DETERMINANTS OF SURGICAL MANAGEMENT OUTCOME FOR ESOPHAGEAL CANCER PATIENTS TREATED AT TIKUR ANBESSA SPECIALIZED HOSPITAL, MINILIK II HOSPITAL, ST PETER HOSPITAL; ADDIS ABABA, ETHIOPIA: MULTI-CENTRE STUDY

BY

DESALEGN FEKADU (MD)

FINAL THESIS TO BE SUBMITTED TO TIKUR ANBESSA SPECIALIZED HOSPITAL, DEPARTMENT OF SURGERY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR SUBSPECIALITY CERTIFICATE IN CARDIOTHORACIC SURGERY

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ADDIS ABABA, ETHIOPIA

ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES

DEPARTMENT OF SURGERY

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BY

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JULY, 2024

ADDIS ABABA, ETHIOPIA

DECLARATION

I, Desalegn Fekadu, do hereby declare that this research result is a result of the works of my own making except where credit is given in a review of the previous literatures in the content and by my knowledge, has never been submitted for any academic award or qualifications in this institution.

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Department of Surgery/ Institutional Review Board approval

The undersigned have examined an institution-based study on determinants of surgical management outcome for esophageal cancer patients treated at Tikur Anbessa Specialized hospital, Minilik II Hospital, St Peter hospital; Addis Ababa, Ethiopia: multi-centre study by Dr. Desalegn Fekadu, with registration number GSR/5601/14, a candidate for sub-specialty certificate in cardiothoracic surgery and hereby certifies that it is a worthy of acceptance.

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ABSTRACT

Introduction: Esophageal cancer (EC) is an insidious malignant disease affecting the esophagus, originates in the esophagus, muscular tube between the throat and stomach. It has two major histological subtypes: squamous cell carcinoma and adenocarcinoma. Globally, esophageal cancer is the seventh leading type of cancer and in addition, it remains a significant cause of mortality and morbidity worldwide. The management of esophageal cancer involves a multidisciplinary approach, including surgery, radiation therapy, and chemotherapy. The study aims to shed light on the various elements affecting the success of esophageal cancer surgical management, ranging from patient demographics to treatment modalities employed at TASH, Minilik II and St Peter Hospitals.

Objectives: Determinants of surgical management outcome for esophageal cancer among patients treated at Tikur Anbessa specialized hospital Minilik II Hospital and St Peter Hospital, Addis Ababa, Ethiopia, 2021-2024.

Methods: A retrospective cohort study was conducted among patients treated at Tikur Anbessa specialized hospital, Minilik II Hospital and St Peter Hospital. The study subjects were all esophageal cancer patients treated at TASH, Minilik II Hospital and St Peter Hospital over the last three years. Data were collected using a semi-structured questionnaire and checklist. Data were entered and analyzed using SPSS version 20 and EPI-info version 7 statistical packages. In the analysis process, frequency distribution of variables was calculated. To ascertain the association between dependent and independent variables, odds ratio with 95% confidence interval was calculated. A multiple logistic regression used to estimate the magnitude impact of each predictor variables on outcome variable after adjusting for all other predictors in the model.

Results: The finding of this study revealed the overall good esophageal surgical treatment outcomes treated at TASH, Minilik II Hospital and St Peter Hospital in Addis Ababa, Ethiopia found to be 110(91.2%). Accordingly, the findings highlight the complex interplay of various factors influencing surgical outcomes in esophageal cancer. Older age, advanced disease stage, the presence of co-existing health conditions, blood loss during surgery, and Post-Operative Complications were factors positive predictors' of increased mortality after esophageal cancer surgery.

Conclusion and recommendations: There was a high mortality rate. Age, comorbidity, blood loss in surgery and post-operative complication are mortality predictors' in esophageal surgery. Hence, it is essential to improve the survival of patients through early detection and timely initiation of the available treatment options.

Key Words: *Esophageal, surgical outcomes, TASH.*

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LIST ACRONYM /ABBREVIATIONS

AAU	Addis Ababa University
AOR	Adjusted Odds Ratio
COR	Crud Odds Ratio
CNCD	Chronic Non Communicable Disease
EC	Esophageal cancer
GERD	Gastro Esophageal Reflex Disorder
NCDs	Non Communicable Disease
SPSS	statistical package for social science
TASH	Tikur Anbessa Specialized Hospital
WHO	World Health Organization

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1. INTRODUCTION

1.1 Background

Esophageal cancer is an insidious malignant disease affecting the esophagus, originates in the esophageal, a muscular tube between the throat and stomach. This crucial conduit facilitates the transport of food from mouth to stomach(1,2). Cancer of the esophagus develops when the normal cells lining its inner surface undergo abnormal changes and multiply uncontrollably. Esophageal cancer (EC) has two major histological subtypes: squamous cell carcinoma and adenocarcinoma. Squamous cell carcinoma arises in the upper and middle portions of the esophagus; It's globally predominant and significantly associated with consuming tobacco, alcohol, hot tea, processed meat and poor nutrition (2–4). On the other hand, Adenocarcinoma typically emerges in the lower esophagus and is linked to chronic gastro-esophageal reflux disease (GERD) and Barrett's esophagus (4).

Globally, esophageal cancer is the seventh leading type of cancer and in addition, it remains a significant cause of mortality and morbidity worldwide (2). GLOBOCAN 2020 report, approximately 604100(3.1%) new cases and 544076(5.5%) deaths, esophageal cancer incidence varies globally with its highest across the 'esophageal cancer belt', namely Asia 481552 and Africa 27546(1,2). The incidence and mortality is higher predominance in males due to the high prevalence of tobacco and alcohol consumption(3,6).

