter field hospital. Name of the participant will be omitted from the questionnaire; instead will use medical record number to ensure confidentiality.

5. RESULT

5.1 Socio-demographic and pre-operative characteristics of the respondent.

A total number of 162 study participants participated in the present study. The mean age of the participants was 41.7 years (SD = 19.6 years).

Most of the study participants 110 (67.9 %) were female. Majority of the study participants preoperative diagnosis were obstetrics 83 (51.2 %) followed by general 57 (35.2%), orthopedics 15 (9.3%). Eighty three of the participants have comorbidities. Most of the study participants did not take any medication before the operation 87 (53.7%), followed by anti-diabetic and anti-hypertensive medication 19 (11.7 %), 22 (13.6%) respectively (Table 1).

Variables	Frequency (%)
Age in years	
<=30 Years	64 (39.5)
31-55 Years	59 (36.4)
>55 Years	39 (24.1)
Sex	
Male	52 (32.1)
Female	110 (67.9)
ASA classification	
Class 1	18 (11.1)
Class 2	80 (49.4)
Class 3	23 (14.2)
Class 4	41 (25.3)
Preoperative diagnosis	
Obstetrics	83 (51.2)
Orthopedics	15 (9.3)
General	57 (35.2)
Other	7 (4.3)
Pre-operative severity	
Asymptomatic	63 (38.9)
Mild	9 (5.6)
Moderate	9 (5.6)
Severe	41 (25.3)
Critical	40 (24.3)
Presence of co-morbidity	
Yes	83 (51.2)

No	79 (48.8)
If yes, type of comorbidity	
Hypertension	6 (7.2)
DM	13 (15.7)
Asthma	3 (3.6)
Other	61 (73.5)
Medication	
Anti-hypertensive	19 (11.7)
Anti-diabetic	22 (13.6)
Anti-coagulant	3 (1.9)
Bronchodilator	3 (1.9)
Other	28 (17.3)
None	87 (53.7)

Table 1: Socio-demographic and pre-operative characteristics for post-operative outcomes and associated factors of COVID-19 patients undergoing emergency surgery, 2021 (n=162).

5.2 Surgical and anesthetics characteristics of the respondent

The duration of surgery for majority of the study participants 134 (82.7%) were less than one hour. Most of the study participants 86 (53.5%) used a spinal type of anesthesia while the rest 76 (46.9%) of the study participants used a general type of anesthesia (Table 2).

Table 2-Surgical and anesthetics characteristics for post-operative outcomes and associated factors of COVID-19 patients undergoing emergency surgery, 2021 (n=162).

Variables	Frequency (%)
Type of surgery	
C/S	82 (50.6)
Laparotomy	8(4.9)
Tracheostomy	19 (11.7)
Amputation	15 (9.3)
Debridement	7 (4.3)
Other	31 (19.1)
Type of Anesthesia	
General	76 (46.9)
Spinal	86 (53.1)
Duration of surgery	
Less than 1 Hour	134 (82.7)
>= 1 Hour	28 (17.3)
Duration of Anesthesia	
Less than 1 Hour	47 (29)
>= 1 Hour	115 (71)

5.3 Post-operative outcome of the study participants

Post-operative respiratory complication of the study participants were 43.2% and the cardio-vascular complication of COVID-19 patients undergoing emergency surgery was found to be 14.8% (Table 3).

Table-3- Post-operative outcome of COVID-19 patients at Eka Kotebe General Hospital and St Peter Hospital, 2021. (n=162).

Variables	Frequency (%)
Post-operative respiratory status	
Patent	76 (46.9)
Inadequate with oxygen support	47 (29.0)
Intubated and ventilated	39 (24.1)
Post-operative respiratory complication	
Yes	70 (43.2)
No	92 (56.8)
Post-operative cardiovascular complication	
Yes	24 (14.8)
No	138 (85.2)
Post-operative mortality status	
Yes	27 (16.7)
No	135 (83.3)

The post-operative mortality status of COVID-19 patients undergoing emergency surgery at Eka Kotebe General Hospital and St Peter hospital was found to be 16.7% (from this 22 (81.5%) were from Eka Kotebe General Hospital and 5 (18.5%) were from St Peter Hospital).

