COLLEGE OF HEALTH SCIENCE SCHOOL OF MEDICINE

SPECIALITY RESEARCH

Incidence and Associated Factors of Delayed Extubation in patients undergoing Infratentorial craniotomy; A 5-Year

Retrospective Analysis in TASH, Addis Ababa, Ethiopia, 2023.

A Research to Be Submitted to Addis Ababa University School of Medicine in Partial Fulfillment for the Requirement of Specialty Certificate of Anesthesiology, critical care and pain medicine.

By - Dr. Nebiyat Abebe

Addis Ababa, Ethiopia, May, 2024

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List of Acronyms and Abbreviations

AAU: Addis Ababa University

ACCPM: Anesthesiology Critical Care and Pain Medicine

ASA: American Society of Anesthesiologists

CBP: cerebral blood flow

CMR: cerebral metabolic rate

CN: cranial nerves

EBL; estimated blood loss

ICP; intracranial pressure

ICU; intensive care unit

IQR; interquartile range

Hr.: Hour

MAP; mean arterial pressure

MMHG; millimeter of mercury

M mol; milli moles

PACU: Post Anesthesia Care Unit

SPSS; Statistical Package for Social Sciences

TASH: Tikur Anbessa Specialized Hospital

UOP; urine out put

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Abstract

Background: Infratentorial craniotomy, a neurosurgical procedure involving the removal of lesions or tumors located in the posterior fossa of the brain, presents unique challenges and considerations regarding perioperative management. Among these challenges, delayed extubation, defined as the postponement of planned endotracheal tube removal following the surgical procedure, emerges as a critical concern. Understanding the incidence and factors contributing to delayed extubation is crucial for optimizing perioperative care and improving patient outcomes.

Objective: The aim of this study was to investigate the incidence of the delayed extubation and to identify the perioperative associated factors in patients undergoing infratentorial craniotomy.

Methods: Retrospective data from patients who underwent infratentorial craniotomy at Tikur Anbessa Specialized Hospital between May 2018 and June 2023 between were analyzed. Patient demographics, clinical variables, and intraoperative factors were collected from medical records**.** The variables were compared between the delayed extubation and early extubation groups.

Results: A total of 112 patients met the inclusion criteria. The incidence of delayed extubation was 83.9%. After multivariate forward logistic regression Independent factors related to delayed extubation were Volume of crystalloid (OR [0.998], 95% CI [0.998 - 0.999], p-value < [0.001]) and duration of surgery (OR [0.091], 95% CI [0.030 - 0.281], p-value < [0.001])

Conclusions;The incidence of delayed extubation after infratentorial craniotomy in adults was 83.9%. Volume of crystalloid and duration of surgery are found as an independent risk factors.

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CHAPTER 1: INTRODUCTION

1.1 Background

Endotracheal extubation in the operating room is plausible after most uneventful craniotomies and patients failing extubation,i.e.expereiencing delayed extubation, had a higher incidence of pneumonia, tracheostomy, and mortality rate.Delayed extubation in this sense is defined as retaining the endotracheal tube in the patient before leaving the operating room.

Infratentorial craniotomy, a neurosurgical procedure involving the removal of lesions or tumors situated beneath the tentorium cerebelli, is associated with significant postoperative challenges, including respiratory complications. Delayed extubation following infratentorial craniotomy poses a considerable clinical concern, as it not only prolongs intensive care unit (ICU) and hospital stays but also increases the risk of respiratory infections, aspiration, and other adverse outcomes. Understanding the incidence and associated factors of delayed extubation is paramount for optimizing patient care and improving surgical outcomes in neurosurgical settings.

In Ethiopia, the burden of neurosurgical conditions is substantial, with traumatic brain injuries, tumors, and vascular anomalies being prevalent indications for surgery. Addis Ababa, as the capital city and home to Tikur Anbessa Specialized Hospital (TASH), serves as a critical hub for neurosurgical care in the country[1]. Despite advancements in surgical techniques and perioperative management, data specific to the incidence and factors contributing to delayed extubation following infratentorial craniotomy remain scarce within the Ethiopian context.

This study aims to fill this crucial gap by conducting a retrospective analysis over a five-year period at TASH, focusing on patients who underwent infratentorial craniotomy. By systematically examining patient records, including demographic data, preoperative variables, intraoperative factors, and postoperative outcomes, we seek to elucidate the incidence of delayed extubation and identify the associated factors contributing to this phenomenon.

Understanding the determinants of delayed extubation is multifaceted, encompassing patient-related factors such as age, comorbidities, and preoperative neurological status, as well as intraoperative variables like surgical duration, blood loss, and the extent of surgical resection. Additionally, institutional factors such as perioperative practices, availability of resources, and staffing levels may also influence extubation timing and patient outcomes.

The findings of this study hold significant implications for clinical practice, healthcare policy, and future research endeavors. By identifying modifiable risk factors associated with delayed extubation, clinicians can tailor perioperative strategies to mitigate these risks and optimize extubation timing, thereby enhancing patient recovery and reducing healthcare resource utilization. Furthermore, insights gained from this research can inform the development of

evidence-based protocols and guidelines tailored to the Ethiopian context, fostering improved neurosurgical care delivery nationwide.

In summary, this retrospective analysis aims to shed light on the incidence and associated factors of delayed extubation following infratentorial craniotomy at TASH, Addis Ababa, Ethiopia. Through a comprehensive examination of patient demographics, surgical variables, and postoperative outcomes, we endeavor to contribute valuable insights towards enhancing perioperative care practices and improving patient outcomes in neurosurgical settings within Ethiopia and beyond.