Ethiopia is one of the countries along the esophageal belt. A study from the largest referral hospital in Ethiopia indicated that esophageal cancer was more common among patients from Arsi and Bale when compared to other regions (2). A previous systematic review showed that morbidity of esophageal cancer was increasing at an alarming rate in the Sub-Saharan African regions with uneven geographical distribution. (5).

The management of esophageal cancer involves a multidisciplinary approach, including surgery, radiation therapy, and chemotherapy. This study encompasses the rising incidence of esophageal cancer globally, necessitating a comprehensive investigation into the factors influencing the surgical management outcomes of patients undergoing treatment in hospitals. Understanding the determinants of management outcomes is crucial for improving patient care and overall survival rates. The study aims to shed light on the various elements affecting the success of esophageal

cancer surgical management, ranging from patient demographics to treatment modalities employed at TASH, Minilik II Hospital and St Peter Hospital.

1.2 Statement of Problem

The management of esophageal cancer poses several challenges, ranging from diagnostic uncertainties to the effectiveness of different treatment approaches. This section aims to clearly articulate the specific issues or gaps in current knowledge and practices. For instance, it may address the varying success rates of treatments, the impact of comorbidities on outcomes, or disparities in access to quality care. Identifying and framing these problems will guide the research towards meaningful solutions.

Most patients are currently diagnosed at a late stage with local or distant metastasis. Besides, many therapies do not confer satisfying survival benefits compared to other cancer populations.(9) Despite improvements in managing esophageal cancer patients, the general outcome remains very poor.(4,10) However, a previous systematic review in Africa revealed a slightly improved survival with esophagectomy and chemoradiation therapy(1,7).

Postoperative complications are the major cause of mortality associated with esophageal cancers.(11). The 5year overall survival rate is minimal, with the lowest cure possibilities.(12–14). Despite the availability of several treatment options, such as surgery, chemotherapy, radiation therapy, and targeted therapy, the prognosis is still poor (surgical management outcome for esophageal cancer among patients treated) (8). Hence, achieving the desired goal of treatment remains challenging. This study aimed to assess the determinants of surgical management outcome for esophageal cancer among patients treated at TASH, Minilik II and St Peter Hospitals.

1.3 Significance of the study

Understanding the significance of the study is crucial for justifying the research effort. This section highlights the potential contributions of the research to the field of oncology and healthcare at large. It also emphasizes how addressing the identified problems can lead to improved patient care, better-informed treatment decisions, and advancements in esophageal cancer management strategies. Additionally, discusses any broader implications for public health or healthcare policy.

This study holds paramount importance in the realm of healthcare for several reasons:

Enhanced Patient Care: By identifying determinants of management outcomes, healthcare professionals can tailor treatment plans, leading to improved patient care and quality of life.

Guiding Treatment Strategies: Insights gained from this study can inform clinicians about the most effective treatment strategies for different patient profiles, contributing to better therapeutic decision-making.

Healthcare Resource Allocation: Understanding the factors influencing management outcomes helps in optimizing the allocation of healthcare resources, ensuring efficient use of facilities and personnel.

Advancement of Medical Knowledge: The findings of this study can contribute to the scientific understanding of esophageal cancer, fostering further research and advancements in the field of surgery and oncology.

In conclusion, this research aims to provide a comprehensive understanding of the determinants influencing the management outcomes of esophageal cancer patients treated in hospitals, ultimately contributing to advancements in healthcare practices and improved patient outcomes.

2. LITERATURE REVIEW

2.1 Concept of Esophageal cancer

Esophageal cancer is the leading cause of cancer-related mortality due to its subtle disease course and poor prognosis (4). Esophageal cancer represents the sixth most common cause of cancer mortality worldwide.(1) Underlying this cancer type are two distinct diseases characterized by different histologies: esophageal adenocarcinoma and esophageal squamous cell carcinoma(2,5).

2.2. Trend of esophageal cancer

The esophageal carcinoma has a public health problem in high incidence countries. The burden of esophageal cancer is different in geographical regions. According to the GLOBOCAN 2018 report, approximately 572,034 new cases and 508,585 deaths and 2020 report 604100(3.1%) and 544076(5.5%) from esophageal cancer were estimated worldwide (9). Esophageal cancer incidence varies globally, with its highest incidence across the 'oesophageal cancer belt', namely East and South African countries, and Asia (10)

The two main types of oesophageal cancers are squamous cell carcinoma and adenocarcinoma (4,5). Squamous cell carcinoma is more common in central, eastern, and southern parts of Africa, with the African esophageal squamous cell carcinoma (ESCC) corridor stretching from the southern part of Sudan to the Eastern Cape Province of South Africa (7). Ethiopia is one of the countries along the esophageal belt. A study from the largest referral hospital in Ethiopia indicated that esophageal cancer was more common among patients from Arsi and Bale when compared to other regions(9,11,12).

2.3. Determinant of management outcome for esophageal cancer

Socio-demographic factors, nature of esophageal cancer, surgical approach, integration of chemotherapy, either neo-adjuvant or adjuvant and preoperative nutrition status emerge as a critical determinants affecting surgical outcomes

2.3.1 Socio-demographic Factors:

Socio-demographic factors play a crucial role in determining surgical management outcomes for esophageal cancer. Numerous studies have explored the impact of variables such as age, gender, socioeconomic status, and ethnicity on patient response to surgical interventions(13). For example, research suggests that older age may be associated with increased postoperative complications, while socioeconomic disparities can influence access to optimal treatment

resources. Understanding these socio-demographic nuances is vital for tailoring surgical approaches to diverse patient populations(8,14).