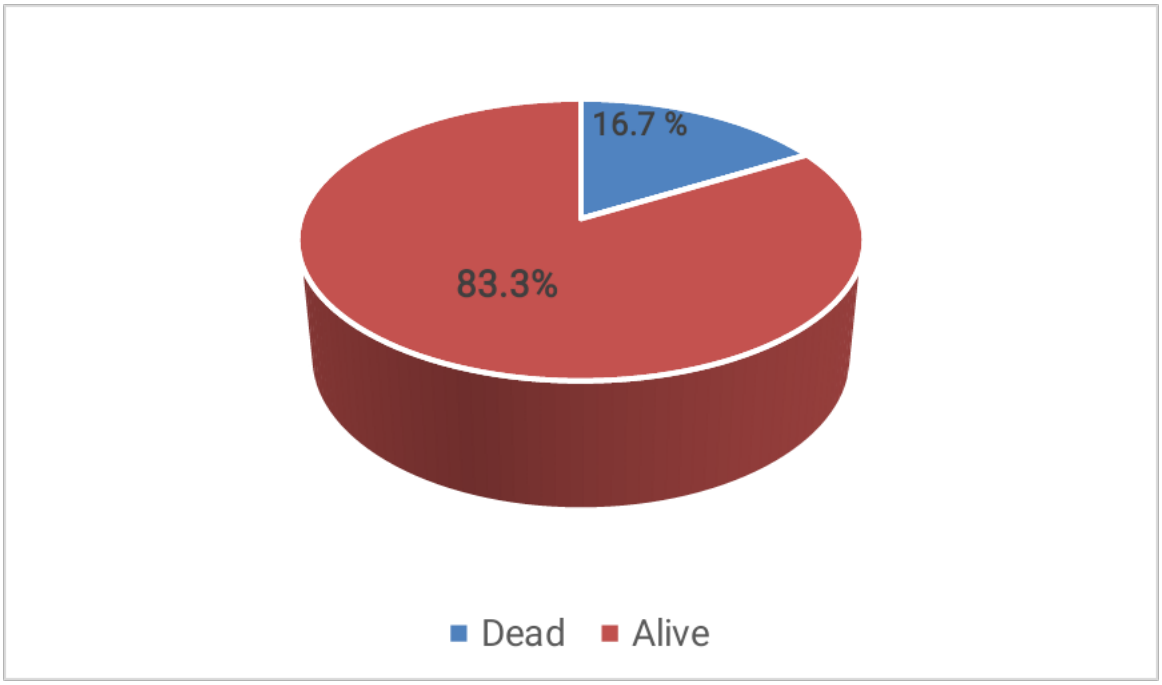


Figure-2- Showing the post-operative mortality status of COVID-19 patients undergoing emergency surgery

5.4 Factors associated with post-operative

5.4.1 Bivariate analysis for post-operative mortality status

Among the socio-demographic and pre-operative factors included in this study; age <=30 Years [COR= 0.11, 95 % CI (0.08–0.91)], ASA classification class 3 [COR= 0.05, 95% CI (0.01 – 0.78)], pre-operative severity asymptomatic [COR= 0.04, 95% CI (0.01 – 0.61)], presence of co-morbidity [COR= 1.78, 95% CI (1.22 – 5.99)] showed significant association with post-operative mortality status in the bivariate analysis (Table-4).

Table-4- Bivariate analysis for socio-demographic and pre-operative factors for post-operative mortality status of the respondents, 2021 (n=162).

Variables	Post-operative Mortality		COR (95% CI)
	Yes	No	
Age			
<=30 Years	4 (14.8)	60 (44.4)	0.11 (0.08-0.91)
31-55 Years	9 (33.3)	50 (37.0)	0.32 (0.20-0.97)
>55 Years	14 (51.9)	25 (18.5)	1
Sex			
Male	14 (51.9)	38 (28.1)	2.74 (0.68-6.22)
Female	13 (48.1)	97 (71.9)	1
ASA classification			
Class 1	2 (7.4)	16 (11.9)	0.14 (0.11-1.97)
Class 2	5 (18.5)	75 (55.6)	0.08 (0.03-2.73)
Class 3	1 (3.7)	22 (16.3)	0.05 (0.01-0.78)
Class 4	19 (70.4)	22 (16.3)	1
Preoperative diagnosis			
Obstetrics	4 (14.8)	79 (58.5)	0.12 (0.09-2.61)
Orthopedics	1 (3.7)	14 (10.4)	0.18 (0.11-3.76)
General	20 (74.1)	37 (27.4)	1.35 (0.82-4.99)
Other	2 (7.4)	5 (3.7)	1
Pre-operative severity			
Mild	3 (11.1)	69 (51.1)	0.05 (0.02-0.66)
Moderate	5 (18.5)	45 (33.3)	0.12 (0.10-0.79)
Critical/severe	19 (70.4)	21 (15.5)	1
Presence of co-morbidity			
Yes	17 (63.0)	66 (48.9)	1.78 (1.22-5.99)
No	10 (37.0)	69 (51.1)	1

