



Saint Paul's Hospital Millennium Medical College

**Magnitude of Postoperative pulmonary Complications
and Associated Factors in Patients who Underwent
Major Surgery at SPHMMC in year 2009 E.C**

By: Naol Jigi (Intern)

Advisors: Temesgen (MPH)

Mekdim (MD, Ass. professor of Surgery)

**A RESEARCH SUBMITTED TO DEPARTMENT OF PUBLIC HEALTH
SPHMMC IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTORATE OF MEDICINE**

July, 2018

Addis Ababa, Ethiopia



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Acknowledgment

To begin with, I would like to thank the almighty God for helping me and giving me strength to do a research like this. Then, my gratitude is towards our College and public health department which provided me a chance of being participants in the research world by my own, thank you for making it happen. Mr. Temesgen, my public health advisor, thank you for your support, encouragement and patience for me and Dr. Mekdim who has been a great teacher, Mentor, and role model for me and a reason to love surgery since the first year of our clinical practice. If it wasn't for you, I wouldn't be here doing this so thank you once again. The last but not the least I would like to thank my families who are like a back bone for my work. Thank you all!

Acronyms

CI..... Confidence interval

COPD..... Chronic Ostructive Pulmonary Disease

DM..... Diabetis Mellitus

HIV..... Human Immune Virus

HTN..... Hypertension

ICU..... Intensive Care Unit

OR..... Odds Ratio

PPC..... Postoperative Pulmonary Complication

RCT..... Randomized Controlled Trial

SPHMMC..Saint Paul's Hospital Millennium Medical College

TB..... Tuberculosis

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Abstract

Introduction: Postoperative complications, although other complications may occur, involving the respiratory tract is the most frequent one that contribute to the greatest peri operative morbidity and mortality. The occurrence of postoperative pulmonary complications varies depending on the clinical treatment setting, the kind of surgery and the definition used.

Objective: The aim of this study was to determine magnitude as well as outcome of postoperative pulmonary complications and factors associated among surgical patients that were operated in SPHMMC in the year 2009.

Methods: Retrospective cross-sectional study was conducted to assess postoperative pulmonary complications (PPC) among surgical patients in SPHMMC. 333 patients were included in this study using random sampling technique. Pre, intra-operative and post-operative data were collected using checklist prepared based on variables of interest. Chi square analysis was used to identify significant factors and then a step wise logistic regression was used to identify independent predictors of PPC. P values and 95% CI were used to see for significance of associations.

Results: 333 patients participated in this study. The incidence of PPC was 7.2%. Smoking (AOR=30 (5.3, 177)), intra operative blood loss (AOR=13.9(2.17, 103), Upper abdominal surgeries (AOR=5.6(1.2, 26.5) and prolonged surgery (AOR=15(3.17, 71.9) were independently associated with PPC.

Conclusion and Recommendation: Magnitude of Postoperative Pulmonary complication in SPHMMC is comparable with most research findings that are done outside the country. However, it is found to be significantly lower than the finding of a research done at Gonder University which is the only research done on this topic in the entire country.

Anticipation of those risk factors which are strongly associated with PPC helps to be ready and take all necessary measures including furthers investigations that should be taken to avoid postoperative pulmonary complications since the adverse outcome of PPC is found to be grave

Chapter one

1. Introduction

I. Background

Postoperative complications can be defined as: any deviation from the normal post-operative course. This definition also takes into account asymptomatic complications such as arrhythmia and atelectasis. Surgery may be well executed without complications but still fail. If the original purpose of the surgery has not been achieved, this is not a complication but “a failure to cure” (e.g. Residual tumor after surgery). Sequelae is an “after-effect” of surgery that is inherent to the procedure (e.g. Inability to walk after amputation of the leg). So, sequelae and failure to cure will not be included in the definition of complication. ^[1]following the same principle, Postoperative pulmonary complication can be defined as deviation of pulmonary function from it's normal postoperative course, although there is no standard definition given yet. ^[15]

The likelihood that a specific complication will arise for a given patient is determined by the nature of the procedure, the anesthetic techniques used, and the patient's preoperative comorbidities. The risk of some complications can be reduced with appropriate preoperative assessment and medical optimization. ^[2]

Postoperative complications involving the respiratory tract are the most frequent cause of mortality and morbidity. Though there is no standard definition of postoperative pulmonary complication, different scholars define it as occurrence of pneumonia which is characterized by fever above 38°C and evidence of pulmonary infiltration. Most pneumonia cases are seen during the first 5 days of postoperative time. ^[16] Atelectasis is another postoperative pulmonary complication which is defined as increased work of breathing and hypoxemia usually occurs after the 2nd day of operation. Respiratory failure defined as inability to be extubated within 48 hours of surgery, acute respiratory distress syndrome and bronchospasm which is common during early postoperative time and diagnosed when there is dyspnea, wheezing, chest tightness, tachypnea, small tidal volume and hypercapnia are included. ^[6]

