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ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCE  
DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE AND PAIN  
MEDICINE

**INCIDENCE, PREDICTORS, AND ETIOLOGIES OF FEVER IN  
CRITICALLY III PATIENTS ADMITTED TO THE SURGICAL  
INTENSIVE CARE UNIT (SICU) AT TIKUR ANBESA  
SPECIALIZED HOSPITAL IN ADDIS ABABA, ETHIOPIA : A  
RETROSPECTIVE OBSERVATIONALL STUDY (2025)**

THE THESIS IS TO BE SUBMITTED TO ADDIS ABABA UNIVERSITY,  
DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE AND PAIN  
MEDICINE FOR THE PARTIAL FULFILLMENT OF THE  
REQUIREMENTS OF A SPECIALTY CERTIFICATE IN  
ANESTHESIOLOGY, CRITICAL CARE AND PAIN MEDICINE.

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**I, the undersigned anesthesiology, critical care and pain medicine resident, declare that I have submitted my original work titled "INCIDENCE, PREDICTORS, AND ETIOLOGIES OF FEVER IN CRITICALLY ILL PATIENTS ADMITTED TO THE SURGICAL INTENSIVE CARE UNIT (SICU) AT TIKUR ANBESA SPECIALIZED HOSPITAL IN ADDIS ABABA, ETHIOPIA : A RETROSPECTIVE OBSERVATIONAL STUDY (2024) ”.**

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## **List of abbreviations**

AAU	Addis Ababa University
ACCM	American College of Critical Care Medicine
IDSA	Infectious Diseases Society of America
SICUs	surgical intensive care units
ICU	Intensive Care Unit
APACHE	Acute Physiology and Chronic Health Evaluation
MDR	Multi Drug Resistant
SOFA	Sequential Organ Failure Assessment
TASH	Tikur Anbessa Specialized Hospital
VAP	Ventilator Associated Pnuemonia
SSI	Surgical Site Infection
VTE	Venous Thrmoboembolism
IVCRI	Intravascular catheter related infections
CRUTI	Catheter related urinary tract infection

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## Abstract

**Background:** Fever is frequently observed in critically ill patients, particularly in SICU and can be indicative of underlying infections or other serious conditions. Understanding the incidence, predictors, and etiologies of fever is important for appropriate management and improved patient results. There is limited understanding of the prevalence and contributing factors of ICU fever in Ethiopia, particularly at Tikur Anbessa Specialized Hospital.

**Objectives:** This study aims to investigate the incidence, predictors, and etiologies of fever in critically ill patients admitted to the SICU at TASH in Addis Ababa, Ethiopia. September 2023 to september 2024

**Methods:** A retrospective observational research were undertaken at SICU of TSAH in Addis Ababa, Ethiopia. Data was collected from patient's medical record who were admitted to the SICU during September 2023 to september 2024. Information on patient demographics, medical history, surgical procedures, body temperature measurements, diagnostic investigations, and treatment received was recorded. A single population proportion formula was used to establish the sample size and simple random sampling technique was employed. Data was analyzed using descriptive statistics to summarize patient demographics, and fever prevalence. Bivariate and multivariable logistic regression analyses was used to identify factors associated with the development of fever in the SICU. All statistical analyses was conducted using appropriate software, and a p-value of less than 0.05 was considered statistically significant.

**Result:** out of 151 study participants, 80 (53%) were male, 71 (47%) were females the mean age of the subjects were  $42.8 \pm 16.5$ . 76 patients (50.3%) developed fever. Among those with fever, an infectious cause was identified in 61 patients (80.3%), and non infectious causes was identified in 15 patients (19.7%), and 66 patients (86.8%) were started on antibiotic therapy. The occurrence of fever is significantly linked to factors such as being over 60 years old (AOR: 5.198; 95% CI: 2.822–11.839, P value **0.00**), staying in the ICU for more than one week (AOR: 2.051; 95% CI: 1.033–4.073, P value **0.040**), having existing health conditions, (AOR: 2.876; 95% CI: 1.320–6.262 P value **0.008**). Individuals who underwent elective surgeries were 90% less likely to experience fever in the SICU than those who had emergency procedures (AOR: 0.095; 95% CI: 0.029–0.309 P value **0.001**).

**Conclusion and recommendation;** Incidence of fever is high among patients admitted to SICU and being old age  $>60$ , prolonged SICU stay, emergency surgeries, having comorbidities, were identified as statistically significant risk factors for the development of fever. Infectious causes of fever were by far the commonest cause but still fair amount of fever were caused by non infectious causes. It is recommended to be vigilant and increase our monitoring in order to identify fever, our approach to fever in the ICU need to go through all the differential diagnosis including the non infectious and rare causes of fever

# 1. Introduction

## 1.1 Background

A joint task force of the ACCM and the IDSA defined ICU fever as a core body temperature  $38.3^{\circ}\text{C}$  ( $101^{\circ}\text{F}$ ). [1]. The average human body temperature is approximately  $37^{\circ}\text{C}$  ( $98.6^{\circ}\text{F}$ ), with a normal physiological range of  $36.0^{\circ}\text{C}$  to  $37.5^{\circ}\text{C}$  ( $96.8^{\circ}\text{F}$  to  $99.5^{\circ}\text{F}$ ). Diurnal variation is typical, with temperatures being lowest in the early morning and highest in the late evening. Additionally, values may differ based on the measurement method. Hyperthermia or hyperpyrexia denotes clinical conditions involving dangerously elevated body temperatures, typically above  $41^{\circ}\text{C}$  ( $105.8^{\circ}\text{F}$ ).

Fever is common occurrence in ICU patients, ranging from 30% to 70%, particularly elevated in those with comorbidities or undergoing surgical procedures [2, 3]. Researchs have shown that fever can lead to poor clinical outcomes in critically ill patients. Studies have shown that fever in ICU, is associated with increased length of stay, increased cost of care, increased mortality and morbidity, forming part of mortality prediction scores like APACHE II & III [4].

The importance of fever as a pathophysiological process is poorly understood. While on one hand, fever may be an appropriate adaptation to an underlying infective process, in other hand it could be harmful. It can indicate underlying systemic inflammation, infection, or physiological stressors, with potential implications for patient outcomes [5]. On the other hand it could increase non essential investigations and could cause antimicrobial misuse.