1.2 Statement of the Problem

The ideal timing of postoperative extubation following infratentorial craniotomy is unclear. The timely diagnosis of neurosurgical complications is required to limit brain damage; the diagnosis of complications relies on rapid neurological examination after early awakening. After uncomplicated surgery, normothermic and normovolemic patients generally recover from anesthesia with minimal metabolic and hemodynamic changes. Thus, early recovery and extubation in the operating room is the preferred method when the preoperative state of consciousness is relatively normal and surgery does not involve critical brain areas or extensive manipulation[2,3].In general early extubation and rapid awakening in patients who undergo intracranial surgery has several benefits, including early detection of post-opera-tive surgical complications, less catecholamine release and decreased expense of intensive care unit (ICU) admission.

The timing of extubation after intracranial surgery is usually a combined decision, made by the anaesthetist and the neurosurgeon. It has been shown that patients who fail early extubation have more postoperative complications and a higher mortality rate, compared with those in whom early extubation succeeds. In the neurosurgery setting it is reported that patients, especially after craniotomy,have a relatively higher incidence of complications, including neurological adverse events (newmotor deficit, dysphasia, seizure, deterioration of consciousness), hemodynamic adverse events(bradycardia, hypertension, hypotension), respiratory adverse events, postoperative nausea and vomiting,metabolic adverse events, hemorrhage, hyperthermia, pain, and reoperation.[4-8]

Patients who experienced postoperative complications are more likely to experience hospital-acquired conditions, thus being more than twice as likely to die in the hospital as those who did not experience one. A single complication increased the mean total cost by$10,000-$20,000, and with 3 complications this cost increased by 3-fold.[9-13]

Delayed extubation has been advocated in high-risk patients, to limit postoperative stress and avoid serious complications such as intracranial haematoma[3], but is associated with increases in pneumonia incidence, morbidity, mortality, tracheostomy, length of stay (LOS) in the intensive care unit (ICU), and hospitalization costs.

Researches done in the developed world regarding the incidence of delayed extubation between 10%- 50 % with some variability of perioperative factors contributing to delayed extubation after infratentorial craniotomy. But there is no enough data regarding the magnitude and the factors in Africa and certainly none in our country. This research is part of the strive to fulfill this gap and to inform clinical practice, enhance perioperative management strategies, and ultimately improve patient outcomes in neurosurgical care settings within Ethiopia and beyond.

1.3 Significance of the Study

To my knowledge, the incidence & factors associated with delayed extubation after posterior fossa craniotomy have not been studied in Ethiopia.

- ✓ It helps improve the quality of health care provided to the group of interest.
- ✓ It serves as a baseline data for future studies.
- ✓ It could serve as baseline for risk reduction QI Projects at TASH.

1.4 Literature Review

Delayed extubation, particularly following infratentorial craniotomy represents a significant concern in the realm of neurosurgical anesthesia. It clearly poses significant clinical challenges, impacting patient outcomes and healthcare resource utilization. Extensive research has focused on understanding the incidence and associated factors of delayed extubation in neurosurgical patients globally. However, there remains a paucity of literature specific to the Ethiopian context and within institutions such as Tikur Anbessa Specialized Hospital (TASH). This literature review aims to synthesize existing evidence on the incidence and factors contributing to delayed extubation post infratentorial craniotomy, providing a foundation for the current retrospective analysis at TASH.

The incidence of delayed extubation following infratentorial craniotomy varies across studies but is consistently reported as a notable concern. A retrospective analysis by Cata JP et al[15] identified delayed extubation in approximately 18 % of patients undergoing posterior fossa surgery. Similarly, a prospective study by Cai et al[17].Reported delayed extubation rates near 50% in patients undergoing infratentorial craniotomy. This wide range among different studies under underscores the complexity of factors influencing extubation timing and the need for institution-specific analysis to inform clinical practice effectively.

Numerous factors have been showen to contribute to delayed extubation both per-operatively & intraoperatively. Pre-op hydrocephalous, LCN dysfuction , tumor size with tumor location has been shown consistently to be associated with delayed extubation. [15,17]. Cai Y et al [16] in adults and Flexman et al[20] in pediatreics found duration of surgery as an independent predictor of delyed extubation.

Neurological status both preoperatively & upon emergence from anesthesia is a critical determinant of extubation readiness. Patients with impaired consciousness or signs of neurological deterioration are often deemed unsuitable for immediate extubation & was found predictor of failed extubation in the multicenteric PRICE survey [16]. Therefore, close neurological monitoring in the peri-operative period is imperative to identify patients at risk for delayed extubation.

Variability in institutional protocols and practices may contribute to differences in extubation practices and outcomes across healthcare settings [19]. Multidisciplinary collaboration between neurosurgeons, anesthesiologists, intensivists, and respiratory therapists is essential to standardize extubation criteria and optimize postoperative care pathways.

Understanding the incidence and associated factors contributing to delayed extubation is essential for optimizing perioperative care and mitigating the risk of adverse outcomes in this vulnerable patient population. Further research elucidating the mechanistic underpinnings and implementing targeted interventions is warranted to enhance extubation practices and improve postoperative outcomes in neurosurgical patients undergoing infratentorial craniotomy.