3.2.2. Nature of Disease

The nature of esophageal cancer, particularly its histological characteristics, significantly influences surgical outcomes. Studies have showed the correlations between histology subtypes and response to surgical interventions. Variations in outcomes based on adenocarcinoma or squamous cell carcinoma histology have been identified. Additionally, research highlights the importance of recognizing histological variations to inform personalized treatment plans and address specific challenges associated with different subtypes(5,13,14).

2.2.3. Stage of Disease:

The stage of esophageal cancer at the time of surgical intervention is a critical determinant of treatment success. Literature reveals that early-stage cancers often yield more favorable outcomes compared to advanced stages(15). Accurate staging is essential for treatment planning, and studies emphasize the significance of timely diagnosis to optimize the effectiveness of surgical approaches. Understanding the relationship between disease stage and surgical outcomes guides clinicians in making informed decisions for patient care (5,12).

2.2.4. Treatment Approach:

The choice of surgical approach is a pivotal determinant in esophageal cancer management outcomes. Research has extensively explored various surgical techniques, comparing their efficacy and impact on patient recovery. Studies highlight advancements and modifications in surgical procedures, aiming to enhance success rates and minimize complications (12,14–16). Understanding different treatment option underscores the importance of tailoring treatment approaches based on individual patient characteristics and the specificities of the disease(15). Additional to treatment approach, Surgeon's experience (number of procedures performed) also determine the outcomes of surgical management of esophageal cancer (7,11,17)

2.2.5. Chemotherapy (Neoadjuvant or Adjuvant):

The integration of chemotherapy, either neoadjuvant or adjuvant, significantly influences surgical outcomes in esophageal cancer cases. Literature reviews emphasize the role of chemotherapy in conjunction with surgery to improve prognosis. Studies analyze the optimal

timing, combinations, and duration of chemotherapy regimens, shedding light on their impact on reducing tumor burden and enhancing the success of surgical interventions (7,17,18). Understanding the synergies between chemotherapy and surgery is vital for comprehensive cancer management(15,16,20).

2.2.6. Nutrition Status:

Preoperative nutrition status emerges as a critical determinant affecting surgical outcomes for esophageal cancer. Research explores the relationship between nutritional status and postoperative complications, emphasizing the importance of adequate nutrition in the perioperative period. Studies highlight interventions aimed at optimizing nutrition before and after surgery, recognizing their role in promoting recovery and minimizing adverse effects(3,5,21). Addressing nutritional needs as part of a holistic treatment approach is essential for improving overall patient outcomes. This emphasizes the role of nutrition in the perioperative period and how addressing nutritional needs is essential for improving overall outcomes after esophageal cancer surgery. These explanations provide a deeper understanding of each determinant and how they contribute to the overall surgical management outcomes for esophageal cancer (21).

2.3. Conceptual Frame Work

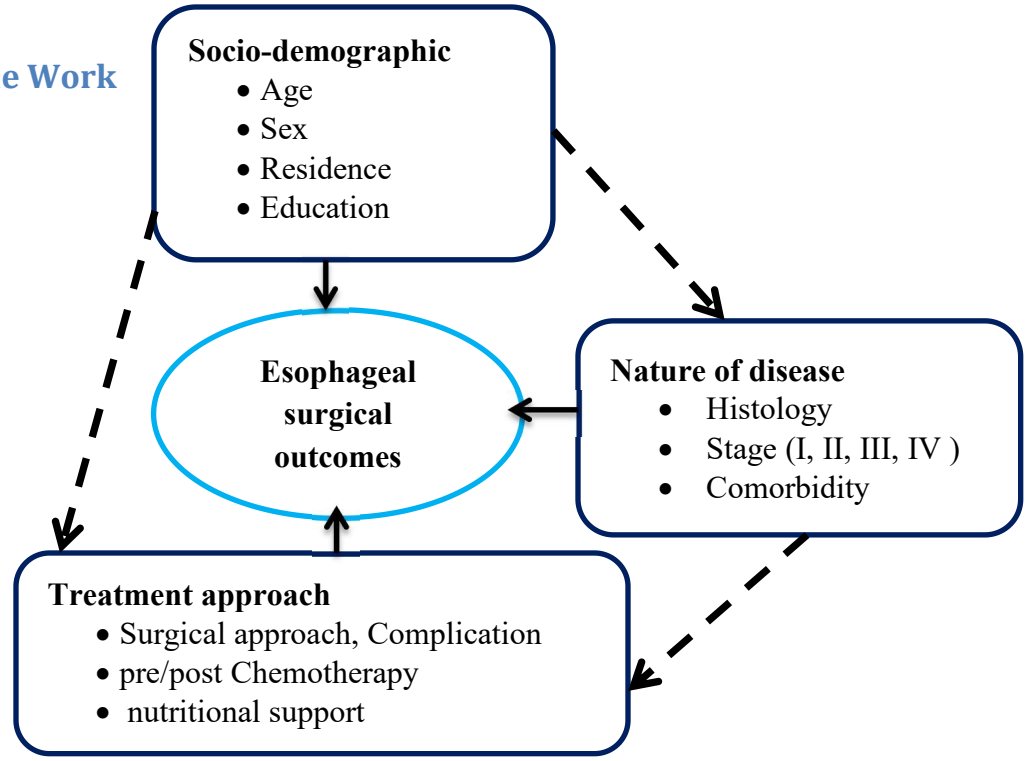

Figure 1 Adapted Conceptual Frame for determinant of surgical outcomes for esophageal cancer treated at TASH, Minili II and St Peter Hospitals (7,10,11)

3 OBJECTIVE

3.1 General Objective

- Determinants of surgical management outcome for esophageal cancer among patients treated at Tikur Anbessa specialized hospital, Minilik II Hospital and St Peter Hospital 2021-2024.