In critically ill patients, many predictors have been recognized as potential risk factors for the development of fever, aiding healthcare providers in risk stratification and targeted interventions. Factors such as advanced age, immunosuppression, presence of invasive devices ,recent surgical procedures, and degree of disease at admission were identified as key predictors [5-8].

Fever in the ICU can be infectious or noninfectious necessitating a comprehensive diagnostic approach. The frequency of causes of fever varies according to the population being studied and the definition of infection that is used but most episodes of fever in the ICU are due to infections. Common infectious etiologies include VAP, IVCRI, SSI, CRUTI, and bacteremia from these and other sources. Benign postoperative fever, drugs, transfusion reactions, acalculous cholecystitis, adrenal insufficiency, thyroid storm and VTE are the most common

non infectious etiologies attributed. Understanding these diverse etiologies is paramount for effective management and optimal outcomes in SICU patients, emphasizing the significance of a multidisciplinary approach to address both causes of fever in this complex clinical setting [9].

Whenever a patient develops a fever in the ICU a targeted detailed history and physical examinations, targeted laboratory and imaging investigations including different cultures need to be done in order to reach a possible diagnosis and start or withhold management accordingly.

In the Ethiopian context, specific data on the burden, predictors, and common causes of fever among critically ill surgical patients at TASH is currently scarce. The knowledge gap hinders the development of evidence-based guidelines tailored to this setting, where healthcare challenges such as infectious disease burdens and resource limitations necessitate locally relevant insights. By addressing these gaps, this retrospective cohort study aims to provide comprehensive insights into fever incidence, predictors, and etiologies specific to this healthcare environment, thereby contributing to enhanced patient outcomes and resource utilization.

## **1.2 Statement of the Problem**

Fever is a common and clinically significant issue in SICUs, affecting up to 70% of individuals [5]. While fever often indicates infection, it can also arise from various other sources in this vulnerable patient population [5]. Understanding the root cause of fever is essential for guiding appropriate treatment strategies and ultimately enhancing patient outcomes. Research has shown that fever can lead to poor clinical outcomes, including those with TBI, stroke, and cardiac arrest. Therefore, a comprehensive approach to identifying and managing the etiology of fever in SICU patients is crucial for optimizing patient care and prognosis.

Diagnosing the cause of fever is indeed a challenging task due to its non-specific nature, necessitating a comprehensive investigation to identify its source accurately. It is crucial to differentiate between fever due to infections and non-infectious causes, as the management strategies differ significantly. Infections often necessitate prompt antibiotic therapy and surgical interventions, while non-infectious etiologies may require specific diagnostic studies and tailored therapeutic approaches [10-12].

Despite its prevalence, a concerning knowledge gap exists regarding the specific burden, predictors, and common causes of fever in SICU patients admitted to TASH , the premier referral center in Addis Ababa, Ethiopia.

This lack of local data presents a multifaceted problem with significant clinical and economic implications:

**Delayed Diagnosis and Treatment:** Clinicians, lacking a clear understanding of the local epidemiology of fever, its associated factors and etiologies may struggle to identify the underlying cause promptly. This may cause a delayed in starting management , potentially resulting in increased morbidity, mortality, and prolonged ICU stay, all of which significantly impact patient well-being.

A frequent challenge is that many patients who develop fever in the SICU are prematurely labeled as having infections and subjected to long durations of antibiotics with out giving any considerations for the other causes of fever which is conserring in low resource setups in increasing the rates of MDR pathogens and also cause of the fever will not be adressed .

**Limited Preventive Strategies:** Without knowledge of the specific risk factors for fever development in this patient population, the implementation of targeted preventive measures becomes a hurdle. This not only increases the incidence of fever but also creates a breeding ground for the emergence of multidrug-resistant organisms, further complicating treatment strategies.

**Suboptimal Resource Allocation:** The absence of data on the most prevalent etiologies of fever in the SICU hinders the optimization of diagnostic tests and antibiotic selection. This can lead to unnecessary testing, inappropriate antibiotic use, and ultimately, increased healthcare costs.

This dearth of information translates to suboptimal care for critically ill surgical patients at Tikur Anbessa SICU. It creates a situation where timely diagnosis and effective management of fever become a challenge, potentially compromising patient outcomes and straining limited healthcare resources.

### 1.3 Significance of the Study

Fever is a common complication in critically ill patients admitted to the SICU at TASH , Addis Ababa, Ethiopia. However, the specific burden, factors associated with its development, and most frequent underlying causes remain unclear. This study holds significant value for several reasons:

#### **Improved Patient Care:**

**Early Diagnosis and Targeted Therapy:** By identifying the predictors and common etiologies of fever, clinicians can diagnose the underlying cause more promptly. This allows for the initiation of targeted therapy, potentially leading to improved patient outcomes, reduced complications, and shorter ICU stays.

**Risk Stratification:** Understanding the risk factors for fever development can help healthcare professionals identify patients who might benefit from closer monitoring or even preventive interventions, ultimately improving overall patient care.

#### **Enhanced Infection Control:**

**Targeted Preventive Measures:** Knowledge of the most usual causes of fever, particularly those related to hospital-acquired infections, can guide the development and implementation of targeted preventive measures. This can potentially reduce the overall incidence of fever in the SICU, leading to a safer environment for patients and healthcare workers.

**Antibiotic Stewardship:** Identifying the predominant pathogens responsible for fever can inform antibiotic selection practices. This promotes antibiotic stewardship, minimizing the emergence of multidrug-resistant organisms and optimizing resource utilization.

**Giving a consideration for non infectious causes of fever;** not all fever in SICU are caused by infectious etiologies. We need to include non infectious causes of fever in our differential diagnosis while managing a patient developing fever so all patients should not be started with antibiotics for fever so this reasearch will show the prevalence of non infectious causes of fever

#### **Local Context and Evidence-Based Practices:**

**Data for Local Guidelines:** This study will provide much-needed data on the specific epidemiology of fever in critically ill surgical patients at Tikur Anbessa SICU. This

information can be used to develop locally-relevant guidelines for fever management, improving the quality of care provided to this patient population.

**Contribution to Global Knowledge:** The findings will contribute to the global understanding of fever in ICU , particularly in resource-limited settings. This knowledge exchange can benefit other hospitals facing similar challenges.