II. Statement of the problem

Postoperative complications increase patient morbidity and mortality and they are a target for quality improvement programs in some countries. ^[4] The reported incidence of postoperative pulmonary complications ranges from 5 to 80 percent, depending upon the patient population and the criteria used to define a complication. ^[20] Various researches have shown that the causes or risk factors for PPC include preoperative co morbidities, smoking, longer duration of surgery and older ages. In addition to mortality and morbidity, postoperative complications are also associated with increase in length of hospital stay, and hospital costs. The treatment cost increase with severity of post-op complications. ^[5]

In developed countries many patients who undergo surgery develop complications with complication rates as high as 30% percent. ^[4]

Postoperative pulmonary complications account for a substantial portion of the risk related to surgery and anesthesia and are a source of postoperative morbidity, mortality and longer hospital stays. The current basis for our understanding of the nature of postoperative pulmonary complications is weak; only small part of high quality studies are available, a uniform definition has not emerged, and studies have focused on specific patients and kinds of surgeries. ^[15]

In Ethiopia, there are scanty researches done on postoperative pulmonary complications and this is also the gap that was identified during selection of this topic, but the evidences from the existing researches show that pulmonary complication is among the leading factor of mortality and morbidity. ^[6]

Significance of the study

In a county of, like ours, where resources are limited, knowing the magnitude of postoperative complications especially of related to respiratory system as it is the major cause of mortality and morbidity, is mandatory as it provides us with significant reduction in surgical costs as well as reduces social and economical burden.

This study gives us the magnitude of postoperative pulmonary complications in surgical patients and factors which influence the degree of occurrence of complications which can help in improving the methods used to operate in our setup and also improve patients outcome.

Chapter two

2. Literature review

The likelihood that a specific complication will arise for a given patient is determined by the nature of the procedure, the anesthetic techniques used, and the patient's preoperative comorbidities^[2]

According to a cohort study done by Daniel Dindo et.al, postoperative complications can be classified into five grades. Grade 1 is “any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions, Grade 2 “ requiring pharmacologic treatments with drugs other than such allowed for grade 1 complications’ blood transfusion and total parenteral nutrition are also included”, Grade 3 “Requiring surgical, endoscopic, or radiological interventions,” Grade 4 “ life threatening complications requiring ICU management”, Grade 5 “ Death of patient.” From among these, Pulmonary complications are the most devastating and the commonest one’s^[1]

Pulmonary complications are a major cause of morbidity and mortality during the postoperative period the reported incidence of postoperative pulmonary complications ranges from 5 to 80 percent, depending upon the patient population and the criteria used to define a complication. The incidence also varies across hospitals, with one study reporting lower rates of complications in hospitals with a high volume of patients than in hospitals with a lower volume following esophagectomy, pancreatectomy, and intact abdominal aortic aneurysm. ^[8,9]

To look at the general prevalence of postoperative complications, we can look at a research which was done in Netherlands which reported that severity should be routinely presented when reporting complications in clinical practice and surgical research papers to adequately compare quality of care and result of clinical trials. The research conducted a prospective observational cohort study to evaluate consequences and severity of complications and recorded all complications of patients admitted to St. Elisabeth Hospital in Tilburg between June 1, 2005 and Dec 31, 2007. During this study period, of the patients who received surgery, 20% had 1 or more complications registered, whereas 10% of those who were treated non-surgically, experienced complications.^[12]

Only eight small studies (averaging 207 patients and 16 outcomes per study) have compared the preoperative evaluation and postoperative pulmonary outcomes in an independent and blind fashion for patients undergoing nonthoracic surgery. These studies were limited by nonrepresentative samples (only two studies enrolled consecutive patients undergoing a wide variety of nonthoracic surgeries, and one of these was restricted to patients referred to internists for preoperative assessment) and reported conflicting results: although 20 variables were found to be significantly associated with postoperative pulmonary complications in at least one of these studies, only 7 were significant in more than one study. Further, the definitions of postoperative pulmonary complications in these studies were often not explicit, and the incidence ranged between 2 and 19%. Some studies included clinically insignificant complications (such as asymptomatic changes in pulmonary function tests or oximetry), whereas others restricted their analyses to outcomes such as respiratory failure or pneumonia. These limitations may distort associations between baseline variables and outcomes, calling into question the results of most of these studies.^[21]

In one research, investigators enrolled 1,055 consecutive patients who attended the University of Alberta Pre-Admission Clinic between June 2001 and October 2003. The mean age was 55 years, 531 (50%) were men, and 28 (2.7%) suffered a pulmonary complication within 7 days of surgery: 13 developed respiratory failure requiring ventilatory support, 9 postoperative pneumonia, 5 atelectasis requiring bronchoscopic intervention, 1 pneumothorax requiring intervention. One of the patients who developed postoperative pneumonia subsequently died. Lengths of stay were substantially prolonged for those patients who developed pulmonary complications within 7 days of surgery: mean 27.9 days versus 4.5 days, $p = 0.006$. Only 92 (9%) study participants underwent upper abdominal surgery; the most frequent types of surgery were lower abdominal/inguinal hernia surgery ($n = 321$, 30%) and orthopedic limb surgery ($n = 238$, 23%). The 91 patients (9%) who were referred for preoperative medicine consults were no more (or less) likely to have postoperative pulmonary complications than those patients not referred (odds ratio [OR] 1.22, 95% confidence interval [CI] 0.36–4.14). The results of bivariate analyses