Among the surgical and anesthetic factors included in this study; Type of anesthesia

general [COR= 8.89, 95 % CI (2.38–11.92)], duration of surgery less than one hour [COR= 0.68, 95% CI (0.04 – 0.81)], post-operative respiratory status patent [COR= 0.06, 95% CI (0.03 – 0.55)] showed significant association with post-operative mortality status in the bivariate analysis (Table-5).

Table-5- Bivariate analysis for surgical and Anesthetic factors for post-operative mortality status, 2021, (n=162).

Variables	Post-operative Mortality (%)		COR (95% CI)
	Yes	No	
Type of surgery			
C/S	4 (14.8)	78 (57.7)	0.05 (0.02-2.93)
Laparotomy	1 (3.7)	7 (5.2)	0.13 (0.09-3.37)
Tracheostomy	3 (11.1)	16 (11.8)	0.16 (0.12-3.37)
Amputation	2 (7.4)	13 (9.6)	0.13 (0.07-2.93)
Debridement	1 (3.7)	6 (4.4)	0.14 (0.08-3.37)
Other	17 (59.2)	15 (11.1)	1
Type of Anesthesia			
General	23 (85.2)	53 (39.3)	8.89 (2.38-11.92)
Spinal	4 (14.8)	82 (60.7)	1
Duration of surgery			
Less than 1 Hour	21 (77.8)	113 (83.7)	0.68 (0.04-0.81)
>= 1 Hour	6 (22.2)	22 (16.3)	1
Duration of Anesthesia			
Less than 1 Hour	16 (59.3)	31 (23.0)	4.87 (0.35-5.11)
>= 1 Hour	11 (40.7)	104 (77.0)	1
Post-op respiratory status	4 (14.8)	72 (53.3)	0.06 (0.03-0.55)
Patent	4 (14.8)	43 (31.9)	0.09 (0.06-0.30)
Inadequate with oxygen support	19 (70.4)	20 (14.8)	1
Intubated and ventilated			

5.4.2 Bivariate analysis for post-operative respiratory complication status

Among the socio-demographic and pre-operative factors included in this study; age <=30 Years [COR= 0.07, 95 % CI (0.03–0.91)], presence of comorbidity [COR= 9.62, 95% CI (3.34 – 13.03)] showed significant association with post-operative respiratory complication status in the bivariate analysis (Table-6).

Table-6- Bivariate analysis for socio-demographic and pre-operative factors towards post-operative respiratory complication status, 2021 (n=162).

Variables	Post-operativeRespiratory complication status (%)		COR (95% CI)
	Yes	No	
Age			
<=30 Years	16 (22.9)	48 (52.2)	0.07 (0.03-0.91)
31-55 Years	22 (52.2)	37 (40.2)	0.13 (0.04-1.37)
>55 Years	32 (39.5)	7 (7.6)	1
Sex			
Male	31 (44.3)	21 (22.8)	2.68 (0.38-6.22)
Female	39 (55.7)	71 (77.2)	1
ASA classification			
Class 1	1 (1.4)	17 (18.5)	0.04 (0.01-1.97)
Class 2	20 (28.6)	60 (65.2)	0.03 (0.01-2.73)
Class 3	11 (15.7)	12 (13.0)	0.07 (0.02-1.28)
Class 4	38 (54.3)	3 (3.3)	1
Preoperative diagnosis			
Obstetrics	20 (28.6)	63 (68.5)	0.05 (0.03-2.61)
Orthopedics	7 (10.0)	8 (8.7)	0.14 (0.11-3.76)
General	37 (52.9)	20 (21.7)	0.30 (0.22-4.99)
Other	6 (8.6)	1 (1.1)	1
Pre-operative severity			
Mild	8 (11.4)	64 (60.9)	0.01 (0.01-3.76)
Moderate	26 (37.1)	24 (6.5)	0.12 (0.10-1.03)
Critical/Severe	36 (51.4)	4 (4.3)	1
Presence of co-morbidity			
Yes	56 (80.0)	27 (29.3)	9.62 (3.34-13.03)
No	14 (20.0)	65 (70.7)	1

Among the surgical and anesthetic factors included in this study; type of anesthesia [COR= 7.19, 95 % CI (1.38–10.92)], duration of surgery [COR= 0.60, 95% CI (0.14 – 0.81)], post-operative respiratory status [COR= 0.007, 95% CI (0.001 – 0.30)] showed significant association with post-operative respiratory complication status in the bivariate analysis (Table-7).