By addressing the knowledge gap regarding fever in critically ill surgical patients at Tikur Anbessa SICU, this study has the benefit to optimize resource allocation, and contribute to advancements in fever management in critical care settings.

## **2. Literature Review**

### **2.1 Introduction**

Fever is a frequent and clinically significant occurrence among critically ill patients admitted to Surgical Intensive Care Units (SICUs) worldwide. It serves as a cardinal sign of systemic inflammation and can stem from various infective and noninfective etiologies, influencing patient outcomes and necessitating vigilant management strategies.

### **2.2 Incidence and etiologies of fever of Fever in SICU Patients**

The occurrence of fever in ICU settings is indeed quite variable, as indicated by studies in the field. Typically, fever rates can range widely from 20% to 70%. This variability can be attributed to several factors, including the diverse demographics and health conditions of patients admitted to ICUs, as well as the complex nature of conditions that precipitate fever in such environments [4, 10, 13].

A retrospective research done in Department of Neurology Zhongda Hospital, Southeast University, Nanjing, China in 2008 . One hundred and thirty-seven patients were included in the final analysis. Febrile episodes occurred in 65% (89/137) of the patients; 48.9% of the fever were explained by infection (predominantly pneumonia or bronchitis), and 15.3% were unexplained despite a complete diagnostic evaluation. Significant risk factors for any fever included age 65 years or older, impaired consciousness, extremity paralysis (muscle force  $\leq$  grade 3), center venous catheterization and tracheal intubation. In addition to those risk factors, the length of the stay at NICU (neurologic intensive care unit )before the fever was

also a significant risk factor for explained infectious fever. These results suggest that critically ill patients treated in NICU (neurologic intensive care unit) often have fever. The risk factors for different types of fever vary considerably..[14]

An inception-cohort study done in Philadelphia USA in 2004, Among 2,419 screened patients admitted to ICU 626 patients (26%) developed fever. Febrile patients were older, sicker, more likely to have undergone emergency surgery, more likely to develop organ dysfunction, and more likely to die. The mean day of onset of fever was day 1 and the mean peak temperature for the episode was  $39.1 \pm 0.1^\circ\text{C}$ . For most patients, it was their only episode of fever, with a mean of  $1.4 \pm 0.1$  episodes/patient. 46% of febrile patients were found to have an infectious cause of fever.[15]

A retrospective cohort study conducted at University of Calgary, Canada on from February . 2000–2006 Fever was defined by temperature  $\geq 38.3^\circ\text{C}$  and high fever by  $\geq 39.5^\circ\text{C}$ . Among a total of 24,204 ICU admission the cumulative incidence of fever and high fever was 44% and 8% and the incidence density was 24.3 and 2.7 per 100 days of ICU admission, respectively. The incidence density of fever was higher in trauma/neuro patients, males, younger patients, and was lower in those with admission Acute Physiology and Chronic Health Evaluation II scores  $\geq 25$ . 17% and 31% of patients with fever and high fever had associated positive cultures. Prolonged fever and high fever lasting for 5 or more days in the ICU occurred in 18% and 11% of febrile patients.[16]

A prospective cohort study done in Chung Ang University College of Medicine, Seoul, Korea From February to June 2007, patients admitted to ICU were daily screened and those who developed fever were enrolled. 237 consecutive admissions of 237 patients over a 5-month period were analyzed. Fever (core temperature  $\geq 38.3^\circ\text{C}$ ) was present in 8% of admission, and it was caused by infective (84.2%) and non-infective processes (15.8%). Most fever occurred within first 5 days in the course of the admission (68.4%) and most lasted less than 5 days (57.9%). The most common cause of infective fever was pneumonia.[17]

A prospective study done in March 2003 USA studied the frequency and causes of fever, among 387 patients consecutively admitted to their NICU (neurologic intensive care unit). Fever occurred in 23% (87/387) of patients. Fifty-two percent of fevers were explained by infection (predominantly pneumonia or bronchitis), and 28% were unexplained despite a complete diagnostic evaluation. NICU length of stay was a risk factor for all three types of fever, other risk factors included depressed level of consciousness and endotracheal

intubation and intraventricular catheterization .Subarachnoid hemorrhage increased the risk of both infectious and unexplained fever.[18]

A Prospective, observational study done in nine-bed general ICU in a 500-bed tertiary care Imperial College School of Medicine, Hammersmith Hospital, London, UK follows a 100 consecutive admissions of 93 patients over a 4-month period between July and October 1996 founds ,Fever was present in 70 % of admissions, and it was caused by infective and non-infective processes in approximately equal number. Most fevers occurred early in the course of the admission, within the first 1–2 days, and most lasted less than 5 .The most common cause of non-infective fever was in the group designated post-operative fever. [19]

Another study suggests prevalence of ICU fever ranges from 26% to 70% depending on the population studied and the definition of fever used also Infectious and noninfectious causes are equally represented.[1].

Fever of non-infectious and neurologic origin affects about 50 % of patients with elevated body temperature, presents as a pathologic loss of thermoregulation, and may be associated with untoward side effects at temperatures above 38.5–39.0 °C.[13]. In surgical ICUs, fever occurs most commonly on postoperative day 1.[1]

The high incidence of fever in ICU patients underscores its importance as a clinical symptom that requires close monitoring and appropriate management. Understanding the epidemiology of fever in ICUs helps healthcare providers tailor treatment strategies to effectively address this common manifestation of critical illness.

### **2.3 Predictors of Fever in SICU Patients**

Fever incidence in SICU patients varies widely, impacted by various things such as patient status , underlying conditions, and environmental factors. Old age, male sex, septic shock, trauma, emergent surgery, and neurocritical illness are associated with the development of fever.[1]

Patient demographics, including age and underlying health conditions, significantly influence the incidence fever in SICU patients. Several studies highlight these factors as critical determinants Older patients tend to have a higher likelihood of developing fever in SICU settings. This may be due to age-related declines in immune function or increased susceptibility to infections. For instance, research has shown that older patients undergoing procedures like

endoscopic submucosal dissection for colorectal tumors are more prone to post-procedural fever [20].