are outlined in Tables 1 and 2. Of the variables reported to be associated with pulmonary complications in more than one previous study, only reduced exercise capacity was not significant in our study (OR 0.88, 95% CI 0.26–0.96). Even after excluding patients going for orthopedic lower limb surgery (in whom noncardiopulmonary reasons likely influenced exercise capacity), reduced exercise capacity was not associated with pulmonary complications (OR 1.61, 95% CI 0.47–5.51). In addition to the definition of a current smoker we employed (within 2 weeks of surgery), we also examined whether the NSQIP definition of current smoker (within 12 months of surgery) was associated with pulmonary outcomes- it was not (OR 1.14, 95% CI 0.50–2.63). Only 11 of the patients in this cohort had a preoperative arterial blood gas ordered by their attending physician and although one patient had a Pco₂ 45 mm Hg, none of these patients developed pulmonary complications after surgery. Preoperative chest radiographs were ordered for 135 patients, but these patients were not more likely to have an adverse pulmonary event after surgery (OR 1.14, 95% CI 0.39–3.34). The multivariate regression analysis identified four variables which were independently associated with an increased risk of postoperative pulmonary complications: age (OR 5.9 for age 65 years, p 0.001), positive cough test (OR 3.8, p 0.01), perioperative nasogastric tube (OR 7.7, p 0.001), and duration of anesthesia (OR 3.3 for operations lasting at least 2.5 hours, p 0.008). The model demonstrates good discrimination and calibration with a C-statistic of 0.875 and a Hosmer-Lemeshow goodness-of-fit statistic of 6.9 (p 0.55). [21]

In a Prospective cohort study done at The Veterans Administration Medical Center, Syracuse, NY. Smoking status was determined by self-report. Postoperative pulmonary complications were determined by systematic extraction of medical record data. Postoperative pulmonary complications occurred in 31 of 141 (22.0%) current smokers, 24 of 187 (12.8%) past smokers, and 4 of 82 (4.9%) never smokers. The odds ratio (OR) for developing a postoperative pulmonary complication for current smokers vs never smokers was 5.5 (95% confidence interval [CI], 1.9 to 16.2) and 4.2 (95% CI, 1.2 to 14.8) after adjustment for type of surgery, type of anesthesia, abnormal chest radiograph, chronic cough, history of pulmonary disease, history of cardiac disease, history of COPD, education level, pulmonary function, body mass index, and age. Current smokers who reported reducing cigarette consumption prior to surgery were more likely to develop a complication compared with those who did not (adjusted OR=6.7, 95% CI,

2.6 to 17.1). Conclusion says that Current smoking was associated with a nearly sixfold increase in risk for a postoperative pulmonary complication. Reduction in smoking within 1 month of surgery was not associated with a decreased risk of postoperative pulmonary complications.^[17]

In another research, the investigators examined the accuracy of preoperative assessment in predicting postoperative pulmonary risk in a prospective cohort of 272 consecutive patients referred for evaluation before nonthoracic surgery. Outcomes were assessed by an independent investigator who was blinded to the preoperative data. There were 22 (8%) postoperative pulmonary complications. Statistically significant predictors of pulmonary complications (all $p \leq 0.005$) were as follows: hypercapnea of 45 mm Hg or more (odds ratio, 61.0), a FVC of less than 1.5 L/minute (odds ratio, 11.1), a maximal laryngeal height of 4 cm or less (odds ratio, 6.9), a forced expiratory time of 9 seconds or more (odds ratio, 5.7), smoking of 40 pack-years or more (odds ratio, 5.7), and a body mass index of 30 or more (odds ratio, 4.1). Multiple regression analyses revealed three preoperative clinical factors that are independently associated with pulmonary complications: an age of 65 years or more (odds ratio, 1.8; $p = 0.02$), smoking of 40 pack-years or more (odds ratio, 1.9; $p = 0.02$), and maximum laryngeal height of 4 cm or less (odds ratio, 2.0; $p = 0.007$). Thus, preoperative factors can identify those patients referred to pulmonologists or internists who are at increased risk for pulmonary complications after nonthoracic surgery.^[22]

According to research done by Rock and Rich published in 2003, General anesthesia and surgery produce changes in the respiratory system and are responsible, along with underlying conditions, for postoperative pulmonary complications. Risk factors include upper abdominal or thoracic surgery, cigarette smoking, chronic respiratory disease, emergency surgery, anesthetic time of 180 min or more, age greater than 70 years, renal failure, poor nutritional status, and significant intraoperative blood loss. The inhibition of phrenic nerve output results in postoperative diaphragmatic dysfunction. Sleep-disordered breathing occurs after surgery even in patients without obstructive sleep apnea, but patients with obstructive sleep apnea may have a worsening of their disease after surgery. A clear advantage of one anesthetic technique over another in reducing postoperative pulmonary complications has not been demonstrated. Conflicting results have been obtained regarding the value of epidural analgesia in preventing postoperative

pulmonary complications. Incentive spirometry decreases rates of postoperative pulmonary complications and hospital lengths of stay.^[18]