Table-7- Bivariate analysis for surgical and anesthetic factors towards post-operative respiratory complication status in COVID-19 patients, 2021, (n=162).

Variables	Post-operativeRespiratory complication status (%)		COR (95% CI)
	Yes	No	
Type of surgery			
C/S	20 (28.6)	62 (67.4)	0.20 (0.17-2.93)
Laparotomy	3 (4.3)	5 (5.4)	0.38 (0.12-3.37)
Tracheostomy	17 (24.3)	2 (2.2)	5.36 (0.77-9.93)
Amputation	7 (10.0)	8 (8.7)	0.55 (0.32-3.17)
Debridement	4 (5.7)	3 (3.3)	0.84 (0.72-5.97)
Other	19 (27.1)	12 (13.0)	1
Type of Anesthesia			
General	51 (72.9)	25 (27.2)	7.19 (1.38-10.92)
Spinal	19 (27.1)	67 (72.8)	1
Duration of surgery			
Less than 1 Hour	55 (78.6)	79 (85.9)	0.60 (0.14-0.81)
>= 1 Hour	15 (21.4)	13 (14.1)	1
Duration of Anesthesia			
Less than 1 Hour	35 (50.0)	12 (13.0)	6.66 (0.35-8.11)
>= 1 Hour	35 (50.0)	80 (87.0)	1
Post-op respiratory status			
Patent	6 (8.6)	70 (76.1)	0.007 (0.001-0.30)
Inadequate with oxygen	28 (40.0)	19 (20.7)	0.12 (0.09-3.30)

support Intubated and ventilated	36 (51.4)	3 (3.3)	1

5.4.3 Bivariate analysis for post-operative cardio-vascular complication status

Among the socio-demographic and pre-operative factors included in this study; sex being male

[COR= 1.32, 95 % CI (1.08–6.22)], presence of comorbidity [COR= 3.36, 95% CI (1.34 – 9.03)], medication usage 2.14 (1.55-7.61) [COR= 2.14, 95% CI (1.55 – 7.61)] showed significant association with post-operative cardio-vascular complication status in the bivariate analysis (Table-8).

Table-8- Bivariate analysis for socio-demographic and pre-operative factors towards post-operative cardio-vascular complication of COVID-19 patients, 2021 (n=162).

Variables	Post-operativecardiovascular complication status (%)		COR (95% CI)
	Yes	No	
Age			
<=30 Years	3 (12.5)	61 (44.2)	0.08 (0.03-1.91)
31-55 Years	7 (29.2)	52 (37.7)	0.24 (0.12-3.37)
>55 Years	14 (58.3)	25 (18.1)	1
Sex			
Male	9 (37.5)	43 (31.2)	1.32 (1.08-6.22)
Female	15 (62.5)	95 (68.8)	1
ASA classification			
Class 1	1 (4.2)	17 (12.3)	0.08 (0.07-1.91)
Class 2	3 (12.5)	77 (55.8)	0.05 (0.03-2.73)
Class 3	3 (12.5)	20 (14.5)	0.21 (0.11-1.28)
Class 4	17 (70.8)	24 (17.4)	1
Preoperative diagnosis			
Obstetrics	5 (20.8)	78 (56.5)	0.38 (0.15-2.61)
Orthopedics	1 (4.2)	14 (10.1)	0.42 (0.34-3.76)
General	17 (70.8)	40 (29.0)	2.55 (0.22-4.99)
Other	1 (4.2)	6 (4.3)	1
Pre-operative severity			
Mild	3 (12.5)	69 (50.0)	0.06 (0.01-0.61)
Moderate	5 (20.8)	45 (32.6)	0.17 (0.04-0.76)
Critical/Severe	16 (66.6)	24 (17.4)	1
Presence of co-morbidity			

Yes	18 (75.0)	65 (47.1)	3.36 (1.34-9.03)
No	6 (25.0)	73 (52.9)	1

Among the surgical and anesthetic factors included in this study; duration of surgery [COR= 1.54, 95 % CI (2.84–³.39)], duration of anesthesia [COR= 11.27, 95% CI (5.02 – 16.13)] showed significant association with post-operative cardio-vascular complication in the bivariate analysis (Table-9).