1.5 Objectives

1.5.1 General Objectives

To determine Incidence and Perioperative Risk Factors of Delayed Extubation in patients undergoing posterior fossa craniotomy in TASH

1.5.2 Specific Objectives

- ✓ The incidence of delayed extubation following posterior fossa craniotomy.
- ✓ To identify the various preoperative factors responsible for delayed extubation
- ✓ To identify the various intraoperative factors responsible for delayed extubation

CHAPTER 2: METHODS AND MATERIALS

2.1 Study Design

This institutional based cross-sectional study is drawn from a retrospective chart review of patients, who underwent posterior fossa surgery between MAY, 2018 and JUNE, 2023.The study was conducted immediately after ethical clearance is obtained.

2.2 Study Area and Period

The study will be conducted at Addis Ababa university school of health science, Tikur Anbessa specialized hospital. Addis Ababa is the largest and capital city of Ethiopia, found at center of the country and 3000 feet above sea level with area of 527sq, Km. It is one of the densely populated areas in the country which inhabits around 5.2 million population. AAU is a large, highly residential national university in Addis Ababa, Ethiopia. It's the oldest school of higher education in Ethiopia. It has fourteen campuses and colleges out of which one is college of health sciences at Tikur Anbessa specialized hospital which is located at center of Addis Ababa near to the immigration office. The hospital was established in 1964 and is now the largest hospital in the country that serves the people of the country as a whole. It provides full range of health care services including, outpatient, inpatient, referral, and surgical services. It is the main teaching center for both clinical and preclinical training of most disciplines. Its also an institution where specialized clinical services that are not available in other public or private institutions are provided to the whole nation. It has around 913 academic staffs and 1204 health care professionals. The hospital has more than 700 beds, and serves more than 400,000 clients per year. It has a total of 15 OR tables (11 elective, 4 emergency) which give service for an estimated surgeries of more than7300 cases per year for different surgical subspecialities. Anesthesia service is given by consultant anesthesiologists with their residents, master anesthetists with their Ms students and BSC anesthetists.It will be conducted from June 1/ 2023GC -May 30/ 2024GC

2.3 Source population

All posterior fossa craniotomy patients who underwent surgery at Tikur Anbessa Specialized Hospital.

2.4 Study Participants

All adult patients (aged_18 years), undergoing infratentorial craniotomy who full fill the inclusion and exclusion criteria.

2.5 Inclusion and Exclusion Criteria

2.5.1 Inclusion Criteria

All adult (aged_18 years) patients who underwent infratentorial craniotomy

2.5.2 Exclusion Criteria

- patients with a tracheostomy tube in situ
- tracheostomy planned to be performed at the same time as the craniotomy and
- incomplete medical data

2.6 Sampling Technique and Sample size

The sample size (n) for this study is calculated by using single proportion population formula. Based on a previous study performed in Cleveland Clinic, Cleveland, OH which showed prevalence of delayed extubation to be 18 %. Assume a 95% of confidence interval with a 5% margin of error and finally, the sample size for the study was calculated as

$$n = (z\acute{\alpha}/2)2\ p(p-1)\ \ / d^2$$

n = 226

Where n is the required sample size; p = 18% is the prevalence of failed extubation at Cleveland clinic, Cleveland; Zα/2 is the value (Z-statistic) at the 95% confidence level (α=0.05) which is 1.96; d is the margin of error 5% (0.05).

N (target population) =240, so b/c of N≤ 10,000

N finite = n1/1+n1/N→116

Adding 10% for those who, incomplete or lost charts, the sample size will be

N final=n/1-I C (incomplete or lost) = 223/1-0.1=**129**

Final sample size is 129

2.6.1 Sampling Procedure

- The sample for this study was with systematic sampling from 240 emergency and elective patients who was operated for infratentorial craniotomy under anesthesia at TASH during the study period with every 2nd case till the calculated sample size is reached.

2.7 Study Variables

2.7.1 Dependent Variable

Extubation (early or late)

2.7.2 Independent Variable

Demographic characteristics, ASA classification, coexisting diseases (i.e., respiratory, cardiac, or hematologic diseases), urgency of surgery, the size of tumor, presence of hydrocephalus, and LCN (IX, X, XI, or XII) dysfunction

The intraoperative data included Difficult airway, postion, intraoperative cardiovascular instability, estimated blood loss (EBL), incidence of massive transfusion, total volume of fluid administered, duration of surgery, UOP and completion after working hours.

2.8 Operational Definitions

Delayed extubation is defined as retention of the endotracheal tube before leaving the operation theater.

The intraoperative cardiovascular instability was defined as hypotension requiring vasopressor/ inotropic agent support or bradycardia requiring atropine.

Lower cranial-nerve dysfunction was identified by preoperative routine neurological examination and defined as one or more functional abnormalities of the lower cranial nerves (IX, X, XI or XII)

Massive blood transfusion is defined as transfusion of blood components including packed red cells (PRCs), fresh frozen plasma (FFP), and platelet concentrate (PC)

Tumor size was defined with the largest cross-sectional diameter of the tumor

2.9 Data Collection Procedure

All patients who fulfill the inclusion criteria and treated during the study period was enrolled and studied. Pre-structured data collection tool was used to collect information about study variables from patient cards. Data collectors was oriented about the components of the data collection format.