In one Randomized, controlled trials (RCTs), to assess strategies to reduce postoperative pulmonary complications in non-cardiothoracic surgeries, Using standardized forms, the authors abstracted data on study methods, quality, intervention and control groups, patient characteristics, surgery, postoperative pulmonary complications, and adverse events. On data Synthesis, The authors qualitatively synthesized, without meta-analysis, evidence from eligible studies. Good evidence (2 systematic reviews, 5 additional RCTs) indicates that lung expansion interventions (for example, incentive spirometry, deep breathing exercises, and continuous positive airway pressure) reduce pulmonary risk. Fair evidence suggests that selective, rather than routine, use of nasogastric tubes after abdominal surgery (2 meta-analyses) and short-acting rather than long-acting intraoperative neuromuscular blocking agents (1 RCT) reduce risk. The evidence is conflicting or insufficient for preoperative smoking cessation (1 RCT), epidural anesthesia (2 meta-analyses), epidural analgesia (6 RCTs, 1 meta-analysis), and laparoscopic (vs. open) operations (1 systematic review, 1 meta-analysis, 2 additional RCTs), although laparoscopic operations reduce pain and pulmonary compromise as measured by spirometry. While malnutrition is associated with increased pulmonary risk, routine total enteral or parenteral nutrition does not reduce risk (1 meta-analysis, 3 additional RCTs). Enteral formulations designed to improve immune status (immunonutrition) may prevent postoperative pneumonia (1 meta-analysis, 1 additional RCT). Conclusion was that few interventions have been shown to clearly or possibly reduce postoperative pulmonary complication.^[19]

In Ethiopia, There is an observational prospective study done at Gonder University assessing postoperative pulmonary complications and associated factors among surgical patients. 405 patients were included in the study using systemic sampling technique. A step wise logistic regression was used to identify independent predictors of postoperative pulmonary complications (PPC). The result showed, the incidence of PPC was 21.7%. Use of General anaesthesia, intraoperative blood loss, poor post-operative pain control and prolonged surgery were independently associated with PPC.^[6]

CHAPTER THREE

3. Objectives of the study

A. General objectives

The general aim of this study is to find out the magnitude of postoperative pulmonary complications and associated factors in patients who have underwent surgical procedure at surgery department in the year 2009 at SPHMMC

B. Specific objectives

- To identify the magnitude of postoperative pulmonary complications
- To find out factors associated with development of pulmonary complications
- To study the correlation between postoperative pulmonary complications and the type of surgery based on area of incision
- To determine the outcome of those patients who develop postoperative pulmonary complications
- To confer tangible data from the observations this study made.

Chapter four

4. Methodology

Description of study area

This particular study is conducted at St Paul's hospital millennium medical college Addis Ababa, Ethiopia. This hospital is localized at the northwest of Addis Ababa and it is one of the largest referral hospitals in the city. It has a lot of catchment area health center from where different complicated cases are referred to. It has so many departments of specialties beneath it and works 24 hrs per day and 7 days per week. The department gives outpatient functions (regular and emergency room), admits and follows patients who are in need, gives dialysis function as well as kidney transplant and well organized teaching center. Department of Surgery is one of well functioning department in this hospital and about 2500 major surgeries are performed each year and it is chosen to be the appropriate study area.

Study population

This study focused on all populations who underwent surgery in the year 2009 E.C at surgery department of SPHMMC irrespective of their admission diagnosis and their sex.

Study period

The study was conducted for a whole month by which time it was tried to assess postoperative pulmonary complications and associated factors in those patients.

Study design

Retrospective cross-sectional study design is an appropriate study design to be chosen for this particular study

Study frame

The study frames are list of people who underwent surgical procedures irrespective of their diagnosis and whether they are admitted to male or female ward.

Data collection method

Data collecting method is chosen to be secondary data collecting system using the patient chart. And Check list was used. Although primary data would have been better and more consistent, because of the limitations of time and consideration of feasibility, secondary data was the primary source of information. The patients who underwent surgery in 2009 was identified using the statistic chart at operation room and patients were selected randomly and using the medical record number of the patients, the charts were collected for investigation.

The check list consists of three parts. The first part includes the sociodemographic status of the patient. The second part involves surgical and anesthetic characteristics of the patient and the last portion investigates the complications associated with the surgery.

Data Analysis and Quality Management

Data obtained was entered, cleaned and prepared for tabulation using statistical data analysis software. Frequencies and other descriptive statistics were done. Bivariate analysis was conducted to examine association between dependent and independent variables; P value, Odds Ratios (ORs) and their 95% CIs was calculated. Then, all variables that has p-value less than 0.2 in the bivariate analysis was included in the multiple logistic regression analysis model and adjusted OR, 95% confidence interval was documented.

The necessary amendments were made upon identification of ambiguities of the tools in the wording, logic and skipping order. The principal investigators and the supervisors checked the collected data for completeness.

