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Analysis of Unplanned Postoperative Intensive Care Unit Admissions Before and During Covid-19 Outbreak

Elif Cansu Gündoğdu[1], Esra Keles[2], Elif Beyza Gunes[1], Melis Özbilen[1], Kürşad Nuri Baydili[3], Emre Mat[2], Elif Unlugedik Sayın[1], Ahmet Kale[1]

[1]University of Health Sciences Türkiye, Kartal Dr. Lütfi Kırdar City Hospital, Department of Obstetrics and Gynecology, Istanbul, Türkiye

[2]University of Health Sciences Türkiye, Kartal Dr. Lütfi Kırdar City Hospital, Department of Gynecologic Oncology, Istanbul, Türkiye

[3]University of Health Sciences Türkiye, Hamidiye Faculty of Medicine, Department of Biostatistics, Istanbul, Türkiye

** Corresponding author: e-jansu@hotmail.com*

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ABSTRACT

Unplanned Intensive Care Unit **(**ICU) admission is associated with a negative outcome and is a surrogate marker for patient safety and a quality indicator.

To investigate the outcomes of the unplanned ICU admission in gynecologic and obstetric patients before and during the COVID-19 pandemic.

This is a retrospective cohort study conducted on patients whotransferred to the ICU from non-ICU units at a tertiary hospital, from March 1, 2012 to 2022.

Demographic features, triage classifications, diagnosis on admission and outcome of the ICU, presence of comorbidities and past surgical history, ASA physical status, type of elective anesthesia, post-operative complications, details of treatment given such as blood transfusion, ionotropic support, and dialysis were reviewed.

A total of 66 unplanned ICU admissions were identified, of whom 41 were before the COVID-19 pandemic, and the remaining 25 were during the COVID-19 pandemic. There was no difference in the need for infusion of inotropic and vasoactive drugs, the shift or day of the week the cases were in between the pre-pandemic and pandemic periods.

This study indicated that the characteristics and outcomes of patients who had unplanned ICU admissions from the gynecologic and obstetric department during the COVID-19 pandemic were broadly similar to the earlier period. Preeclampsia/eclampsia, low- risk pregnancy, and placenta accreata/percreata were clinical medical conditions more prevalent.

The characteristics and outcomes of patients who had unplanned ICU admissions from the obstetrics and gynecology department during the COVID-19 pandemic were similar to the pre-pandemic period.

Keywords: COVID-19, ICU, unplanned ICU admissions, gynecology

1. INTRODUCTION

Coronavirus disease (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is as a major public health concern almost two years after emerging (Wang C et al., 2020). To date, more than 542 million people have been infected with COVID-19, leading to more than 6.3 million deaths worldwide (WHO, 2022a).

In this unprecedented time, countries have taken preventive measures such as closing borders, travel restrictions, social distancing, and wearing of mask, which were crucial to reduce the risk of SARS-CoV-2 transmission, but meanwhile, COVID-19 disease has affected many areas of life and has

contributed to disrupt health services (WHO, 2022b). Consequently, healthcare systems have been reorganized to meet the accelerating numbers of patients: elective surgeries have been postponed, and inpatient facilities have been limited (Aziz S, et al, 2020; Wurmb et al., 2020; European Center for Disease Prevention and Control, 2020). Several studies reported a reduction in unplanned Intensive Care Unit (ICU) admissions after the implementation of lockdown measures compared to non-pandemic epochs (Sperotto F et al., 2021). Prior studies have documented that some adverse events are probably preventable and are often linked to management errors (Leape LL et al, 1991). According to the NICE (National Intensive Care Evaluation) criteria, unplanned ICU admission is defined as ‘‘an admission that could not have been deferred without risk for at least 12 hours’’ (Arts D et al., 2002). It isknown that unplanned ICU admission is associated with a negative outcome and is a surrogate marker for patient safety and a quality indicator of anesthesia and surgical care (Ridley S, et al, 1990; Haller et al., 2005).