Patients with pre-existing health issues, such as large tumors or chronic diseases, are also at higher risk of developing fever following surgical procedures or due to complications arising from their conditions. These underlying conditions can predispose them to infections or inflammatory responses that manifest as fever [21]. In critically ill patient populations, those admitted with septic shock, fever is a common symptom. Studies have indicated that fever is prevalent in such cases, with the median age of febrile patients typically around 56 years [22]. This demographic insight helps in understanding the context and potential causes of fever in these patients.

These findings underscore the importance of tailoring fever management strategies in SICU based on patient demographics. Older patients and those with significant underlying conditions may require more vigilant monitoring and targeted interventions to address fever promptly and effectively.

## **2.4 Conclusion**

Understanding the incidence, predictors, and common causes of fever in SICU at TASH is crucial for informing evidence-based clinical practices. By elucidating these factors, healthcare providers can implement targeted monitoring protocols and early intervention strategies to mitigate complications associated with fever and improve patient outcomes in intensive care settings. Future research should continue to explore novel approaches to fever management and validate predictive models tailored to diverse patient populations in Ethiopian healthcare contexts.

## **3 Objectives**

### **3.1 General Objective**

- To investigate the incidence, predictors, and etiologies of fever in critically ill patients admitted to the Surgical Intensive Care Unit (SICU) at TASH in Addis Ababa, Ethiopia. September 2023 to september 2024

### **3.2 Specific Objectives**

- To determine the incidence of fever among critically ill surgical patients admitted to the SICU at TASH in Addis Ababa, Ethiopia. September 2023 to september 2024

- To identify the predictors associated with the development of fever among critically ill surgical patients admitted to the SICU at TASH in Addis Ababa, Ethiopia. September 2023 to september 2024
- To identify the etiologies of fever in critically ill surgical patients admitted to the SICU at TASH in Addis Ababa, Ethiopia. September 2023 to september 2024

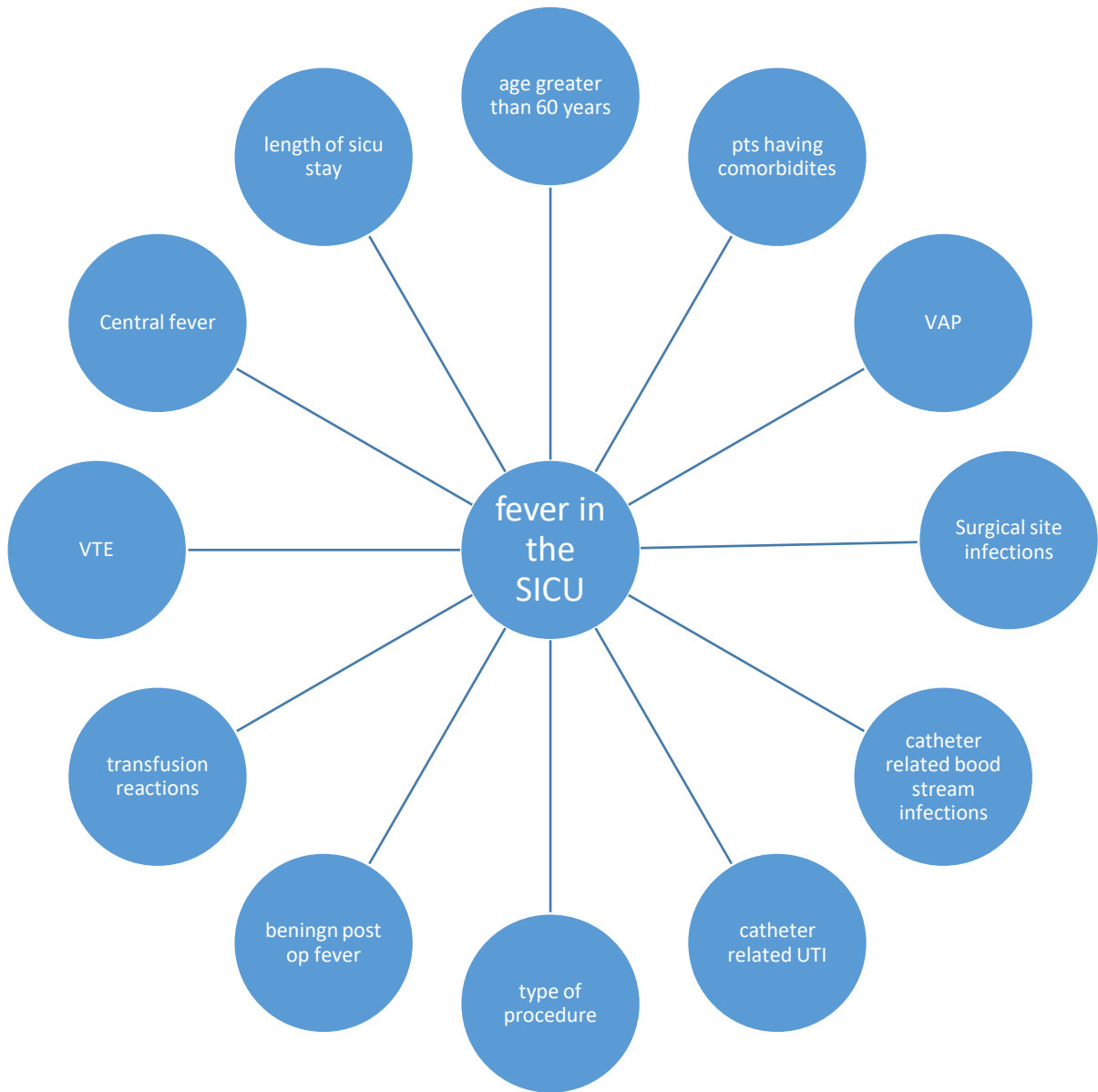


Figure 1; Conceptual framework of common etiologies and associated factors of fever in SICU

## **4 . Methodology**

### **4.1 Study Design**

This research was carried out as a retrospective observational design to investigate the incidence, predictors, and etiologies of fever in critically ill patients admitted to the SICU at TASH in Addis Ababa, Ethiopia. from september 2023 to september 2024

### **4.2 Study Setting**

In this study, data was collected retrospectively from charts of critically ill patients who were admitted to TASH ,SICU from september 2023 to september 2024 . TASH is the highest referral hospital in the country. The hospital has adult ICU which has 3 categories (SICU Medical ICU and cardiac ICU ).SICU has a capacity of 10 bed and 10 mechanical ventilators and provides critical care services to postoperative surgical patients as well as trauma and emergency surgery cases. The SICU is runned by an intensivist and the anesthesiologist. The nurse to patient ratio is approximately 2:1

### **4.3 Source population**

source population includes all adult patients (aged 18 years and above) admitted to the SICU during the study period

### **4.4 Study Population**

study population includes all adult patients (aged 18 years and above) admitted to the SICU during the study period who developed fever

### **4.5 Study period**

The data collection was conducted between December and January 2024 from patient charts who were admitted to SICU from September 2023 to September 2024

## 4.6 Inclusion criteria

All adult patients (aged 18 years and above) admitted to the SICU during the study period was eligible for inclusion.