Sample size determination

It's important to calculate the optimum number of sample size to infer appropriate conclusion from the study. The researcher has to include the number of study population so in regard the following formula was chosen to calculate the sample size.

$$n = \frac{Z^2 p(1-p)}{d^2}$$

$$19 | \text{Page } n = \frac{1}{1 + \frac{1}{N} \left(\frac{Z^2 p(1-p)}{d^2} - 1 \right)}$$

Where, Z is the upper $\alpha/2$ points of standard normal distribution, n =sample size, d = margin of error, P =population proportion, α =degree of accuracy and N =study population. With $\alpha=0.05$ significance level, $Z=1.96$. Estimated population proportion value is not known so it is used to be 50%.

The study population (N) is taken to be the number of patients who underwent surgery in 2009 E.C about 2500. Therefore, the sample size calculated to be 333.

Sampling method

The chosen sampling method is simple random sampling.

Sampling criteria

Inclusion criteria

All Patients who were admitted and underwent major surgery at SPHMMC in the year 2009 E.C

Exclusion criteria

Patients who were admitted after they developed complications from surgery done in another hospital.

Variables considered in the study

Dependent variable

- Magnitude of postoperative pulmonary complications

Independent variables

- Age
- Sex
- Marital status
- Area of residence
- Type of surgery (area of the surgery)
- Cigarette smoking

- Presence of underlying disease(TB, HIV, DM, HTN, chronic mal absorption syndromes)
- Postoperative diagnosis
- Method of surgery (open or laparoscopic)
- Duration of surgery
- Intra-operative bleeding
- Type of anesthesia (spinal or general)
- Length of stay in the hospital

Operational Definition

Postoperative pulmonary complications in this study is defined to be any lung or respiratory abnormality which develops within 7 days after undergoing surgery and which is diagnosed and documented by a physician before discharge of the patient.

Ethical consideration

Every information about the participants are confidential in a way it is going be used only at the interest of the study and approval was given for this research from Ethics Committee.

Chapter Five

5. Results

5.1 Socio-Demographic Characteristics

From the total 333 patients 161(48.3%) were male and 172(51.7%) were female. Age distribution and the other socio-demographic characteristics are shown in the following table.

Table1: Socio-demographic Characteristics of patients who underwent surgery in year 2009

	Character	Frequency	Percentage
Age	0-11	33	9.9%
	11-31	133	39.9%
	31-60	133	39.9%
	>60	34	10.2%
sex	Male	161	48.3%
	Female	172	51.7%
Marital	Married	145	43.5%
Status	Single	188	56.5%
Economic	Free	120	36%
Status	Paying	213	64%

Table2. Residence of patients who underwent surgery at SPHMMC in year 2009

	Frequency	Percent
Oromia	158	47.4%
Amhara	27	8.1%
Tigray	2	.6%
SNNPR	12	3.6%
Addis Abeba	134	40.2%
Total	333	100.0%

5.2 Surgical and Anesthetic Characteristics of the Patients.

Out of the 333 patients, only 6 (1.8%) patients are documented as smokers and 35(10.5%) consume Alcohol. Out of those who consume alcohol the majority; 33 (94.3%) of the were documented to consume 1-7 bottle per week. The rest 2(5.7%) patients consumed 8-15 bottles per week.

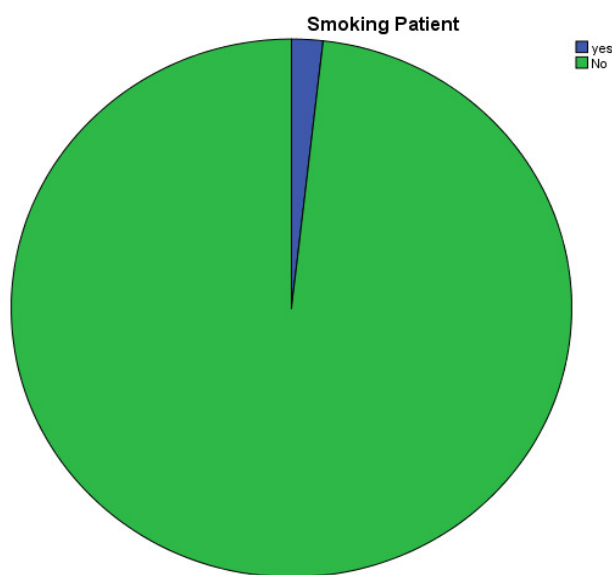


Fig1: percentage of smokers in patients who underwent surgery at SPHMMC in year 2009

The Total number of patients who had known medical illnesses prior to the surgical procedure is 52(15.6%). The types of medical illnesses as well as percentage of each medical illness among those who have known medical illnesses are as follows:

Table 3: Types and Percentages of medical illnesses in patients who underwent surgery at SPHMMC in year 2009

Type of Medical illness	Frequency	Percentage
Hypertension	15	28.8
Diabetis	7	13.5
Asthma	4	7.7
Both HTN and DM	6	11.5
HIV	11	21.2
Others	9	17.3
Total	52	15.6

The surgeries were done under General Anesthesia for 289(87%) patients and under spinal anesthesia for 44(13%) patients. Among all the 333 patients, only 4(1.2%) patients sustained intraoperative bleeding and among these 4 patients 2(50%) lost less than 500ml blood and the remaining 2 lost more than 500ml of blood.