Current literature has examined ICU admission for specific disease processes such as acute coronary syndrome, lung resection, and cancer (Quinn TD et al., 2015). However, no studies have yet been performed to examine the unplanned ICU admission before and during the COVID-19 pandemic. A better understanding of the impact of COVID-19 on unplanned ICU admissions would provide insight to physicians and public health authorities about healthcare management. In that context, we investigate the indications, patient characteristics, and outcomes of the unplanned ICU admission in gynecologic and obstetric patients before and during the COVID-19 pandemic.

2. METHODS

This is a retrospective cohort study conducted on patients who transferred to the ICU from non-ICU units at Kartal Dr. Lütfi Kırdar City Hospital, Istanbul, a tertiary center affiliated with the University of Health Sciences Turkey, and provides a comprehensive level of healthcare. The institution has an 85-bedded mixed ICU with an average of 3500 admissions annually. There are three operating theatres with six operating rooms, three of which are used for elective gynecological surgeries, two for obstetrics, and one for emergency surgical procedures. The Department of Gynecology and obstetrics is performing about 3000 surgical procedures annually. The first COVID-19 case was reported in Turkey on March 10, 2020. Thus, we compared the two different time points in our study. Pre-COVID pandemic period was defined as from March 1, 2012 to March 10, 2020, whereas COVID pandemic period defined as from March 10, 2020 to March 1, 2022.

Following the approval by the Research Ethical Committee of the hospital (Approval number: 2022/514/220/9), the medical records of all gynecologic and obstetric admissions (age >18 years) to the ICU, from March 2010 through March 2022, with a length of hospital stay >2 days included, were analyzed. The exclusion criteria were patients already in the ICU before surgery, emergency surgery, patients are taken directly to the operating room from the emergency department, were prisoners, were pregnants, were readmitted to the ICU, and were planned ICU transfers following invasive procedures such as cardiac catheterization, defibrillator placement, ablations.

Abstracted data consists of demographic features, triage classifications (elective/emergency), diagnosis on admission and outcome of the ICU, presence of comorbidities and past surgical history, American Society of Anesthesiologists (ASA) physical status, type of elective anesthesia, post-operative complications, details of treatment given such as blood transfusion, ionotropic support, and dialysis.

At our hospital, there is not a specific set of criteria for ICU admissions. The decision to admit a post-operative patient to the ICU is made on a case-by-case basis by the surgical team in consultation with the anesthesia team in the operating room. Mechanical ventilation and infusion of vasopressor medications are allowed only in the ICU. UIA was defined as an admission that was not planned for more than 24 hours (Piercy et al., 2006). Preoperative assessments are made according to the American Society of Anesthesiologists (ASA) physical status class of VI. Primary diagnoses, comorbidities, and procedures are coded following guidelines for the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM).

All statistical analyses were performed using the IBM SPSS for Windows, Version 25.0. (IBM Corp., Armonk, NY, USA). Qualitative variables were presented with frequency (n) and percentage (%) values. Descriptive variables were presented with mean and standard deviation (Mean±SD), median, minimum and maximum values. For comparison, the $\chi 2$ test or Fisher's Exact Test was used, where necessary. Data was collected from March 10, 2020, compared with the 2012-2020 (pre-pandemic) period. A p-value of <0.05 was considered statistically significant.

3. RESULTS

Over the 10-year study period, 18086 gynecological surgical procedures were performed. Of those, 98 were admitted to the ICU. A total of 66 unplanned ICU admissions were identified, of whom 41 were before the COVID-19 pandemic, and the remaining 25 were during the COVID-19 pandemic (Figure 1).