3.2 Specific Objective

- Assess outcome of esophageal cancer surgical management among patients treated at Tikur Anbessa specialized hospital, Minilik II Hospital and St Peter Hospital 2021-2024.
- Identify determinants of surgical management outcome for esophageal cancer among patients treated at Tikur Anbessa specialized hospital, Minilik II Hospital and St Peter Hospital 2021-2024.

4. METHODS AND MATERIALS

4.1 Study Setting and Period

The study was conducted at Tikur Anbessa Specialized hospital, Minilik II Hospital and St Peter Hospital, Addis Ababa, Ethiopia. Ethiopia, officially the Federal Democratic Republic of Ethiopia, is a landlocked country located in the Horn of Africa region of East Africa. It shares borders with Eritrea to the north, Djibouti to the northeast, Somalia to the east and southeast, Kenya to the south, South Sudan to the west, and Sudan to the northwest. Ethiopia covers a land area of 1,112,000 square kilometers (472,000 sq. miles). As of 2022, its projected population is estimated to be 105.17 million (19) making it the 2nd-most populous country in Africa next to Nigeria. Addis Ababa is a national capital and largest city.

TASH, established in 1972, is a public teaching hospital of the AAU, CHS. It is the largest referral hospital in the country with 700 in-patient beds. The hospitals provide different service range from chemotherapy to surgical services includes cardiothoracic surgery for cardiac, lung, and esophageal surgery.

Menelik II Referral Hospital is a public health care hospital in Addis Ababa, and is one of the oldest hospitals in Ethiopia. Named after Emperor Menelik II, it was established in 1909, serving as a tertiary care hospital that provides with specialized services in the country. It is located near Jan Meda on Russia St. It is one of the affiliates of TASH, AAU giving cardiothoracic surgery services as well.

St. Peter Hospital has a rich history that dates back to Sene 23, 1953EC, when it was established in Mesalemiya. Originally known as the TB Demonstration and Training Center, the facility was inaugurated by Emperor Haile Selassie after the land was acquired at a cost of 24,950 ETB. Spanning an area of 4,990 m^2, the hospital was situated in the Shewa Kefle Hager of Gefersa Wereda, specifically in Kolfe Kebele, which was a residential area for retired individuals and currently serving as a comprehensive specialized Hospital. It is one of the affiliates of TASH, AAU giving cardiothoracic surgery services as well.

The study was conducted on patients operated from February, 2021 to February, 2024.

4.2 Study design

A three (3) years retrospective cohort study was conducted using record review during the study period.

4.3 Population

4.3.1 Source Population

The source population was all patients who have undergone operations at thoracic operating rooms of the three hospitals.

4.3.2. Study Population

The study population was all patients who had been operated for a diagnosis of esophageal cancers during the study period.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion Criteria

All patients who have undergone surgical treatment for a diagnosis of esophageal cancer during the study period were included.

4.4.2. Exclusion Criteria

Patients with incomplete medical records and those who were unwilling to give information on phone call.

Those with post resection biopsy of other than carcer were also excluded.

4.5 Sample Size Determination

All patients who have undergone surgery for esophageal cancer during the study period were selected.

4.6 Study Variables

4.6.1. Outcome Variables

- postoperative survival
- postoperative recurrence

4.6.2 Independent Variables

Socio-demographic Characteristics;

- Age

- Sex
- Residence
- Religion
- Ethnics

Preoperative variables;

- presentation (symptoms, radiologic findings)
- duration of symptoms
- treatment for other presumptive diagnosis
- smoking history
- primary tumor site

Intraoperative variables (surgical approach)

- Mckeown esophagectomy
- Ivor Lewis esophagectomy
- Transiatal esophagectomy
- Sweet esophagectomy

Postoperative variables; tumor size, American Joint Committee on Cancer (AJCC) stage, histological type, margin status

4.7 Operational Definition

Mckeown esophagectomy- The **McKeown procedure** is an tri-incisional esophagectomy, right thoracotomy through 5th intercostal space, laparotomy and neck incision for anastomosis(22).

Ivor Lewis- In the Ivor Lewis esphagectomy, the esophageal tumor is removed through an abdominal incision and a right thoracotomy. The esophagogastric anastomosis is located in the upper right chest(23).

Transhiatal- The procedure is performed with an abdominal and a cervical incision and allows mobilization of the stomach as a conduit to the cervical esophagus and making anastomosis in the neck(20).

Sweet- Sweet esophagectomy (Sweet group) was defined as the partial esophagectomy and proximal gastrectomy with the removal of the abdominal and lower mediastinal lymph nodes. Patients were placed in the right lateral decubitus position. Thoracotomy was performed via the left sixth or seventh intercostal space and anastomosis is made in the left chest (24).

***Recurrence*;** a repeated occurrence of EC either at primary site or distant site following initial surgical resection (25,26)

***Postoperative survival*;** the duration patient is alive following the initial surgical treatment for esophageal cancer (27).

***Destroyed lung*;** total and irreversible destruction of one lung due to chronic bronchopulmonary infections, it is used for disease of an entire lung, not for damage of one or two lobes(28).