Concerning the admission circumstance, out of the total number of patients under the study 227(68.2%) were **Elective** and the remaining 106(31.8%) were admitted on **emergency** bases.

The types of surgical procedures done are summarized in the following table

Table4 Types of Surgical Procedures done for patients who underwent surgery at SPHMMC in year 2009

Types of Surgery	Frequency	Percentage
Thyroid	50	15%
Upper abdominal	66	19.8%
Lower abdominal	105	31.5%
Breast	16	4.8%
Extremities	43	12.9%
Genito-urinary	53	15.9%
Total	333	100%

Among these 333 patients, duration of surgery for 196 (58.9%) patients was 1-3 hours which accounts for the majority and for 125(37.5%) patients was less than 1 hour and the remaining 12 (3.6%) patients, it lasted 3-5 hours.

295(88.6%) patients underwent open surgery while 38(11.4%) of patients underwent laparoscopic surgery. For all of these surgical patients, Prophylactic antibiotics were given and post operatively, analgesia was also given.

5.3 Magnitude of Post-Operative Pulmonary Complication

Among the total of 333 patients under study, **24(7.2%)** patients developed post-operative pulmonary complication.

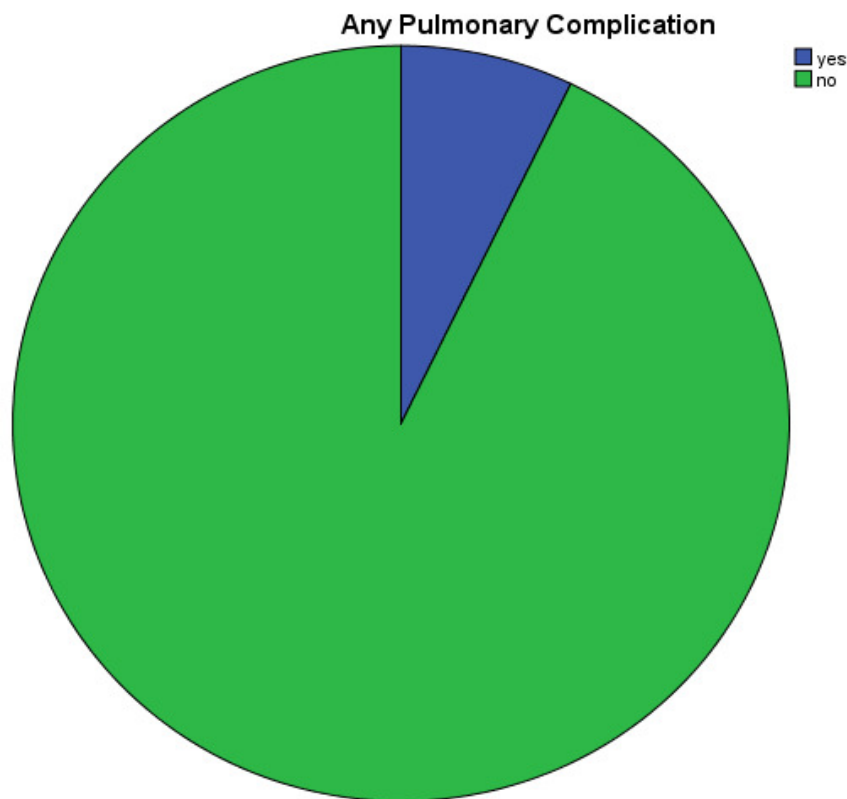


Fig2 Magnitude of pulmonary complications in patients who underwent surgery at SPHMMC in year 2009

The types of pulmonary complication and percentage among those who developed pulmonary complication will be summarized in the following table:

Table: 5 Types of Pulmonary Complications in patients who underwent surgery at SPHMMC in year 2009

Types of complication	frequency	percentage
Pneumonia	14	58.3%
Respiratory failure	8	33.3%
Atelectasis	2	8.3%
Total	24	100%

Among those patients who developed post operative pulmonary complications, 6(25%) needed ventilator support while 2(8.3%) died.

5.4 Factors Associated with Postoperative Pulmonary Complication

Using the Chi-Square, There are 8 variables that showed statistical significance as risk factors for the development of postoperative pulmonary complication. These include: Smoking, Alcohol Consumption, Types of Anesthesia, Intra-op bleeding, Mode of Admission, Types of Surgery, Duration of Surgery, and Method of surgical procedure. For each one of them, the *p value* has been summarized in Table 6.

Using regression analysis for significant factors that has p-value less than 0.2, those factors which are found to be independently associated with pulmonary complication are 4 in number; Smoking, Intra-op bleeding, upper abdominal surgeries and longer duration of surgery. The results are summarized in Table 7.