2.10 Data Analysis

Data will be checked for completeness and was entered using google form into excel and cleaned then the data will be imported to SPSS 27 software for analysis. Categorical variables will be presented as number and percentage (%). Continuous variables with normal distribution will be presented as mean and standard deviations (mean ± SD). .The medians with IQR represented the nonnormally distributed continuous variables. Comparison of continuous data will be done using Student's t-test for normally distributed variables and Mann–Whitney U-test for non-normally distributed variables. Univariate analyses will be performed, followed by multiple logistic regression analyses to identify factors related to delayed extubation. Pre- and intraoperative factors will be analyzed as predictors of delayed extubation, and factors with a P-value<0.05 will be included in multivariate analysis (stepwise forward logistic regression), to identify the independent factors of delayed extubation.

2.11 Data Quality Control

The data collection format was reviewed by peers and mentors and was tested using pretest before start of data collection. Data collectors was trained before the start of the data collection and was supervised routinely during data collection. Data was reviewed for completeness and clarity routinely by the primary investigator.

2.12 Ethical Considerations

The following ethical considerations were carefully addressed:

- **Informed Consent:** Since this study involves retrospective analysis of existing medical records, the requirement for obtaining individual informed consent was waived by the IRB from Addis Ababa University College of Health Science Institution. This decision was based on the retrospective nature of the study, ensuring the confidentiality and anonymity of patient data.
- **Protection of Privacy and Confidentiality:** Strict measures have been implemented to protect the privacy and confidentiality of patient information throughout the study. All data

obtained from medical records will be anonymized and securely stored, with access restricted to authorized research personnel only.

- **Beneficence and Non-Maleficence:** The study aims to contribute valuable insights into the incidence and associated factors of delayed extubation following infratentorial craniotomy procedures. It is conducted with the intention of improving clinical practices and patient outcomes. No interventions or interactions with human subjects are involved in this retrospective chart review.
- **Conflict of Interest:** The researchers involved in this study declare no conflicts of interest that could influence the objectivity or integrity of the research findings.

2.13 Result dissemination plan

The study result will be submitted to Addis Ababa University School of medicine and be presented to the health science community and disseminated to the concerned and the result will be published on peer reviewed scientific journals.

CHAPTER 3: RESULT

We were able to review and analyze the medical records of 112 adult patients who underwent infratentorial craniotomy during the study period. The remaining seventeen charts were lost could not be included in the analysis. There were 94 (83.9 %) patients in the delayed extubation group.

The median age of patients was 30(19) and there were 57(50.9%) male & 55(49.1%) female. In both early & delayed extubation group there were comparable age and sex distribution as depicted in **Figure** 1. There were 2 cases with respiratory disease, 4 cases with cardiac condition, no cases with hematologic disease & there was no cases done under emergency condition. In the entire population 95.5% of the patients were ASA 2 and only 1.8% were in highest group ASA 3 and their distribution among delayed and early group is shown in **Figure** 2. As shown in Table 1, statistically significant differences in baseline variable was observed between patients who were extubated in the operating room and those who were not interms of lower CN dysfunction which occurred in 71 (75.5%) of patients in the latter group.

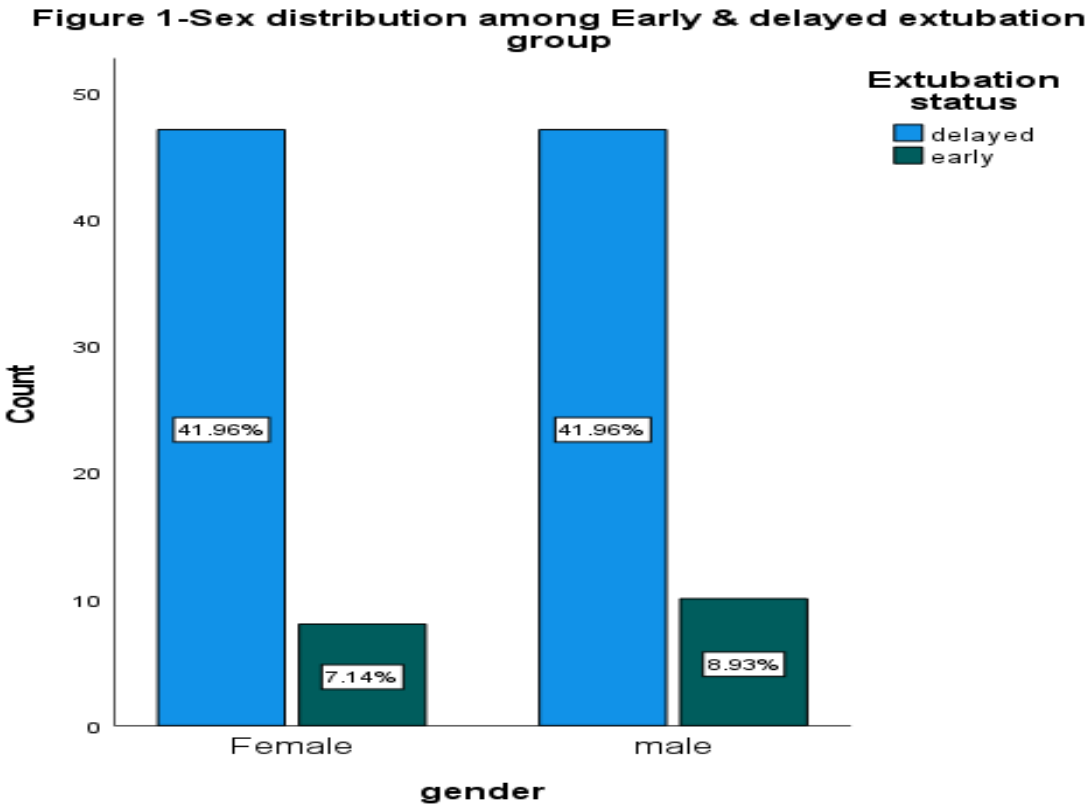


Figure 2-Distribution of ASA Physical status among the two groups.