4.8 Data Collection Tool and Procedures

Data were collected using structured questionnaire prepared in English. Data were extracted from OR logbook, preoperative patient medical record, operation notes, pathologic record and postoperative follow up records. The data were also contacted by telephone address for additional information on their postoperative conditions. Patients who have surgery for recurrence Esophageal Cancer will be only included once and outcomes will be determined from the date of the first surgery. Three general practioner physicians (GP) were selected and trained on the purpose of the study and data collection procedures. Data was filled by the principal investigator and trained physicians.

4.9 Data processing and analysis

The collected data was compiled, organized, coded, entered and cleaned using Epi-info version 7.1 software packages and was analysed using SPSS version 20. In the analysis process, frequency distribution of variables was worked out in order to describe them.

Bivariable logistic regression analyses was used and Crude Odds Ratio (COR) with 95% CI was computed to assess the association between each independent and the outcome variables. Variables with p-value < 0.25 during the bivariable analyses were included in the multivariable logistic regression analysis. Multicollinearity between independent variables was checked using Variance Inflation Factor (VIF), and no significant (VIF > 10) collinearity was detected. Model goodness-of-fit was checked by Hosmer-Lemeshow test, and the final model was well fitted (p-value ¼ 0.36). The final model was performed to control for all possible confounding variables and identify factors associated with outcome variable by estimating AOR with 95% CI. Level of statistical significance was declared at p-value < 0.05.

4.10 Data quality management

To assure the quality of data, Instruments were commented by advisors and then pre-test was made on 5% of the sample size to identify problems on the questionnaire and correction was incorporated in the final questionnaires.

Training of data collectors and supervisor was given on the objectives and relevance of the study, confidentiality of information, and how to extract data from logbook and medical records.

Daily supervision was carried out by the principal investigator to monitor quality of the data collection process and checking the completeness and consistency of collected data. Double data entry with Epi-info and SPSS was used.

4.12 Primary Ethical consideration

Data collection was commenced after ethical approval is obtained from the Research Ethical Committee of surgery Department/IRB of AAU, CHS. Informed consent was taken from all patients for their willing, use of data for academic and research purposes. All contacted and included have agreed and participated. Medical record number was used for the data collection and personal identifier of the patient was not used in the research report. Access to the collected information was limited to the principal investigator and trained data collectors, so confidentiality was maintained throughout the project.

4.13 Data presentation and dissemination

The results of this study will be disseminated to AAU, all the three Hospitals, Regional health bureau, Ministry of health and other concerned bodies. Finally the findings will be presented in different seminars, meetings and workshops and published in reputable scientific journals

5. RESULTS

5.1 Socio-demographic characteristics of the study participants

A total of 122 eligible esophageal cancer patients were involved in the study. The mean age of patients was 55.9 years (SD: 14.8). Most study participants were males 79(64.8%) and more than half (55.7%) were from the Oromia region. (8%) and (2.5%) had a history of alcohol intake, smoking respectively.

Table 1 Socio-Demographic Characteristics of patients with esophageal cancer in TASH, Minilik II Hospital and St Peter Hospital, Addis Ababa, Ethiopia, 2023–2014(n=122).

Variables		Frequency	Percent
Age Category	<35	8	6.6
	35-45	24	19.7
	45-54	30	24.6
	55-64	60	49.2
Sex	Female	43	35.2
	Male	79	64.8
Institution (health facility)	Minik	33	27.1
	Tikur Anbesa	42	38.5
	St peter	47	34.4
Region	Oromia	68	55.7
	Addis Ababa	12	9.8
	Undocumented	18	14.8
	Amhara	13	10.7
	SNNPE	8	6.6
	Others	3	2.5
Resident	Urban	79	35.2
	Rural	43	64.8
Family History of cancer	Yes	0	0
	No	122	100
Alcohol consumption	Yes	8	6.6
	No	114	
smoking habit	Yes	3	2.5
	No	119	97.5

5.2. Histological type and Treatment options given to esophageal cancer patients at TASH, Minilik II Hospital and St Peter Hospital 2024.

The current study showed etiologically **99.2%** of esophageal cancer is primary type, out of this squamous cell carcinoma was the most common histological type of esophageal cancer 104, (85.2%). At the time of diagnosis, 34(27.9%), 63(51.6%) and 20(16.4%) patient were respectively in stages II, III and IV.

In addition, the lung and liver were the most common sites of distant metastasis. Comorbid diseases were present in 17(13.9%) participants. The most common coexisting conditions were Diabetes, hypertension, and retroviral disease (Table 2).

Regarding to treatment Options given to Patients Out of the total patients, 68(55.7%) were treated with trans-hiatal Esophagectomy surgical procedure, while 25(20.5%) sweet Esophagectomy. On other hand 10(8.2%) of them received chemotherapy, whereas only 1 (0.6%) was treated with Gastrostomy feeding tube.

Out of the total most patient 101(82.8%) had intraoperative blood loss <500ml, while remaining patients had intraoperative blood loss more than 500ml. More over few patients (32) (26.2%) experienced postoperative-complication but majority of them 90(73.8) had no experience of postoperative-complications (Table 2).

Table 2| Distribution of histologic types and Treatment options of patients with esophageal cancer in TASH, Minilik II Hospital and St Peter Hospital Addis Ababa, Ethiopia, 2023–2024(n=122).