Table 6: Summary of Description of each variable and Association by Chi-Square

	Total number	Postoperative Pulmonary Complication	
	N0. (%)	Yes	<i>P-value</i>
Total Number		24(100%)	
Age			0.177
0-11	33(9.9)	2(8.3%)	
11-31	133(39.9)	5(20.8%)	
31-60	133(39.9)	14(58.3%)	
>60	34(10.2)	3(12.5%)	
Sex			0.798
Male	161(48.3)	11(45.83%)	
Female	172(51.7)	13(54.16%)	
Residence			0.276
Oromo	158(47.4)	7(29.2%)	
Amhara	27(8.1)	6(25%)	
Tigray	2(0.6)	0(0%)	
SNNPR	12(3.6)	0(0%)	
Addis Abeba	134(40.2)	11(45%)	
Marital Status			0.87
Married	145(43.5)	10(43.7%)	
Single	188((56.5)	14(56.3%)	
Economic Status			0.775
Free	120(36)	8(36.2%)	
Paying	213(64)	16(63.8%)	
Smoking			0.00
1-5 years	2(33.3)	2(8.3%)	
6-10 years	4(66.7)	2(8.3%)	
Alcohol Consumption	35(10.5)	6(25%)	0.016
Medical Illnesses	52(15.6)	6(25%)	
Hypertension	Hypertension	15(28.8%)	0
	DM	7(13.5%)	2(33.3%)
	Asthma	4(7.7%)	0
	HIV	11(21.2%)	4(66.7%)
Hypertension and DM	Hypertension and DM	6(11.5%)	0
	Others	9(17.3%)	0
Type of Anesthesia			0.059
Spinal	44(13)	0	

General	289(87)	24(100%)	
Intra-op Bleeding	4(1.2)	2(8.3%)	0.027
<500 ml	2(50%)	0	
>500ml	2(50%)	2(100%)	
Admission Circumstance			0.047
Elective	227(68.2)	12(50%)	
Emergency	106(31.8)	12(50%)	
Type of surgery			
Thyroid	50(15)	0	
Upper Abdominal	66(19.8)	12(50)	
Lower Abdominal	105(31.5)	10(41.7)	
Breast	16(4.8)	0	
Extremities	43(12.9)	0	
Genito-Urinary	53(15.9)	2(8.3)	
Duration of Surgery			0.00
<1 hr	125(37.5)	4(16.7%)	
1-3hr	196 (58.9)	16(66.7%)	
3-5hr	12 (3.6)	4(16.7%)	
Method of Surgical Procedure			0.068
Open	295(88.6)	24(100%)	
Laparoscopic	38(11.4)	0	
Hospital Stay			0.00
<1 week	220(66.1)	2(8.3%)	
1-2 weeks	87(26.1)	12(50%)	
2-4 weeks	26(7.8)	10(41.7%)	

Selected factors and adjusted odds ratios for postoperative pulmonary complications

Table 7: OR for significant factors using Logistic Regression

Variables	AOR(95% CI)	P- value
Smoking	30(5.3, 177)	0.001
Alcohol Consumption	2.895(0.714, 11.74)	0.137
Known Medical Illness	4.387(1.335, 14.412)	0.195
Type of Anesthesia	0.00	0.997
Intra-op bleeding	13.9(2.17,103)	0.01
Emergency Admission	0.302(0.108, 0.845)	0.052
Types of surgery		
Thyroid	-	0.997
Upper Abdominal	5.6(1.2, 26.5)	0.028
Lower Abdominal	2.6(0.56, 12.7)	0.214
Breast	-	0.999
Extremities	-	0.998
Genito-Urinary	/	
Duration of Surgery		
<1 hr	/	reference
1-3hr	2.6(0.87,8.23)	0.083
3-5hr	15(3.17, 71.9)	0.001
Method of Surgery	-	0.998

Outcomes of PPC

Table 8: Outcome (Adjusted OR) of patients with PPC

Variables	OR(95% CI)	P-value
Hospital stay		
<1 week	reference	
1-2 weeks	17(3.81,79.72)	0.00
2-4 weeks	68.1 (13.7,337)	0.00
Ventilatory support	-	0.00
Death	15.04(10.02, 22.52)	0.005

Chapter Six

6. Discussion

6.1 Magnitude of postoperative pulmonary complications

One of the objectives of this study is to find out the magnitude of postoperative pulmonary complications in SPHMMC and accordingly, in this study, the magnitude of postoperative pulmonary complication is found to be **7.2%**. This finding is comparable with research done by Finlay A. McAlister et.al [22] which was 8% and Kamlesh et.al (11.9%)[29]. The study which was done by Finlay et.al is in non cardiothoracic patients which makes it similar to this study since there is currently no cardiothoracic surgery in SPHMMC. However, The result of this study is much lower compared to a study done at Gonder University by Zewditu et.al where the prevalence of PPC was found to be 23.3% [6]. This large number might be because of different reasons but one important explanation is that the Gonder study included thoracic surgery which might have inflated the number.

Postoperative pneumonia is the most serious postoperative complication occurred in 9% to 40% of patients after surgery. It ranks as the third most common postoperative infection, behind urinary tract and wound infection in hospitals.[23] Accordingly, in this study, Pneumonia is the most common pulmonary complication (58.3%) which is also congruent with study done by Zewditu et.al (85.2%) as well as Brook [6, 23].