## 4.7 Exclusion criteria

- Patients with a known diagnosis of fever on admission or
- Those transferred from other healthcare facilities with an existing febrile condition
- Those patients whose chart is not well documented

## 4.8 Sample Size determination

a single population proportion formula was used to determine the sample size. In a previous study done on incidence of fever in ICU was 80%.<sup>[4]</sup>

$$N = \frac{(Z_{\alpha/2})^2 \times P(1 - P)}{(d)^2}$$

Where N: is maximum sample size

$Z_{\alpha/2}$ : is standard score value for 95% confidence level which is equal to 1.96

P: is expected prevalence or proportion

D: is the margin of error

$$= \frac{(1.96)^2 \times 0.8 \times (1-0.8)}{(0.05)^2} = 245$$

source population is < 10,000 the adjusted sample size will be calculated as

N=the total SICU admitted patients in past 1 year which is 400

$n = \frac{no}{(1-n0/N)}$   $n = \frac{245}{(1+245/400)}$

n=151

final sample size was 151

## 4.9 Sampling technique

- Participants were selected through the application of a simple random sampling approach

## 4.10 Data Collection

Data was obtained retrospectively by a standardized case report form (CRF) designed for this study. The CRF captured information from the following sources:

**Medical records review:** Demographic information, surgical details (type of surgery, duration), vital signs (including temperature), laboratory investigations (complete blood count, inflammatory markers, cultures), medications administered, imaging studies (chest X-ray, CT scans), and in-hospital events.

**chart review:** Assess for the development of fever during the ICU stay from their medical records

**Physician diagnosis:** Underlying cause of fever, if identified, based on physician judgment and available clinical data.

Upon SICU admission, demographic data including age, gender, and comorbidities was collected. During the SICU stay, daily temperature measurements along with clinical assessments for signs of infection or non-infectious causes of fever was documented.

Potential predictors associated with the development of fever such as comorbidities (diabetes mellitus, chronic obstructive pulmonary disease), surgical procedures or trauma type (elective vs. emergency surgery), presence of invasive devices, and severity scores on admission was analyzed.

Investigations including CBC , blood cultures, urinalysis along with CXR or CT scans as clinically indicated will aid in identifying potential infectious etiologies contributing to fever episodes. In addition to these investigations drug-related reactions and non-infectious causes leading to febrile conditions would also be explored.

## 4.11 Study Variables

### Dependent Variable

Prevalence of fever in patients admitted to SICU

### Independent Variables

age > 60, comorbidities, surgical procedure type, length of sicu stay.

## 4.12 Statistical Analysis

The data were examined through descriptive statistics to summarize patient demographics, clinical characteristics, and fever prevalence. Descriptive statistics such as mean incidence rate per 100 admissions along with frequency distributions for predictors and etiologies contributing to fever episodes among critically ill patients in the SICU setting at Tikur Anbesa Specialized Hospital would provide essential insights into this patient population. Logistic regression analyses was used to identify factors associated with the development of fever in the SICU. These analyses will help determine independent predictors of fever while controlling for potential confounding variables. All statistical analyses was conducted using appropriate software, and a p-value of less than 0.05 will be considered statistically significant.

## 4.13 Operational definition

- **Fever** in an ICU patient is defined as a single temperature of  $\geq 101$  degrees F or  $\geq 38.3$  C
- **High grade fever** is defined as a single temperature of  $\geq 39.5$  C
- **Prolonged fever** is a persistent fever in the icu lasting greater than 5 days

● **Early onset fever** in the icu if onset of fever with in 2 days of admission to SICU

● **benign post op fever** ; Low-grade fever occurs within the first 48 hours post-op: Short-lived: resolves on its own no signs of infection.

● **central fever** ; non-infectious Persistent and high-grade fever that originates from a neurological cause no evidence of infection

● **non infectious causes of fever** ; elevations in body temperature that after a thorough investigation were no sign of infection

#### **4.14 Ethical Considerations**

This study was adherent to ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the ACCPM departement of Tikur Anbessa Specialized Hospital.. Confidentiality of patient information was maintained throughout the study and during data analysis and publication.

## 6. RESULT

### Section 1: Patient Demographics

Out of 151 patients admitted to the SICU, 80 (53%) were males and 71 (47%) were females. The majority, 107 patients (70.4%), were under the age of 60. The mean age of the participants were  $42.8\text{yrs} \pm 16.5$ . Additionally, 87 patients (57.6%) had associated co-morbidities like hypertension, DM, CKD, and others. (See table 1 below).

Variables	Frequency	Percent	
Age(year)	<60	107	70.4
	$\geq 60$	44	28.9
Sex	Male	80	53
	Female	71	47
Presence of co-morbidity	Yes	87	57.6
	No	64	42.4

Table 1 Sociodemographic and comorbidities for patients admitted at SICU

Among the patients admitted to the SICU, 115 (76.2%) were admitted following elective surgeries. Neurosurgical procedures were the most common, accounting for 52 patients (34.4%) of cases, followed by cardiothoracic surgeries in 26 patients (17.2%) and gastrointestinal surgeries in 22 patients (14.6%)