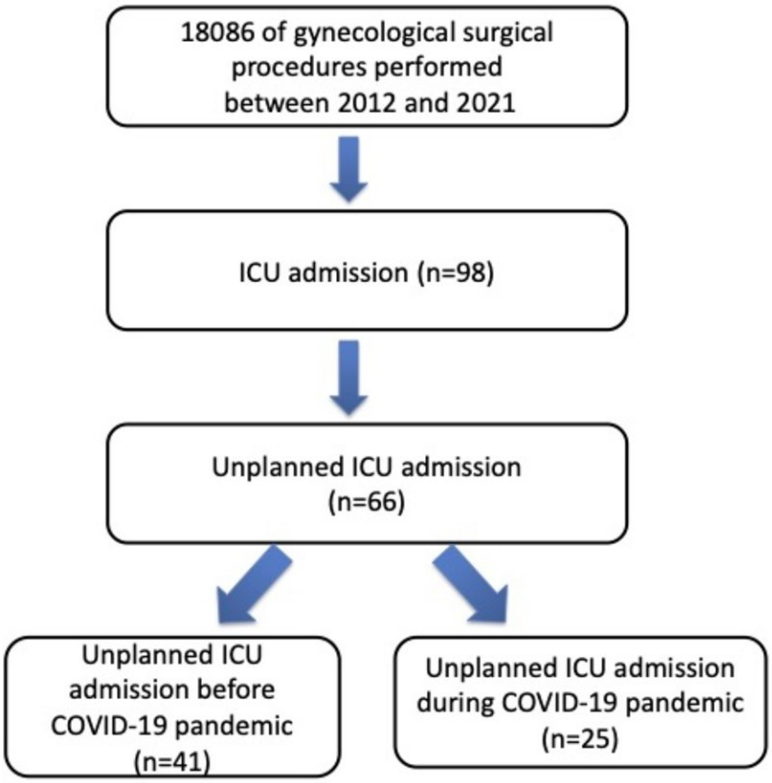

Figure 1. Flow diagram of the study.

Baseline characteristics are presented in Table 1. The median age of the pre-COVID group(36 years) was comparable to that of the COVID-19 pandemic group (34 years). There was no difference between the two groups in terms of the presence of comorbidities, preoperative consultations, and facility type (p=0.307, p=0.760, p=0.594). There was no difference in the median total length of hospital stay, the total length of ICU stay, and the length of hospital stay either prior to or after ICU admissions between the two groups (p=0.760, p=0.983, p=0.271, p=436). There was no significant difference according to the shift or day of the week the cases were in between pre-and during COVID-19 pandemic groups (p=1.000, p=0.358).

Table 1. Baseline characteristics of unplanned ICU admissions before and during COVID-19pandemic

	Pre-COVID-19	During COVID-19	P value
Age	36 (18-71)	34 (24-84)	0.905
BMI (kg/m^2)	28 (18-44.9)	29.15 (18.3-37)	0.962
Past surgical history	15 (36.6)	11 (44)	0.609
American Society of Anesthesiologistsstatus			
I	1 (2.4)	0 (0)	0.642
II	16 (39)	12 (48)	
III	23 (56.1)	12 (48)	
IV	1 (2.4)	0 (0)	
V	0 (0)	1 (4)	
Past surgical history			
Yes	15 (36.6)	11 (44)	0.609
No	26 (63.4)	14 (56)	
Comorbidities			
Yes	22 (53.7)	17 (68)	0.307
No	19 (46.3)	8 (32)	
Preoperative consultations			
Yes	8 (19.5)	6 (24)	0.760
No	33 (80.5)	19 (76)	
Ascites			
Yes	4 (9.8)	1 (4)	0.642
No	37 (90.2)	24 (96)	
Shift			
Day shift (7:00 am- 5:00 pm	20 (48.8)	13 (52)	1.000
After-hours shift (5:01 pm-6:59 am)	21 (51.2)	12 (48)	
Day of week			
Weekday	34 (82.9)	18 (72)	0.358
Weekend	7 (17.1)	7 (28)	
Facility type			
Central hospital	5 (12.2)	1 (4)	0.594
Emergenct department	7 (17.1)	5 (20)	
Length of total hospital stay (prior toICU admission) (in days)	0 (0-4)	0 (0-9)	0.271
Length of total hospital stay (after theICU admission) (in days)	3 (0-15)	4 (0-40)	0.436
Total length of hospital stay (day)	7 (3-26)	7 (3-50)	0.760
Length of ICU stay (day)	2 (1-24)	2 (1-14)	0.983