Table-9- Bivariate analysis for surgical and anesthetic factors towards post-operative cardio-vascular complication of COVID-19 patients, 2021, (n=162).

Variables	**Post-operativecardiovascular complication status (%)**		**COR (95% CI)**
	Yes	**No**	
Type of surgery			
C/S	4 (16.7)	78 (56.5)	0.12 (0.07-2.93)
Laparotomy	1 (4.2)	7 (5.1)	0.35 (0.12-2.97)
Tracheostomy	7 (29.2)	12 (8.7)	1.42 (0.17-2.93)
Amputation	2 (8.3)	13 (9.4)	0.37 (0.19-4.77)
Debridement	1 (4.2)	6 (4.3)	0.50 (0.22-5.01)
Other	9 (37.5)	22 (15.9)	1
Type of Anesthesia			
General	23 (95.8)	53 (38.4)	36.88 (0.38-44.92)
Spinal	1 (4.2)	85 (61.6)	1
Duration of surgery			
Less than 1 Hour	21 (87.5)	113 (81.9)	1.54 (2.84-4.39)
>= 1 Hour	3 (12.5)	25 (18.1)	1
Duration of Anesthesia			
Less than 1 Hour	18 (75.0)	29 (21.0)	11.27 (5.02-16.13)
>= 1 Hour	6 (25.0)	109 (79.0)	1
Post-op respiratory status			
Patent	3 (12.5)	73 (52.9)	0.05 (0.01-1.77)
	4 (16.7)	43 (31.2)	0.12 (0.08-1.59)

Inadequate with oxygen support Intubated and ventilated	17 (70.8)	22 (15.9)	1

5.5. Multivariable analysis

5.5.1. Multivariate analysis for post-operative mortality status

After adjustment for possible confounders on multivariate analysis age, pre-operative severity of the disease, presence of comorbidity, duration of surgery and post-operative respiratory status have significant association with post-operative mortality status in multivariate analysis at 95% CI ($p < 0.05$).

COVID patient's whose ages are less or equal to 30 years had 48 % reduced odds of having post-operative mortality than those COVID patients whose age are greater than 55 years (AOR= 0.52 (0.14-0.89)). Asymptomatic COVID patients had 78 % reduced odds of having post-operative mortality than critical COVID patients (AOR=0.22 (0.19-0.83)). COVID patients with comorbid status were 2.37 times more likely to have post-operative mortality than those COVID patients who did not have any comorbidity (AOR= 2.37 (1.90-6.71)). COVID patients whose duration of surgery took less than one hour had 61% reduced odds of having post-operative mortality than those COVID patients whose duration of surgery took greater than or equal to two hours (AOR=0.39 (0.11-0.81)). COVID patients with a patent post-operative respiratory status had 83% reduced odds of having post-operative mortality than those COVID patients whose post-operative respiratory status were intubated and ventilated (AOR=0.17 (0.09-0.96)) (Table-10).

Table-10- Multivariate analysis for post-operative mortality status of COVID-19 patients, 2021, (n=162).

Variables	Post-operative Mortality		COR (95% CI)	AOR (95% CI)
	Yes	No		
Age <=30 Years	4 (14.8)	60 (44.4)	0.11 (0.08-0.91)	0.52 (0.14-0.89)**