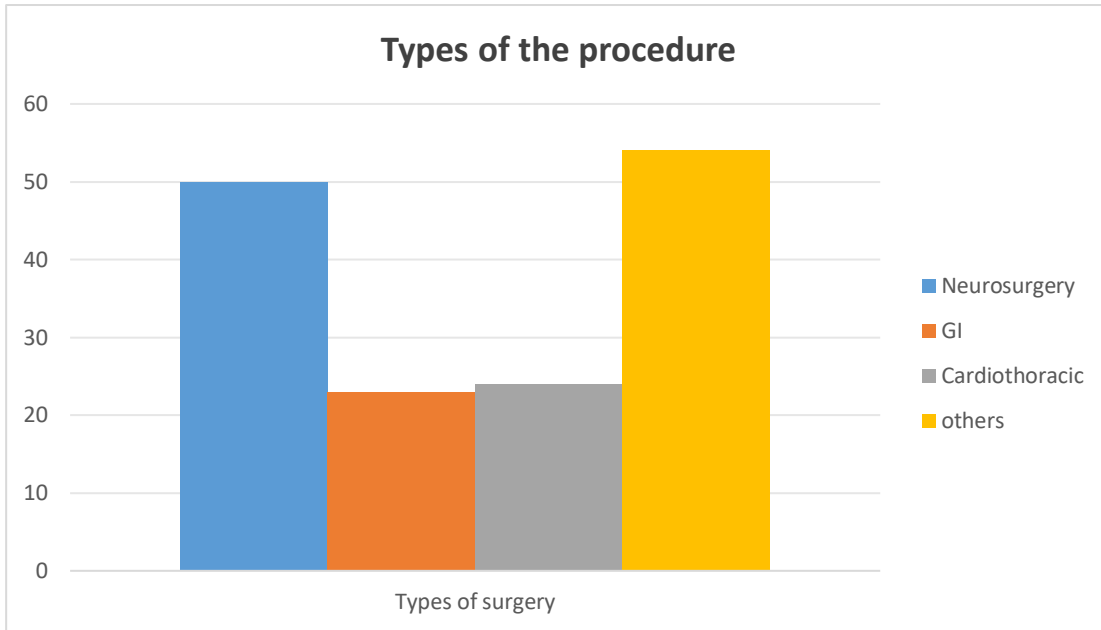


Figure 1 types of procedure

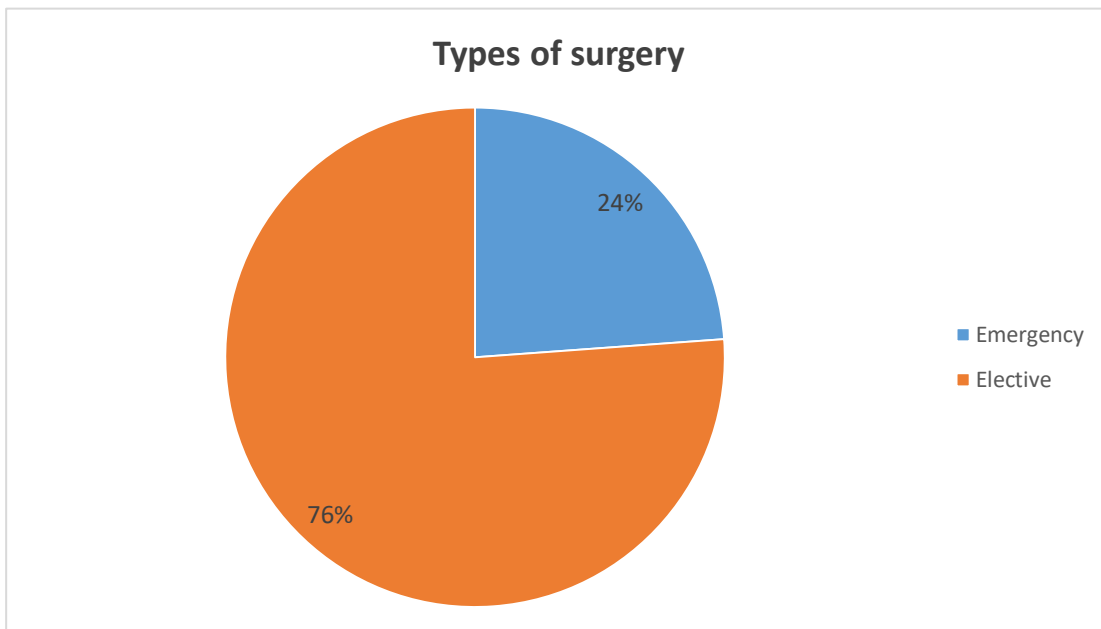


Figure 2 types of surgery

Regarding the occurrence of fever in surgical ICU, 76 patients (50.3%) experienced fever, with 48 cases (31.8%) developing after 48 hours of admission. Low-grade fever was observed in 68 patients (89.5%). In terms of duration, prolonged fever lasting more than 5 days was 19 (25%)