The diagnosis, based on ICD-9 billing codes associated with unscheduled admission is shown in Table 2. For all, preeclampsia/eclampsia (32.8%), followed by low-risk pregnancy (20.3%), and placenta accreata/percreata (10.9%) were the top three codes identified. The most common diagnosis leading to unplanned ICU transfer were hemodynamic instability (31.8%) and acute respiratory failure (22.7%). Hypovolemic shock (13.6%) was the most common etiology identified for ICU admission. An altered level of consciousness was the principal reason for unplanned ICU admission.

Table 2. Incidents that may be the cause of unscheduled admission

Primary diagnosis for admission to the hospital	n (%)
Benign ovarian cyst	2 (3,1)
Malignant ovarian cyst	4 (6,3)
Endometrial cancer	2 (3,1)
Abnormal uterine bleeding	2 (3,1)
Tubaovarian abscess	5 (7,8)
Placenta accreata/percreata	7 (10,9)
Low-risk Pregnancy	13 (20,3)
Preeclampsia- eclampsia	21 (32,8)
Ectopic pregnancy/rupture	3 (4,7)
Traffic accident	1 (1,6)
Uterine rupture	3 (4,7)
Covid positivity	1 (1,6)
Diagnoses Leading to Unplanned ICU Transfers	
Hemodynamic instability	21 (31,8)
Acute respiratory failure	15 (22,7)
Cardiovascular failure	2 (3)
Diabetic ketoacidosis	1 (1,5)
Neurological	12 (18,2)
Metabolic	6 (9,1)
Hypovolemic shock	9 (13,6)
Indication for ICU admission/definite diagnosis	
Uterine atony	7 (9,7)
Anaphylaxis	1 (1,4)
Pulmonary embolism	1 (1,4)
Cardiovascular failure	8 (11,1)
ARDS	6 (8,3)
Acute kidney failure	2 (2,8)
Hypovolemic shock	16 (22,2)
Pneumonia	2 (2,8)
Septic shock	3 (4,2)
Pulmonary edema	3 (4,2)
HELLPS	9 (12,5)
DIC	8 (11,1)
Subarachnoid hemorrhage	6 (8,3)
Reason for admission to ICU/Ward issues	
Hypertension	4 (8,3)
Operating load	5 (10,4)
Massive bleeding	2 (4,2)
Hypotension (BP <90 mmHg) and Tachycardia (HR >120 bpm)	4 (8,3)
Arrhythmia	1 (2,1)
Altered conscious state-seizure	18 (37,5)
Cardiac arrest	1 (2,1)
Hypoxia (SpO2 <90%)	13 (27,1)

There was no difference in the need for infusion of inotropic and vasoactive drugs between the pre-pandemic and pandemic periods (p=0.596) (Table 3).

Table 3. Characteristics of ICU stay and anesthesia

Characteristics	Pre-COVID-19	During COVID-19	P value
Total duration of anesthesia (min)	60 (50-240)	100 (50-300)	0.224
Operating time (min)	60 (35-200)	80 (40-240)	0.263
Need for inotropic and vasoactive drug infusion	12 (29.3)	9 (36)	0.596
Hemodialysis	1 (2.4)	0 (0)	1.000
Estimated blood loss (mL)	200 (50-6000)	400 (100-3500)	0.067
Total volume (mL)	2000 (500-11500)	2000 (1000-8000)	0.163
Total urine output (mL)	200 (20-1200)	200 (50-1400)	0.324
Type of anesthesia			
General	37 (90.2)	22 (88)	1.000
Spinal	4 (9.8)	3 (12)	

4. DISCUSSION

In the present study, the characteristics and outcomes of patients who had unplanned ICU admissions from the gynecologic and obstetric department during the COVID-19 pandemic were broadly similar to the earlier period. Preeclampsia/eclampsia, low-risk pregnancy, and placenta accreata/percreata were clinical medical conditions more prevalent. Additionally, we did not observe a significant difference in morbidity or severity of illness using proxy measures such as duration of surgery, length of ICU stay, and advanced level of ICU interventions, including invasive mechanical ventilation, inotropic and vasoactive drug infusion, and hemodialysis.