	Variables	Frequency	Percent
Etiologic type of Cancer	Primary	121	99.2
	Secondary	1	0.8
Histologic type of Cancer	Adenocarcinoma	18	14.8
	Squamous cell carcinoma	104	85.2
Site of cancer	Upper third of the esophagus	0	0
	middle third of the esophagus	22	82
	Lower third of the esophagus	100	18
Stage of cancer	Stage I	5	4.1
	Stage II	34	27.9
	Stage III	63	51.6
	Stage IV	20	16.4
Comorbidity	DM	2	1.6
	Asthma	4	3.3

	RVI	5	4.1
	Hypertension	6	4.9
	None	105	86.1
Treatment received	Feeding tube	1	0.8
	Neo-Adjuvant chemotherapy	4	3.3
	Adjuvant chemotherapy	6	4.9
	None	111	91
Type of surgery	Ivor lewis	12	9.8
	Mckeown	17	13.9
	Sweet	25	20.5
	Transhiatal	68	55.7
Surgeon experience	Senior fellow	2	1.6
	Senior fellow, junior fellow	3	2.5
	Senior consultant, Senior fellow, junior fellow	6	4.9
	Senior fellow	28	23
	Senior consultant, junior fellow	30	24.6
	Senior consultant, Senior fellow	53	43.4
Postoperative-Complication	Yes	32	26.2
	No	90	73.8
Intraoperative blood loss	<500	101	82.8
	500-1000	16	13.1
	>1000	5	4.1
ICU(n=122)	Yes	19	15.6
	No	103	84.4
Postoperative care	No	12	9.8
	Yes	110	90.2

5.3 Esophageal surgical treatment outcomes

Regarding to the Overall esophageal treatment outcomes; the finding of the study showed that the 110(90.2) success and 12(9.8) fail.

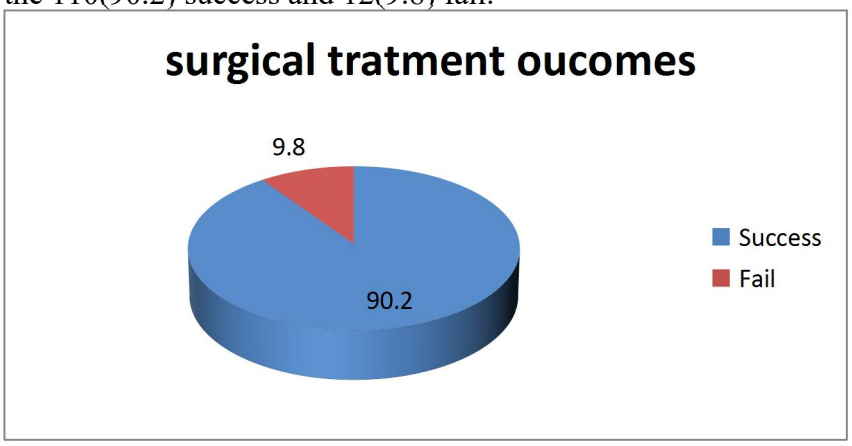

Figure 2 Over all esophageal surgical treatments outcomes

5.3 Determinants of esophageal cancer surgical outcomes

This study examined the association between various factors and surgical outcomes (survival vs. death) in patients with esophageal cancer. At bivariate logistic regression analysis, Age, Histology, Stage, Duration of symptoms, Treatment received, Comorbidity, Intra-Operative blood loss and Post-operative Complications were identified to be candidate for multivariable logistic regression model, p-value less than 0.25.

In multivariable logistic regression model, Age, Histology, Stage, Comorbidity, Intraoperative Blood Loss, Post-operative Complications knowledge were significantly associated with esophageal surgical treatment outcomes.

Accordingly, Patients with age over fifty five years old had 2.4 times significantly higher risk of death compared to those with age less than fifty five years old (AOR = 2.4; 95% CI: 1.447, 12.887).

Similarly, Patients having no comorbidity including DM, Hypertension and HIV had 7.6 times significantly less odds of death compared to those with comorbidities (AOR=7.610, 95% CI: 1.329, 23.582). More over regarding to clinical stage of cancers patient on stage four esophageal cancer was strongly linked to (5.1 times) higher odds of death compared to those Stage three (AOR = 5.164, 95% CI: 1.001, 16.633).

Additionally, less blood loss during surgery/ intra-Operative (<500 mL) was associated with 6.7 times less risk of death compared to those with > 500 ml blood loss (AOR = 6.767; 95% CI: 1.268, 16.104) and patients who had not experienced post-operative complications had 5.4 times significantly less odds of death compared to those who did (AOR = 5.436; 95% CI: 1.105, 6.744).

TABLE 3|Determinants of esophageal cancer surgical outcomes among patients registered at TASH, Minilik II Hospital and St Peter Hospital Addis Ababa, Ethiopia, 2023/2024(n=122).