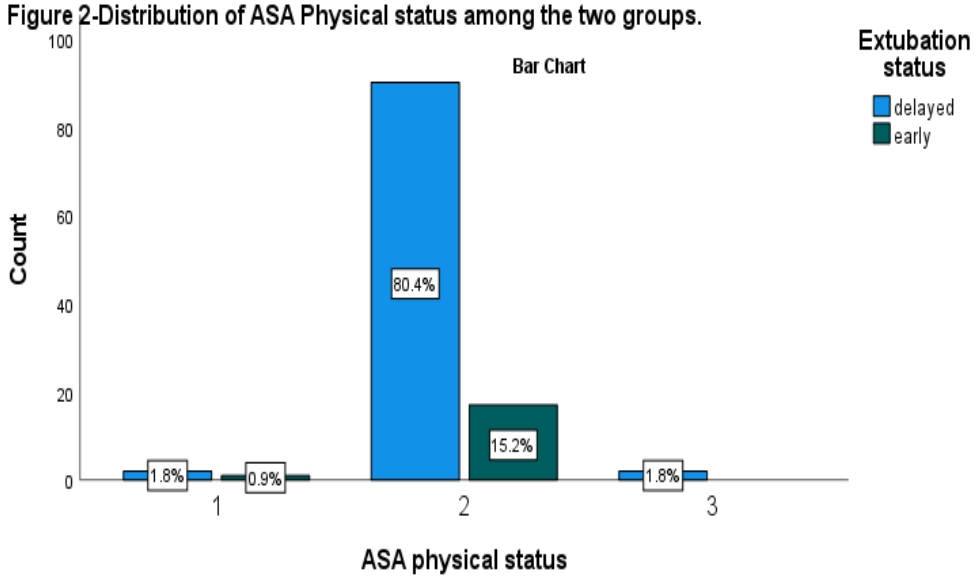
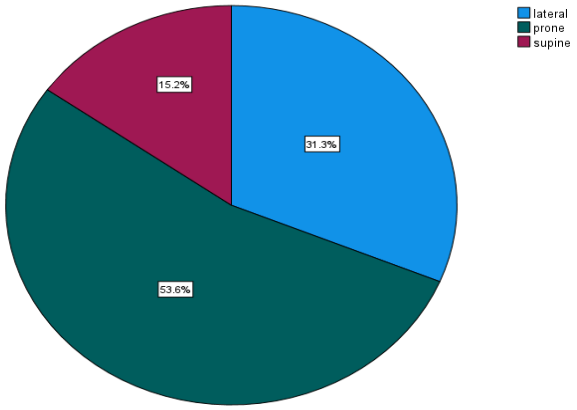


Table 1-Patients' demographic and clinical characteristics

Variables	Total (n=112)	Early extubation (n=18)	Delayed extubation (n=94)	p-Value
Sex				0.666
Male	57(50.9)	10(55.6)	47(50)	
Female	55(41.61)	8(44.4)	47(50)	
Age(y)	30 (19)	37.5(16)	30(21)	0.634
Tumor size(mm)	36.67 ± 9.55	33.9 ± 12.13	37.26 ± 8.88	0.175
Preoperative lower cranial nerves dysfunction	79(70.5)	8(44.4)	71(75.5)	0.008[a]
Preoperative hydrocephalus	30(26.8)	3(16.7)	27(28.7)	0.390
ASA physical status				0.591
I	3(2.7)	1(5.6)	2(2.1)	
II	107(95.5)	17(94.4)	90(65.7)	
III	2(1.8)	0	2(2.1)	
Coexisting respiratory diseases	2(1.8)	1(5.6)	1(1.1)	0.297
Coexisting cardiac disease	4(3.6)	0	4(4.3)	1.000

Note: Data were expressed as number (%), mean ± SD,median(interquartile range). a Significant at p <0.05.

Figure 3-position in which surgery is performed.



During intra-op period there was no difficult airway encountered and the majority of surgery were performed in prone position followed by Lateral & supine position as depicted in Figure 3.

The majority of the factors related to delayed extubation occurred intraoperatively as shown in Table 2. The group of patients who were not extubated in the operating room had a significantly larger intraoperative blood loss (a median of 1400 ml) and not surprisingly received a larger volume of crystalloids (median 5000ml) than those extubated early as depicted in Figure 4 & 5. They also have longer duration of surgery 6.5 with interquartile range of 2 and 50 % of them are completed after working hour.