The existing literature on unplanned ICU admission focuses particularly on specific diseases, preventable adverse events, or specific patient groups (Floylich D et al., 2016; Farzi et al., 2017). However, there has been no detailed investigation of the characteristics associated with unplanned ICU admissions in gynecologic and obstetrics patients prior to and during the COVID-19 pandemic. Providing optimal healthcare to this group of patients is essential (Fadiloglu E et al., 2019), particularly obstetric patients, which reflects the maternal health outcomes of countries. Previous attempts have been made to identify the perioperative factors associated with post-operative ICU admission after elective cardiac surgery using the American College of Surgeons National Surgical Quality Improvement Program® (ACS NSQIP®). The study by Bruceta et al. reported duration of surgery more than 4 hours did not associate with unplanned ICU admission (Bruceta et al., 2020). Similarly, we did not find an association in the operating time in our study cohort between prior to and during the COVID-19 pandemic.

We observed that admissions for the time period between COVID-19 pandemic were higher to that of the previous years. Given the larger numbers of unplanned ICU admissions reported in this study, we may speculate that implementation of public health measures such as social distancing, wearing masks and consolidation of the hygiene practices is of great importance and continue to be widely adopted and maintained in the society in order to reduce ICU admissions.

COVID-19 represents a massive challenge for health care systems in many countries across the world. A high number of patients required ICU at the same time leading to an elevated risk of collapsing the health care systems. Shifts in health-seeking behavior resulting in the delayed presentation have emerged as a significant concern during the COVID-19 pandemic (Lynn RM et al., 2021). Comparison of severity of illness on presentation in ICU admission during COVID-19 pandemic with data from the earlier periods; drawn from the analysis basedon length of ICU stay, need for advanced levels of critical care support, such as invasive mechanical ventilation, inotropic and vasoactive drug infusion, and hemodialysis did not show any evidence of delayed access to healthcare.

Several limitations to this study need to be acknowledged. Firstly, this was a single-center retrospective study makes it susceptible to reporting bias, including underestimation of adverse events and near misses.

Secondly, COVID-19 incidence and ICU availability, as well as the response to the pandemic, varied significantly across countries, which may limit the external validity of the present study (Grasselli G et al., 2020; Aziz S et al., 2020; Wurmb T et al., 2020; Verelst F et al., 2020). Thirdly, although our study represents a diverse population and provides a snapshot of risk factors associated with unplanned ICU admissions, it is unable to explain institutional-based differences or the principles guiding clinical management decisions on a case-by-case basis. Variations in surgical techniques, anesthetic management, and ICU staffing and resources may have affected the rates of unplanned postoperative ICU admission (Haller et al., 2008). Finally, it was not possible to stratify the severity of comorbid conditions. Notwithstanding these limitations, to the best of our knowledge, this is the first comprehensive study to examine unplanned intensive care admissions in patients from the gynecology and obstetrics department before and during the COVID-19 pandemic. We believe this report can guide and help physicians and healthcare systems in being aware of the complex adjustments of events around a pandemic and identify new strategies for prevention. Considerably more work will need to be done to develop a better understanding of the impact of the COVID-19 pandemic on unplanned ICU admissions.

In conclusion, this paper indicated that the characteristics and outcomes of patients who had unplanned ICU admissions from the obstetrics and gynecology department during the COVID-19 pandemic were similar to the pre-pandemic period. Further research on this issue would provide deeper insight for improvement in the healthcare system and patient safety.

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