31-55 Years	9 (33.3)	50 (37.0)	0.32 (0.20-0.97)	0.45 (0.21-1.74)
>55 Years	14 (51.9)	25 (18.5)	1	1
ASA classification				
Class 1	2 (7.4)	16 (11.9)	0.14 (0.11-1.97)	0.88 (0.32-2.44)
Class 2	5 (18.5)	75 (55.6)	0.08 (0.03-2.73)	0.99 (0.17-5.76)
Class 3	1 (3.7)	22 (16.3)	0.05 (0.01-0.78)	0.61 (0.33-10.87)
Class 4	19 (70.4)	22 (16.3)	1	1
Pre-operative severity				
Mild	3 (11.1)	69 (51.1)	0.05 (0.01-0.61)	0.52 (0.31-1.99)
Moderate	5 (18.5)	45 (33.3)	0.12 (0.09-0.76)	2.09 (0.66-5.14)
Critical	19 (70.4)	21 (15.6)	1	1
Presence of co-morbidity				
Yes	17 (63.0)	66 (48.9)	1.78 (1.22-5.99)	2.37 (1.90-6.71)*
No	10 (37.0)	69 (51.1)	1	1
Type of Anesthesia				
General	23 (85.2)	53 (39.3)	8.89 (2.38-11.92)	7.95 (0.89-14.00)
Spinal	4 (14.8)	82 (60.7)	1	1
Duration of surgery				
Less than 1 Hour	21 (77.8)	113 (83.7)	0.68 (0.04-0.81)	0.39 (0.11-0.81)**
>= 1 Hour	6 (22.2)	22 (16.3)	1	1
Post-operative respiratory status				
Patent	4 (14.8)	72 (53.3)	0.06 (0.03-0.55)	0.17 (0.09-0.96)*
Inadequate with oxygen support	4 (14.8)	43 (31.9)	0.09 (0.06-0.30)	0.47 (0.33-1.07)
	19 (70.4)	20 (14.8)	1	1

Intubated and ventilated				

{P<0.05 =*} {P<0.01 =**} {P<0.001 =***}

5.5.2 Multivariable analysis for post-operative respiratory complication status

After adjustment for possible confounders on multivariate analysis age less than or equal to thirty years, presence of comorbidity, patient with patent post-operative respiratory status have significant association with post-operative respiratory complication in multivariate analysis at 95% CI ($p < 0.05$).

COVID-19 patients whose age were less than or equal to thirty years had 88% reduced odds of having post-operative respiratory complication than COVID-19 patients whose age were greater than 55 years.

COVID-19 patients with comorbidity conditions were 6.90 times more likely to have post -operative respiratory complication than patients who did not have comorbid condition.

COVID-19 patients with a patent post-operative respiratory status had 81 % reduced odds of having post-operative respiratory complication than patients with intubated and ventilated post-operative respiratory status (Table-11).

Table-11- Multivariate analysis for factors associated with post-operative respiratory complication status among COVID patients, 2021, (n=162).

Variables	Post-operativeRespiratory complication status (%)		COR (95% CI)	AOR (95% CI)
	Yes	No		
Age				
<=30 Years	16 (22.9)	48 (52.2)	0.07 (0.03-0.91)	0.12 (0.09-0.57)*
31-55 Years	22 (52.2)	37 (40.2)	0.13 (0.04-1.37)	0.17 (0.13-1.29)
>55 Years	32 (39.5)	7 (7.6)	1	1
Presence of co-morbidity				
Yes	56 (80.0)	27 (29.3)	9.62 (3.34-13.03)	6.90 (2.87-12.11)*
No	14 (20.0)	65 (70.7)	1	1
Type of Anesthesia				
General	51 (72.9)	25 (27.2)	7.19 (1.38-10.92)	6.90 (0.77-11.54)
Spinal	19 (27.1)	67 (72.8)	1	1
Duration of surgery				
Less than 1 Hour	55 (78.6)	79 (85.9)	0.60 (0.14-0.81)	0.81 (0.43-2.02)
>= 1 Hour	15 (21.4)	13 (14.1)	1	1
Post-op				

respiratory status				
	6 (8.6)	70 (76.1)	0.007 (0.001-	0.19 (0.09-0.50)**
Patent	28 (40.0)	19 (20.7)	0.30)	0.33 (0.19-1.93)
Inadequate with			0.12 (0.09-3.30)	
oxygen support	36 (51.4)	3 (3.3)		1
Intubated and			1	
ventilated				

{P<0.05 =*} {P<0.01 =**} {P<0.001 =***}

5.5.3. Multivariable analysis for post-operative cardio-vascular complication

After adjustment for possible confounders on multivariate analysis patient with asymptomatic pre-operative severity status, presence of comorbidity have significant association with post-operative cardio-vascular complication in multivariate analysis at 95% CI ($p < 0.05$).

COVID-19 patients with mild pre-operative severity status had 69 % reduced odds of having post-operative cardio-vascular complication status than patients with critical pre-operative severity status.

COVID-19 patients with comorbidity conditions were 3.94 times more likely to have post -operative cardio-vascular complication than patients who did not have comorbid condition (Table-12).