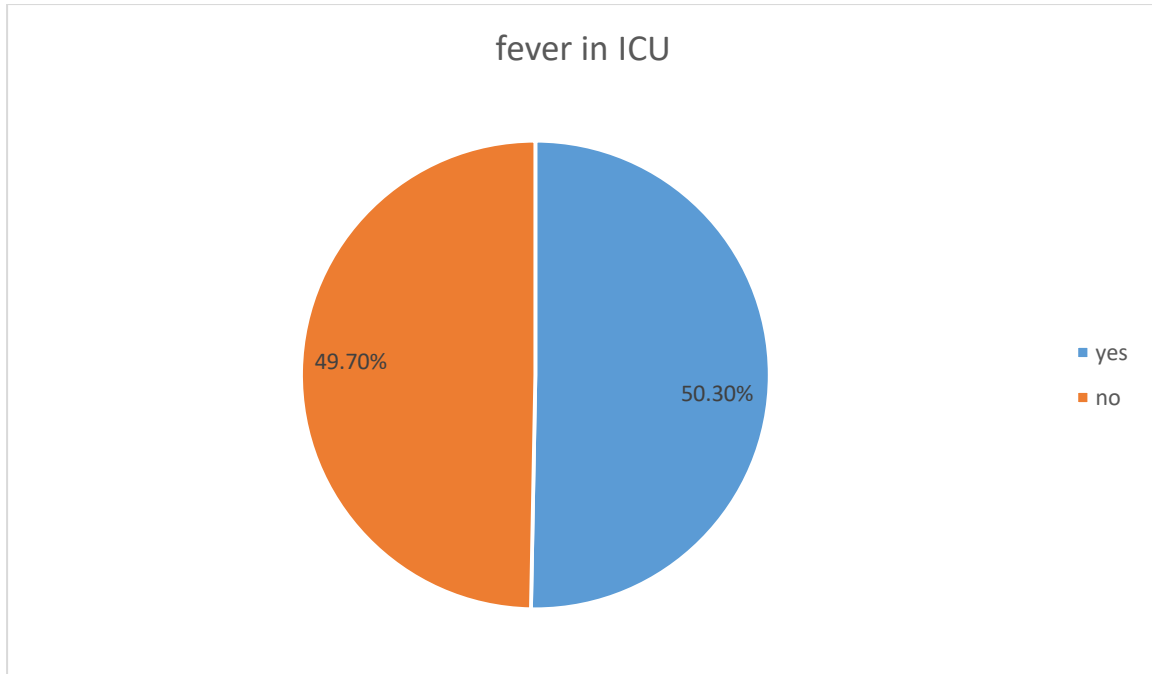


Fig 3. Incidence of fever

Variables	Frequency(N=76)	Percent(%)	
Onset of fever	<=48hrs	28	36.8
	>48hrs	48	63.2
Degree of fever	<39.5c	68	89.5
	>=39.5c	8	10.5
Duration of fever	<3 days	17	22.4
	3-5 days	40	52.6
	> 5 days	19	25

Table 2 incidence of fever in SICU

Among the patients admitted to the SICU who developed fever, an infectious cause was identified in 61 cases (80.3%). Of these, 17 patients (27.8%) had surgical site infections (SSI), and 14 patients (22.9%) developed ventilator-associated pneumonia (VAP). Fever was attributed to non-infectious causes in 15 patients (19.7%), including 7 cases (46.6%) of benign postoperative fever and 4 cases (26.6%) of central fever

Causes of fever		Frequency	Percent(%)
Infectious cause (n=61)	VAP	14	22.9
	SSI	17	27.8
	UTI	4	6.6
	CNS infections	7	11.5
	HAI	9	14.8
	Other	10	16.4
Non-infectious cause (n=15)	Dehydration	1	6.7
	Central fever	4	26.6
	Thromboembolic disease	2	13.4
	Benign POP fever	7	46.6
	Others	1	6.7

Table 3 causes fever among patients admitted at SICU

Among the patients who developed fever, 66 (86.8%) were started on antibiotics. This included 46 patients with infectious causes and 17 patients with non-infectious causes

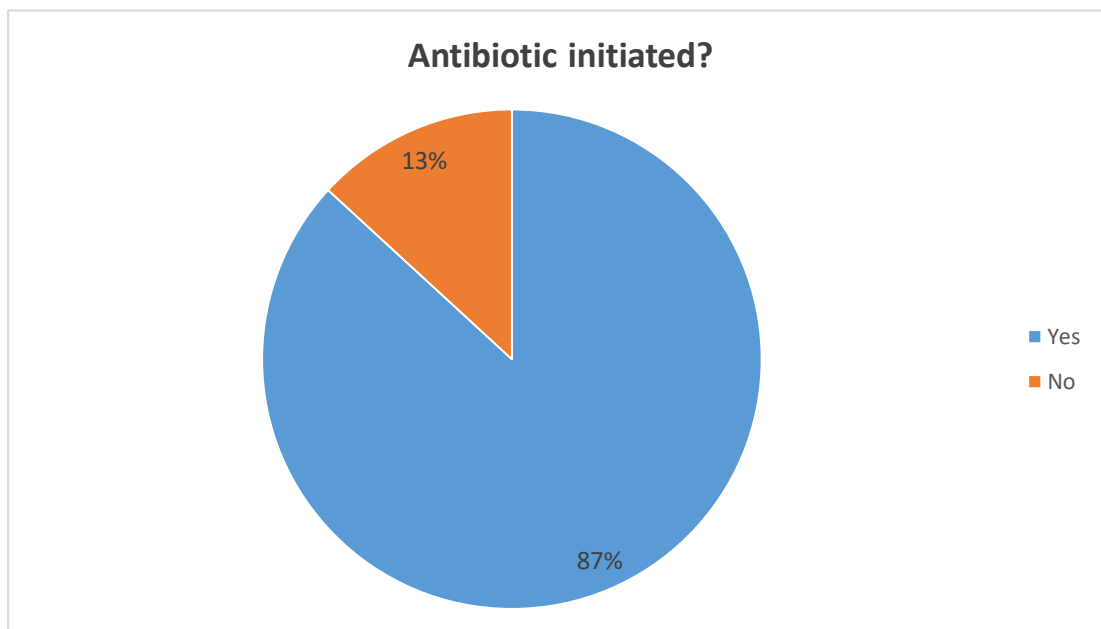


Figure 3 antibiotics initiated for patients who developed fever

### **Factors associated with Fever in patients who was admitted in the ICU**

In the SICU, the occurrence of fever is significantly linked to factors such as being over 60 years old, staying in the ICU for more than one week, having existing health conditions, the type of surgery performed, and whether the procedure was elective or emergency. Patients over the age of 60 were approximately 5 times more likely to develop a fever after SICU admission compared to those under 60 (AOR: 5.198 95% CI 2.282-11.839). Similarly, patients who remained in the ICU for over a week had double the risk of developing fever compared to those with a shorter stay (AOR: 2.051; 95% CI: 1.033–4.073). The presence of co-morbid conditions also increased the likelihood of fever by nearly 2.8 times (AOR: 2.876; 95% CI: 1.320–6.262). Conversely, individuals who underwent elective surgeries were 90% less likely to experience fever in the SICU than those who had emergency procedures (AOR: 0.095; 95% CI: 0.029–0.309). As for the type of surgery, patients undergoing gastrointestinal (GI) and neurosurgery operations were 3.7 times (AOR: 3.702; 95% CI: 1.022–13.405) and 3.2 times (AOR: 3.211; 95% CI: 1.115–9.25) more likely, respectively, to develop a fever in the SICU.