Figure 4-Volume of crystalloid given to early & delayed extubation groups

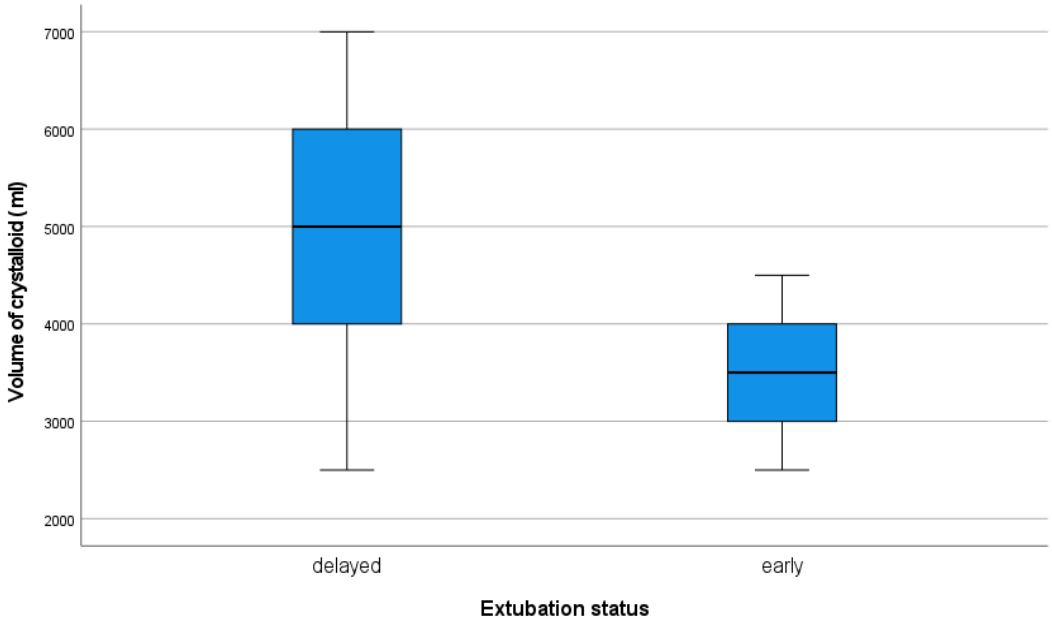


Figure 5-Intraoperative blood loss among delayed & early extubation groups

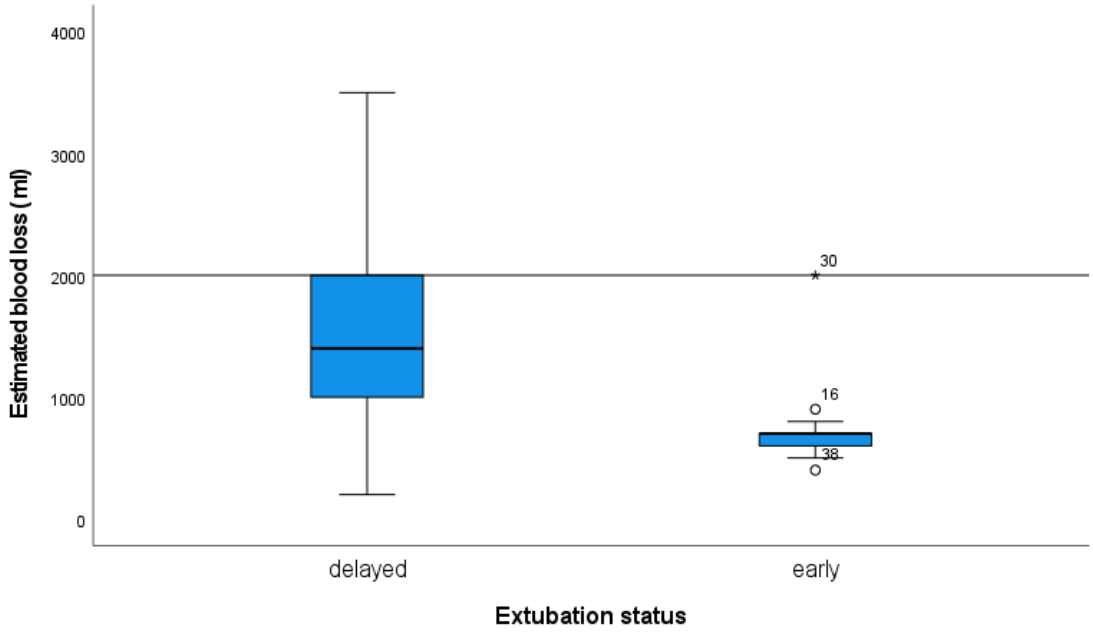


Figure 6- Duration of surgery among early and delayed extubation groups

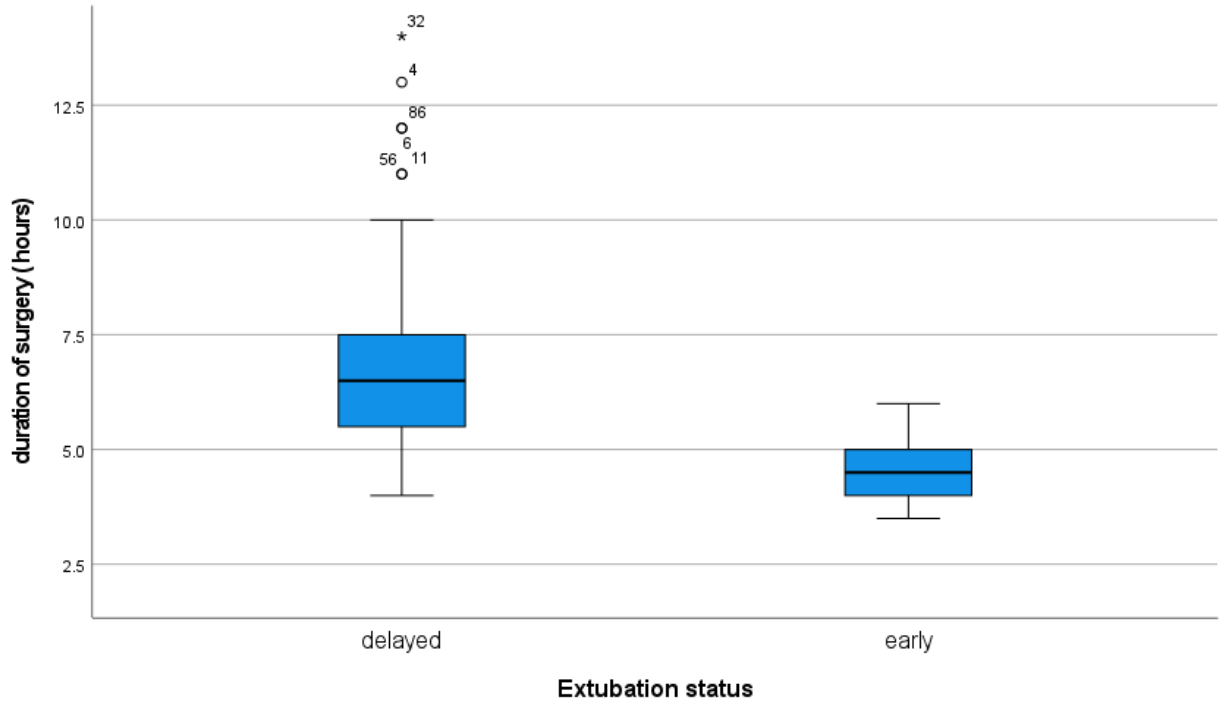


Figure 7- completion of surgery after working hour

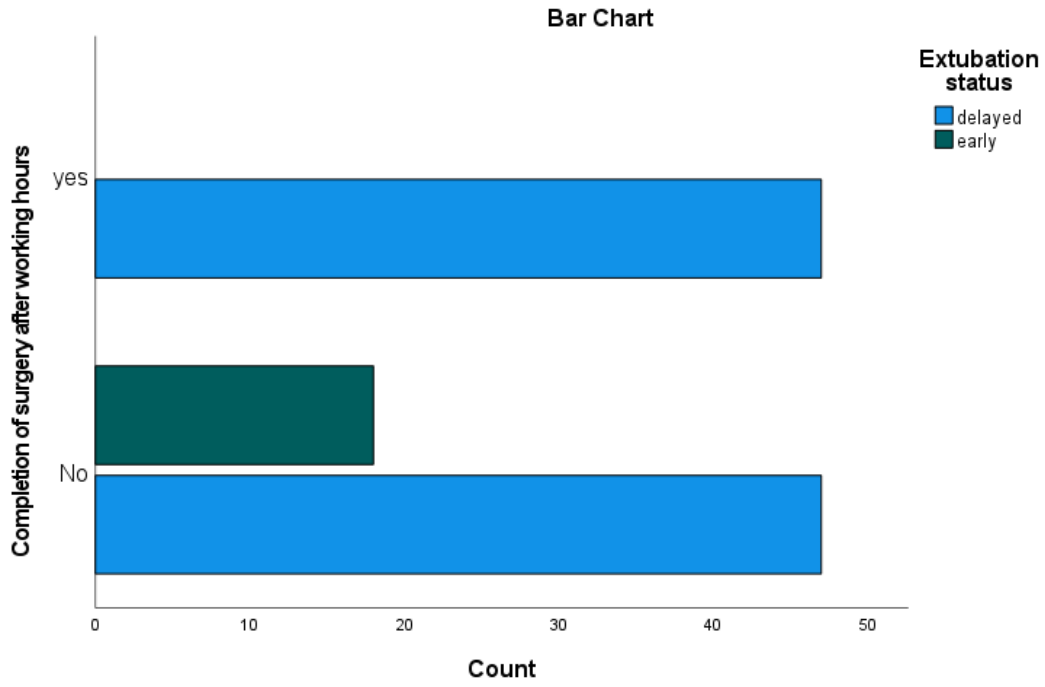


Table 2-Univariate analysis of intraoperative factors in early extubation and delayed extubation groups

Variables	Total (n=112)	Early extubation (n=18)	Delayed extubation (n=94)	p-Value
Positioning				0.311
Supine	17(15.2)	1(5.6)	16(17.0)	
Lateral	35(31.3)	8(44.4)	27(28.7)	
Prone	60(53.6)	9(50.0)	51(54.3)	
Intraoperative cardiovascular instability	8(7.1)	1(5.6)	7(7.4)	1.000
EBL (ml)	1200(1050)	700(138)	1400(1000)	<0.001[a]
Massive blood transfusion	7(6.3)	0(0.00)	7(7.4)	0.595
Crystalloid(mL)	5000(2000)	3500(1000)	5000(2000)	<0.001[a]
Urine output(mL/kg/h)	4.6(2.9)	4.2(2.1)	4.7(3)	0.281
Duration of surgery(hr)	6.0(2.5)	4.5(1)	6.5(2)	<0.001[a]
Completion of surgery after working hours	47(42)	0(0.00)	47(50)	<0.001[a]

Note: Data were expressed as number (%), mean ± SD,median(interquartile range). a Significant at p <0.05.