Table-12- Multivariate analysis for factors associated with post-operative cardio-vascular complication status among COVID patients, 2021, (n=162).

Variables	Post-operativecardiovascular complication status (%)		COR (95% CI)	AOR (95% CI)
	Yes	No		
Sex				
Male	9 (37.5)	43 (31.2)	1.32 (1.08-6.22)	1.40 (0.98-2.03)
Female	15 (62.5)	95 (68.8)	1	1
Pre-operative severity				
Mild	3 (12.5)	69 (50.0)	0.06 (0.01-0.61)	0.31 (0.20-0.92)*
Moderate	5 (20.8)	45 (32.6)	0.16 (0.04-0.76)	0.47 (0.39-1.91)
Critical	16 (66.6)	24 (17.4)	1	1
Presence of co-morbidity				
Yes	18 (75.0)	65 (47.1)	3.36 (1.34-9.03)	3.94 (1.83-5.77)*
No	6 (25.0)	73 (52.9)	1	1
Duration of surgery				
Less than 1 Hour	21 (87.5)	113 (81.9)	1.54 (2.84-4.39)	1.76 (0.57-3.79)
>= 1 Hour	3 (12.5)	25 (18.1)	1	1
Duration of Anesthesia				
Less than 1 Hour	18 (75.0)	29 (21.0)	11.27 (5.02-16.13)	10.83 (0.43-33.78)
>= 1 Hour	6 (25.0)	109 (79.0)	1	1

{P<0.05 =*} {P<0.01 =**} {P<0.001 =***}

6. Discussion

In this study the overall magnitude of 30 days post-operative mortality among COVID-19 patients who undergone emergency surgery was found to be 16.7%. This finding is comparable with a study conducted at California (14.8%) (12), the finding is also higher than a study conducted at university of Chile (12.8%) (13), this finding is found to be lower than a multicenter study conducted at Province of Québec and the Canadian province (23.1%) (14). In this study the overall magnitude of post-operative respiratory complication among COVID-19 patients who undergone emergency surgery was found to be 43.2%, the finding was also found to be higher than a study conducted at University of Chile (30.8%) (13). In this study the overall magnitude of post-operative cardio-vascular complication among COVID-19 patients who undergone emergency surgery was found to be 14.8%, the finding was also higher than a study conducted at University of Chile (7.7%). The observed differences across studies can be attributed to a variety of factors such as the implemented protocols, the period and severity of the pandemic, variations in healthcare policies implemented by different countries, individuals between hospital centers and resources.

In this study age is one of the factor which had a significant association with post-operative mortality status and post-operative respiratory complication, COVID patient's whose ages are less or equal to 30 years had 48 % reduced odds of having post-operative mortality than those COVID-19 patients whose age are greater than 55 years (AOR= 0.52 (0.14-0.89)). COVID-19 patients whose age were less than or equal to thirty years had 88% reduced odds of having post-operative respiratory complication than COVID-19 patients whose age were greater than 55 years. Similar finding was observed in a study conducted at Italy (15).

This study also revealed that pre-operative clinical status had a strong association with post-operative cardio-vascular complication status. COVID-19 patients with mild pre-operative severity status had 69 % reduced odds of having post-operative cardio-vascular complication status than patients with critical pre-operative severity status (AOR=0.31 (0.20-0.92)).

This study showed that COVID-19 patient's comorbid status is significantly associated

with post-operative mortality, post-operative respiratory complication status and post-operative cardio-vascular complication status. COVID-19 Patients with comorbid status were 2.37 times more likely to have post-operative mortality than those COVID patients who did not have any comorbidity (AOR= 2.37 (1.90-6.71)). COVID-19 patients with comorbidity conditions were 6.90 times more likely to have post-operative respiratory complication than patients who did not have comorbid condition (AOR=6.90 (2.87-12.11)). COVID-19 patients with comorbidity conditions were 3.94 times more likely to have post-operative cardio-vascular complication than patients who did not have comorbid condition (AOR=3.94 (1.83-5.77)).

Duration of surgery was also another significant variable which had an association with post-operative mortality status, COVID-19 patients whose duration of surgery took less than one hour had 61% reduced odds of having post-operative mortality than those COVID patients whose duration of surgery took greater than or equal to two hours (AOR=0.39 (0.11-0.81)).

This study also revealed that post-operative respiratory status is highly associated with post-operative complication. COVID-19 patients with a patent post-operative respiratory status had 81 % reduced odds of having post-operative respiratory complication than patients with intubated and ventilated post-operative respiratory status (AOR=0.19 (0.09 -0.50)).