Variables		Fever		COR	P-value	AOR
		Yes	No			
Age	60 and above	33	11	4.465(2.638-9.782)	<b>0.00</b>	<b>5.198(2.282-11.839)</b>
	Less than 60	43	64	1		1
Sex	Female	35	36	0.925(0.488-1.753)	0.811	
	Male	41	39	1		
Length of icu stay	7 days or more	52	37	2.225(1.147-4.316)	<b>0.040</b>	<b>2.051(1.033-4.073)</b>
	Less than 7 days	24	38	1		1
Co-morbidities	Yes	61	26	3.215(1.570-7.912)	<b>0.008</b>	<b>2.876(1.320-6.262)</b>
	No	27	37	1		1
Types of surgery	Elective	49	64	0.312(0.141-0.690)	<b>0.001</b>	<b>0.095(0.029-0.309)</b>
	Emergency	27	11	1		1
Procedure type	Neurosurgery	31	21	2.952(1.072-8.134)	<b>0.031</b>	<b>3.211; 95% CI: 1.115–9.25</b>
	Cardiothoracic	9	17	1.059(0.328-3.418)	0.924	
	GI	15	7	4.286(1.246-14.735)	<b>0.046</b>	<b>3.702; 95% CI: 1.022–13.405</b>
	ENT	13	14	1.857(0.596-5.783)	0.285	
	Others	8	16	1		1

Table 4 factors associated with fever in SICU

## 7. Discussion

In this study, out of 151 study participants, 76 patients (50.3%) developed fever. Among those with fever, an infectious cause was identified in 61 patients (80.3%), and non-infectious causes were identified in 15 patients (19.7%), but 66 patients (86.8%) were started on antibiotic therapy. In the SICU, the occurrence of fever is significantly linked to factors such as being over 60 years old, staying in the ICU for more than one week, having existing health conditions, the type of surgery performed, and whether the procedure was elective or emergency.

The incidence of fever in this study was lower, but most of the predictors associated with fever were similar and the incidence of infectious causes of fever was higher than a retrospective study done in China in 2008.

The incidence of fever in the current study was lower and the incidence of non-infectious causes of fever also was lower when compared to a previous study conducted in London, UK, in 1996, where fever was observed in 70% of hospital admissions.

The incidence of fever in this study was higher and the incidence of non-infectious causes of fever was lower than a study conducted in the United States reported that fever occurred in 23% of patients. Of these cases, 52% were attributed to infections, while 28% remained unexplained even after thorough diagnostic evaluation.

The incidence of fever in this study was higher than a prospective cohort study conducted in South Korea in 2007, which found that fever occurred in 8% of hospital ICU admissions.

The incidence of fever in ICU was found in this study to be higher compared to a retrospective cohort study conducted at the University of Calgary, Canada from February 2000–2006.

The incidence of fever in the ICU as well as the incidence of infectious causes in the current research is greater than an inception-cohort research conducted in Philadelphia, USA in 2004.

## **8. Conclusion**

Incidence of fever is high among patients admitted to SICU at TASH and being old age . 60 ,prolonged SICU stay ,emergency surgeries ,having comorbidities , were identified as statistically significant risk factors for the development of fever. infectious causes of fever were by far the commonest cause but still fair amount of fever were caused by non infectious causes . These findings highlights the importance of continuous monitoring of critically ill patients who are admitted to SICU and to look for those predictors and whenever patients develop fever to thoroughly examine and investigate and start management immediately according to the underlying causes .

## **9. Strength and limitation of the study**

Some of strengths includes avoiding recall bias, objective data source, foundation for future research, utilization of existing data.

Limitations of the study was difficulty in getting all the required information on the patient chart because of poor documentation, difficulty of the physician to rule out infectious or the non infectious cause of fever because of lack of all the necessary investigations which has an impact on the incidence on both causes ,and lack of local research papers and data .

## **10.Recommendation**

The results of this study shows the higher incidence of fever in patients admitted to SICU especially those who has predicting factors so it is recommended to be vigilant and increase our monitoring in order to identify fever. Not all fevers are caused by infection so our approach to fever in the icu need to be inclusive and need to go through all the possible differential diagnosis including the non infectious and rare causes of fever. The results shows a fair amount of fevers are caused by non infectious orgin but almost most of the patients were on braod spectrum antibiotics, fever is not equivalent with infection so better usage of antibiotic stewardship is recommended. One of the challenges in the SICU of TASH is lack of monitoring so for the adminstration its recommended to fullfil monitors for all icu patients. The significance of fever in critically ill patient is still an under studied area and have a conflicting results so its recommended for all concerned researchers to conduct furter studies on effect of fever on morbidity ,mortaity ,duration of icu stay and over all cost on crtically ill patients admitted to SICU.

## Questionnaire

1. Patient ID: \_\_\_\_\_
2. Age: \_\_\_\_\_
3. Sex:
  - Male
  - Female
4. Admission Date: \_\_\_\_\_
5. Discharge Date: \_\_\_\_\_

### Section 2: Clinical Information

1. Diagnosis upon Admission: \_\_\_\_\_
2. Comorbidities (check all that apply):
  - DM
  - HTN
  - COPD
  - CKD
  - Others: \_\_\_\_\_
3. Surgical Procedure (if applicable): \_\_\_\_\_
4. Type of Surgery:
  - Emergency
  - Elective

### Section 3: Fever Assessment

1. Fever on Admission:
  - Yes
  - No
  - If yes, temperature: \_\_\_\_\_ °C
2. Fever Development during SICU Stay:
  - Date of onset: \_\_\_\_\_
  - Maximum temperature recorded: \_\_\_\_\_ °C
  - Duration of fever: \_\_\_\_\_

### Section 4: Laboratory Investigations

1. Blood Cultures Taken:
  - Yes
  - No
  - If yes, results: \_\_\_\_\_
2. Other Cultures (check all that apply):
  - Urine Culture
  - Sputum Culture
  - Wound Culture
  - Others: \_\_\_\_\_
3. Relevant Laboratory Results:

- White Blood Cell Count: \_\_\_\_\_ (cells/mm<sup>3</sup>)
- CRP: \_\_\_\_\_ (mg/L)
- Procalcitonin: \_\_\_\_\_ (ng/mL)
- Others: \_\_\_\_\_

Section 5: Treatment and Outcome

1. Antibiotics Administered:
  - Yes
  - No
  - If yes, list: \_\_\_\_\_
2. Response to Treatment:
  - Improved
  - Unchanged
  - Worsened
3. Outcome at Discharge:
  - Discharged Home
  - Transferred to another Unit
  - Deceased

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