Multiple logistic regression analyses identified duration of surgery and volume of crystalloids as independent risk factors for delayed postoperative extubation (Table 3)

Table 3- Stepwise forward regression analysis to identify factors independently associated with delayed extubation in patients undergoing infratentorial craniotomy

Factors	B	S.E.	Wald	Sig.	OR	95% C.I.for EXP(B)	
						Lower	Upper
duration of surgery (hours)	-2.393	0.574	17.400	<0.001	0.091	0.030	0.281
Volume of crystalloid (ml)	-0.002	0.000	15.852	<0.001	0.998	0.998	0.999

CHAPTER 4: DISCUSSION

The incidence of delayed extubation following infratentorial craniotomy in adults in this study is 83.9% which is by far higher than other studies which reported incidence ranging from 10% - 49.8%. The high incidence of delayed extubation observed in our study underscores the complexity of managing airway extubation following infratentorial craniotomy. This finding aligns with previous research highlighting the challenges associated with timely extubation in neurosurgical patients, particularly those undergoing posterior fossa procedures. The intricate neuroanatomy and potential for postoperative complications, such as impaired airway reflexes and respiratory depression, necessitate careful monitoring and management during extubation. Additionally, patients with infratentorial tumor have a higher risk for respiratory failure and death after craniotomy as shown by Flexman[20] . All these factors result in delayed extubation following infratentorial craniotomy. we identified two independent risk factors contributing to delayed extubation: the duration of surgery and the volume of crystalloid administered intraoperatively.

Our findings highlight the volume of crystalloid administered intraoperatively as an independent risk factor for delayed extubation. Patients who received large Volume of crytalloid (OR-0.998-,CI 0.998-0.999) during infratentorial craniotomy remained intubated at the end of surgery. Fluid management plays a crucial role in neurosurgical patients, as excessive fluid administration can exacerbate cerebral edema and increase the risk of postoperative complications. Concezione et al [21] reviewed neurosurgical patients may require large amounts of intravenous fluids to correct preoperative dehydration and/or to maintain intraoperative and postoperative hemodynamic stability as part of therapy for vasospasm, for blood replacement, or for resuscitation. Diana et al [22] showed that the average estimated blood loss in craniotomy was 1120 ml but in our case is slightly higher. These observations along with diuretics used as a part of brain relaxation therapy could explain the large volume of crystalloids administered to the patients. DeMuro et al [25] found positive fluid balance as risk factor for airway edema which is heightened when the patients assume prone position which forced the anesthesiologist to practice delayed extuation.

Extended duration of surgery (OR-0.091, CI 0.030-0.281) was shown as another independent risk factor in this study which was also found to be predictor in other studies done both in pediatric and adult patients with infratentorial craniotomy.Long operation times are probably caused by surgical factors and lead to more fluid administration, blood loss, and drug consumption, which accordingly increase the risk of brain edema, delayed recovery, and delayed extubation.Allison et al[24] also found Long neuro-surgical durations are linked to poor patient outcome.

The higher incidence observed in this study is still believed to be the product different patient related, anesthesia related and surgery related factors as the study could not conduct analysis of all variables related to this pillars due to the retrospective nature and poor documentation on top of lost medical data of patients. We recommend prospective, multicenter studies with larger

sample sizes are warranted to validate our findings and elucidate additional factors contributing to delayed extubation post infratentorial craniotomy.

Our study has several limitations. First, this was a single-institution retrospective study, which can be influenced by the inherent biases and local practices related to our medical personals' experience and team setting. Second some variables related to anesthetic technique & some data on various perioperative variables were missing. Third, a substantial limitation we face is the fairly low number of patients available in our database which affects power of the study.

CHAPTER 5: CONCLUSION

According to our study, the incidence of delayed extubation after infratentorial craniotomy of adult patients was 83.9% and volume of crytalloids & duration of surgery were independent risk factors for delayed extubation. Our findings underscore the importance of optimizing perioperative management to facilitate timely extubation and improve patient outcomes in this challenging patient population.

CHAPTER 6: RECOMMENDATION

We recommend prospective, multicenter studies with larger sample sizes are warranted to validate our findings and elucidate additional factors contributing to delayed extubation post infratentorial craniotomy. More over hospital based guidelines will improve perioperative care of this patients as it set standards and every effort should be made together with surgical teams to reduce duration of surgery.

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CHAPTER 8: ANNEXES

8.1 Annex 1- Data Abstraction Tool

PATIENT DEMOGRAPHIC AND CLINICAL CHARACTERISTICS			
VARIABLES		EARLY EXTUBATION	DELAYED EXTUBATIO
SEX	MALE		
	FEMALE		
AGE			
TUMOR SIZE			
PREOPERATIVE LOWER CRANIAL NERVES DYSFUNCTION			
PREOPERATIVE HYDROCEPHALOUS			
ASA PHYSICAL STATUS	I-II		
	III-IV		
COEXISTING RESPIRATORY DISEASE			
COEXISTING CARDIOVASCULAR DISEASE			
COEXSTING HEMATOLOGY DISEASE			

PATIENT DEMOGRAPHIC AND CLINICAL CHARACTERISTICS		
EMERGENCY SURGERY		
INTRAOPERATIVE VARIABLES		
Intraoperative difficult Airway		
Intraoperative cardiovascular instability		
EBL		
MASSIVE BLOOD TRANSFUSION		
VOLUME OF CRYSTALLOID		
UOP		
DURATION OF SURGERY		
COMPLETION OF SURGERY AFTER WORKING HOUR		