6.1. Strength and limitation of the study

The main strength of this study is that, it used a larger sample size compared to study's conducted on post-operative outcome of COVID-19 patients but this sample size is not still enough to assess the factors associated with post-operative outcome of COVID-19 patients. **Limitations**

The study used secondary data.

Limited references.

7. Conclusion and Recommendation

7.1 Conclusion

Post-operative mortality among COVID-19 patients undergoing emergency surgery at Eka Kotebe General Hospital and Saint Peter Hospital was high. The significant factors associated with post-operative mortality includes: - age, presence of comorbidity, duration of surgery, post-operative respiratory status.

Post-operative respiratory complication among COVID-19 patients undergoing emergency surgery at Eka Kotebe General Hospital and Saint Peter Hospital was found to be high. The significant factors associated with post-operative respiratory complication status includes: - age, presence of comorbidity, post-operative respiratory status.

Post-operative cardio-vascular complication among COVID-19 patients undergoing emergency surgery at Eka Kotebe General Hospital and Saint Peter Hospital was high. The significant factors associated with post-operative cardio-vascular complication status includes: - pre-operative severity status and presence of comorbidity.

7.2 Recommendation

To health professionals

Emphasis should be given for Optimization of patients with comorbidities and elderly patients prior to surgery according to severity of covid19 infection status to minimize rate of post-operative morbidity and mortality.

Well trained professional and multi-disciplinary effort needs to be applied in an effort to prevent and manage those cardiovascular and respiratory complications arising postoperatively due to covid-19

Clear perioperative management plan with appropriate OR materials and medication preparation needs to be sort out ahead of surgery for those high risk patients in an effort to mitigate post-op complications

To researchers

There is a Need to conduct further studies with different factors, larger sample size and stronger study design to explore the underlying determinants of post-operative outcomes among COVID-19 patients undergoing emergency surgery.

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Annex 1

The study questionnaire

Part one: socio-demographic

Serial no.	Questions	Response	code
101	Age		
102	Sex	Male Female	1 2
103	ASA classification	Class 1 Class 2 Class 3 Class 4	1 2 3 4
104	Preoperative diagnosis	Obstetrics Orthopedics General Others	1 2 3 4…..specify

Part two: pre-operative data

Serial no.	Questions	Response	code
201	Preoperative severity of infection	Mild Moderate Severe Critical	1 2 3 4
202	Presence of comorbidities	Yes No	1 2
203	If yes, types	HTN DM Asthema Other	1 2 3 4….specify

204	Medication	Anti-hypertensive Anti- diabetic Anti-coagulant Bronchodilator Other none	1 2 3 4 5….specify 6

Part three: surgical and anesthetic factors

Serial no.	Questions	Response	code
301	Type of surgery	c/s laparotomy tracheostomy amputation others	1 2 3 4 5….specify
302	Type of anesthesia	General Spinal Others	1 2 3….specify
303	Duration of surgery	<1hr 1hr >1hr	1…specify 2 3…specify
304	Duration of anesthesia	<1hr 1hr >1hr	1…specify 2 3…spcify

Part four: post-operative outcome

Serial no.	Questions	Response	code
402	1st 10 days postop respiratory status	Patent Inadequate with oxygen support Intubated and ventilated	1 2 3
403	2nd 10 days postop respiratory status	Patent Inadequate with oxygen support Intubated and ventilated	1 2 3
404	3rd 10 days postop respiratory status	Patent Inadequate with oxygen support Intubated and ventilated	1 2 3
405	1st 10 days respiratory complication	Yes No	1....specify 2
406	2nd 10 days respiratory complication	Yes No	1...specify
407	3rd 10 days respiratory complication	Yes No	1....specify 2
408	1st 10 days cv complication	Yes No	1....specify 2
409	2nd 10 days cv complication	Yes No	1...specify 2
410	3rd 10 days cv complication	Yes No	1...specify 2

411	1st 10 days mortality	Yes No	1… specify cause 2
412	2nd 10 days mortality	Yes No	1… specify cause 2
413	3rd 10 days mortality	Yes No	1… specify cause 2
414	1st 10 days other complication	Yes No	1.. specify 2
415	2nd 10 days other complication	Yes No	1..specify 2
416	3rd 10days other complication	Yes No	1...specify 2