Determinant		Surgical outcomes		COR (95%CI)	AOR (95%CI)
		Alive	Die		
Age	≤55	32	6	1	
	>55	78	6	2.473(1.73,8.126)	**2.401(1.447,12.887***
Histology	Adenocarcinoma	31	7	3.568(1.053,12.091)	4.602(0.807,26.55)*
	Squamous cell	79	5	1	1
Stage(n=80)	Stage 3	14	6	1	1
	Stage 4	57	6	4.071(1.139,14.5551)	**5.164(1.001,16.633)***
Duration of	<6month	73	5	1	1
symptoms	>6month	37	7	3.412(.820,9.299)	3.412(0.820,9.299)
Treatment	Yes(chemo, Gatr)	19	5	1	1
receive	No	91	7	3.6(1.042,12.792)	1.354(0.051,2.461)
Comorbidity	Yes	22	6	1	**1**
	No	88	6	4(1.176,13,606)	**7.61(1.329,23.582)**
Intra-Operative	<500	92	7	3.651(1.242,12.792)	**6.767(1.268,16.104)***
blood loss	>500	18	5	1	**1**
Post-operative	Yes	24	7	1	1
Complication	No	86	5	5.017(1.461,7.225)	**5.436(1.105,6.744)****

1 reference, CI confidence interval, COR crude odds ratio, AOR adjusted odds ratio *p-value <0.05; **p-value<0.01; ***p-value<0.001

6. DISCUSSION

The finding of this study revealed the overall good esophageal surgical treatment outcomes treated at TASH, Minilik II Hospital and St Peter Hospital in Addis Ababa, Ethiopia found to be 110(91.2%). Accordingly, the findings highlight the complex interplay of various factors influencing surgical outcomes in esophageal cancer. Older age (AOR = 2.401; 95% CI: 1.447, 12.887), advanced disease stage (AOR = 5.164; 95% CI: 1.001, 16.633), the presence of co-existing health conditions (AOR = 7.61; 95% CI: 1.329, 23.582), blood loss during surgery (AO R = 6.767, 95% CI: 1.268, 16.104) and Post-Operative Complications (AOR = 5.436, 95% CI: 1.105, 6.744)) were factors associated with increased mortality after esophageal cancer surgery.

In this study, the successful surgical treatment outcomes were 91.2% (95%CI: 1.05, 1.16.) This finding is almost in line with other finding done at Shanghai Chest Hospital, 2016(29) and higher than a study done in Ethiopia (9). This could be due to variations in the socio-demographic and clinical characteristics of the study populations as well as time difference.

The finding showed that older age more than 55years is 2.4times associated with increased mortality. The findings in less with the existing literature in Addis Ababa, showing older patients with esophageal cancer have a worse prognosis (6). This is likely due to age-related decline in organ function and immune system, making them more susceptible to complications and mortality.

Patients with no comorbidities had 7.6times less likely to die compared to its counterpart (AOR= 7.61, 95% CI: 1.329, 23.582). Similarly, previous studies reported in Kenya showed that patient with comorbidity score are seven times significant predictors of mortality in esophageal cancer surgery (14). The high mortality rate could also be attributed to complications arising from multiple comorbidities that the patients had, which complicate the management of esophageal cancer. This highlights the need for careful patient selection and meticulous perioperative management to optimize outcomes in high-risk patients. Therefore close monitoring should be done among patients with comorbidities that are life-threatening.

Similarly, patients with advanced esophageal (Stage four) cancer have a significant five times risk factor for mortality (AOR = 5.164; 95% CI: 1.001, 16.633). This finding is similar to the study in Kenya and Ethiopia, where patients diagnosed in later stages have higher mortality rate

(9, 13, 14). Earlier diagnosis and treatment at less advanced stages offer better chances of survival. This could be because most esophageal cancer was asymptomatic during the early stages and diagnosed late when the outcome of the treatment is poor.

Significantly patients with low intraoperative blood loss during surgery had almost seven times less likely risk factor for mortality after esophageal cancer surgery (AOR=6.767, 95%CI:1.268,16.104). This underscores the need for careful surgical techniques and prompts intervention to control intra operative bleeding (31).

Finally, patient having no post-operative complications had five times less risk to die compared to patients who had post-operative complication like infection, wound healing issues, anastomotic leak and organ dysfunction, which significantly increase mortality risk. (AOR=5.436, 95%CI: 1.105, 6.744). The finding is in line with results from the International Esodata Study Group at Germany. This emphasizes the importance of proactive post-operative care and monitoring to identify and manage complications effectively (31).

7. CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

The study highlights the significant impact of patient characteristics, disease stage, and perioperative factors on the outcome of esophageal cancer surgery. Factors like age, tumor histology, stage, comorbidities, blood loss during surgery, and postoperative complications are crucial determinants of mortality after esophageal cancer surgery.

7.2 RECOMMENDATIONS:

Early Detection and Management: Emphasize public awareness campaigns and access to early diagnostic tools to detect esophageal cancer at earlier stages when treatment is more effective.

Risk Stratification and Management: Implement a robust risk stratification system to identify patients with high-risk factors and tailor their management plans accordingly, including pre-operative optimization, careful surgical planning, and meticulous post-operative monitoring.

Multidisciplinary Care: Promote multidisciplinary care involving surgeons, oncologists, pathologists, and other specialists to ensure comprehensive management, optimal surgical techniques, and personalized treatment strategies.

Post-operative Care Optimization: Improve post-operative care protocols to identify and manage complications promptly, including infection prevention, wound management, and nutritional support.

Continuous Quality Improvement: Implement continuous quality improvement initiatives to track outcomes, identify areas for improvement, and enhance surgical practices.

Patient Education and Empowerment: Provide patients with comprehensive information about their condition, treatment options, and the importance of adhering to self-care recommendations for optimal outcomes.

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ANNEX I: QUESTIONERS IN ENGLISH

ADDIS ABABA UNIVERSITY, DEPARTMENT OF SURGERY

QUESTIONNAIRE ON DETERMINANTS OF SURGICAL MANAGEMENT OUTCOME FOR ESOPHAGEAL CANCER PATIENTS TREATED AT TASH, MINILIK II AND ST PETER HOSPITALS, ADDIS ABABA, ETHIOPIA, 2024

Informed Consent form (For data verification)

Good morning / afternoon

My name is _____, I am working as data collector to gathers information regarding surgical management outcome for esophageal cancer patients treated at Tikus Anbessa Specialized Hospital, Minilik II Hospital and St Peter Hospital 2024. It is my pleasure to notify you that you have been identified to participate in this study.

I am going to ask you few questions which are very important and related to care.
Your name will not be written in this form and the information you will give to us is kept confidential. If you do not want to answer all or some of the questions, you do have the right to do so. However, your willingness to answer all of the questions would be important to the project and you be appreciated. It doesn't take more than 10 minutes.
Would you participate in study?
Yes _____
No _____
If the answer is yes, thanks! Conduct
If the answer is No, thanks! Transfer to the next respondent
Name and signature of the data collector who sought the consent _____
Date of interview_____
Name and signature of the supervisor _____
Date _____

Questionnaire ID code_____

Checklist as following with instruction:

1. Please answer all questions by providing a "circle" on alternative choice or write on space given
2. Please answer all questions as honestly, frankly and objectively as possible
3. Please hand in the questionnaire to the researcher immediately after completion.

Answer the questions by placing a "circle" on answer a corresponding to the question which is applicable to you.

Part: I Socio-Demographic Characteristics of patient treated for esophageal cancer TASH, Minilik II Hospital and St Peter Hospital Addis Ababa, Ethiopia, 2021/4 (n=).			
s. no	Question	Response	Skip to
101	Sex of the respondent	A. Male B. Female	
102	How old are you?	A. <35 B. 35-44 C. 45-54 D. >55	
103	Ethnicity	A. Amara B. Oromo C. Tigre D. Somali E. Others_____	
104	Current marital status	A) Single B) Married	
105	Family size	A) <2 B) 3-5 C) >6	
106	Residency	A. Rural B. Urban	
107	Educational status	A. No formal education B. Primary school C. Secondary school D. Above Secondary school E. College/University	

108	What is your religion?	A. Orthodox B. Muslim C. Protestant D. Others	
109	What is your occupation?	A. Government B. House wife C. Merchant D. Farmer E. Private worker F. Others, specify_____	
110	Average monthly income	A. <5000 EBR B. 6000-10,000 EBR C. 11,000-15,000 EBR D. 16,000-20,000 EBR E. >21,000 EBR	
111			
Part II: Medical and surgical characteristics of patient treated for esophageal cancer TASH, Minilik II Hospital and St Peter Hospital Addis Ababa, Ethiopia, 2021/4 (n=).			
201	Date of diagnosis	____DD/____/Month/____/years	
202	type cancer/Tumor	A. Squamous cell carcinoma B. Adenocarcinoma C. Other…	
203	Tumor location	A. Upper third B. Middle third C. Lower third	
304	Stage of Esophageal cancer at diagnosis	A. Stage I B. Stage II C. Stage III D. Stage IV	
205	Any previous treatments received	A. No B. Neo-adjuvant Chemotherapy C. Adjuvant chemotherapy D. jejunostomy Feeding at time of surgery E. Radiation(Brachytherapy) F. Esophageal stents G. Others	
206	Any comorbidity	A. None B. diabetes C. Hypertension D. CHF E. CKD	

		F. Others	
207	Family history of cancer	A. Yes B. No	
208	Type of surgical procedure undergone	A. Tranhiatal Esophagectomy B. Ivor Lewis Esophagectomy C. Mckeown Esophagectomy D. Sweet Esophagectomy E. Minimally invasive surgery	
209	Date of surgery:	____DD/____/Month/____/years	
210	Surgeon's experience (number of procedures performed)	A. Senior Consultant B. Senior Fellow C. Junior Fellow	
211	Any complications during or after surgery	A. Yes, specify---------- B. No	
212	Length of hospital stay:		
213	Post-operative care a. Adherence to post-operative instructions (medication, diet, exercise, etc.)	C. Yes D. No	
	b. Number of follow-up appointments attended		
	c. Any post-operative complications experienced (infections, anastomotic leaks)	A) Yes B) No	
	d. Quality of life after surgery (rate on a scale of 1-10, with 10 being the best).	A. Better B. Same C. Worse	
214	Post-operative lab A. Alb B. Hgb C. Org Renal D. Org Liver results	 _____ _____ _____ _____	
215	Supportive care A. Availability of TPN B. Capacity for gastrostomy tubes C. Intensive care unit D. Palliative care team	 A. YES/ B. NO A. YES/ B. NO A. YES/ B. NO A. YES/ B. NO	
216	Outcome of patients	A. Alive B. Died C. Unknown	

Part III: Dietary and lifestyle characteristics of patient treated for esophageal cancer TASH, Minilik II Hospital and St Peter Hospital Addis Ababa, Ethiopia, 2021/4 (n =).			
301	Changes in dietary habits post-surgery	A. Yes B. No	
302	Alcohol consumption habits	A. Yes B. No	
303	Smoking consumption habits	A. Yes B. No	
304	Level of physical activity:	A) Yes B) No	

Annex: ASSURANCE OF PRINCIPAL INVESTIGATOR AND ADVISORS

The undersigned research work on 'Determinant of surgical management outcome for esophageal cancer among patients treated at Tikur Anbessa specialized hospital, Minilik II Hospital and St Peter Hospital'; is my original work thesis to be submitted to Tikur Anbessa specialized hospital, department of surgery, in partial fulfillment of the requirements for subspecialty certificate in cardiothoracic surgery.

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned research work is my original work for partial fulfillment of the requirements for subspecialty certificate in cardiothoracic surgery.

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