6.2 Factors associated with development of pulmonary complications

Independent Risk factors for pulmonary complication which are found in this study using logistic regression are 4 in number. These are: Smoking, Intra-op bleeding, upper abdominal surgeries and longer duration of surgery.

Smoking is significantly associated with postoperative pulmonary complication (p- 0.001, OR 30 with 95% CI of (5.3, 177). There is true also in a study done by Leslie et.al to assess preoperative smoking habits and postoperative pulmonary complications and the OR of developing

postoperative pulmonary complication in current smokers to non smokers was 5.5 (95% CI, 1.2 to 14.8) [17].

Intra-op blood loss is another predictor of postoperative pulmonary complication in this study ($p=0.008$). The odds ratio of developing PPC in patients who have lost more than 500ml of blood compared to those who have lost less than 500ml of blood is 13.9 (95% CI 2.17, 103). Similar finding was reported by Zewditu et.al with OR of patients who lost >500ml of blood intra-op being 2.02 (95% CI 1.18; 3.46). [6]

From the types of surgery, Upper abdominal surgery (based on incision site) is significantly associated with PPC; OR 5.6 (95% confidence interval (1.2, 26.5) (p value 0.028), Which is in agreement with study done by Brooks et.al where the study concluded that Upper abdominal surgery is one of the independent risk factors for PPC [23]. In contrast to this study, Also statistically not significant, the percentage of post operative pulmonary complication is higher in patients who underwent lower abdominal surgery in a study done at Gonder University (With regard to lower abdominal procedures, out of 240 cases 56 developed PPC (23.3%)). [6]. However, according to Laurie Barclay, Overall, the odds ratio (OR) for pulmonary complications (in patients undergoing abdominal surgery) during 2001-2004 period was 1.21 (95% confidence interval [CI], 1.21 - 1.22). [25]

Similarly, prolonged surgery was also identified as significant predictors of PPCs and it is well supported by literature review especially done by Graybill et.al (AOR=2.02 (1.18; 3.46). In this study also, pulmonary complications are strongly associated with longer duration of surgery and patients who were under surgery for more than 3 hours are 15 times more likely to develop post operative pulmonary complication. [26]

Although logistic regression shows no statistically significant relation between Alcohol consumption and pulmonary complication, Chi Square analysis showed significant relationship between alcohol consumption and pulmonary complication as a risk factor ($p=0.016$). Odds ratio of development of PPC in Alcoholic patients to those who are not alcoholic is 3.2 (95% CI 1.2, 8.7). This is consistent with findings of Eliassen et.al (RR = 1.80; 95% CI: 1.30–2.49) who concluded “Preoperative alcohol consumption was associated with an increased risk of general

postoperative morbidity, general infections, wound complications, pulmonary complications, prolonged stay at the hospital, and admission to intensive care unit.”[28]

Underlying medical diseases are not significantly associated with pulmonary complications ($p = 0.195$) in this study. In contrast, several studies show that there is association between medical disorder, Especially COPD and PPC. According to Kamlesh et.al, chronic obstructive pulmonary disease was independently associated with development of a PPC [OR 16.77 (95% CI 2.56–109.88) $p = 0.003$]. [29] However, Brook’s et.al found no significant association between PPC and COPD. [23]

6.3 Outcomes of PPC

Postoperative pulmonary complications are associated with substantial morbidity and mortality. It has been estimated that nearly one fourth of deaths occurring within 6 days of surgery are related to postoperative pulmonary complications. [23] The current study showed mortality of 8.3% which is somehow lower but still comparable with the research done at Gonder University (11%) but exactly same figure with study conducted in Tanzania which revealed that postoperative pulmonary complications accounted for 8.3% of morbidity and mortality.[30] In this study done at SPHMMC, showed patients who developed PPC are 15 times most likely to die compared to those who did not have PPC. In addition, PPC is associated with longer hospital stay [OR 68.1 (95% CI 13, 73.37)].

6.4 Conclusion

Magnitude of Postoperative Pulmonary complication in SPHMMC is comparable with most research findings that are done outside the country. However, it is found to be significantly lower than the finding of a research done at Gonder University which is the only research done on this topic in the entire country. It might be surprising that the finding of this research concerning the magnitude of PPC is consistent with western standard, but literatures show that the prevalence of PPC ranges from 5%-80% depending upon the patient population and the criteria used to define a complication.[20] This might also be contributed to the difference in the prevalence of some risk factors which are independently associated with PPC, especially cigarette smoking, which is significantly low in prevalence in this study (1.8%) as compared to Kamlesh et.al where 42% were smokers (PPC 11.9%). [29] In general, various researchers have concluded that determination of frequency and clinical impact of PPC in modern practice is limited because of lack of a uniform definition of PPC in the literature. [6]

PPC's are life threatening as shown by PPC-mortality rising as high as 8.3%. Smoking, Upper abdominal surgeries, blood loss of greater or equal to 0.5 L and long surgical time were independently associated with the development of postoperative pulmonary complications and this is important because the ability to anticipate and prevent modifiable adverse clinical events such as postoperative pulmonary complications has become a principal measure of the quality and safety of hospital care.

6.5 Recommendation

Recommendation for surgical team is that anticipation of those risk factors which are strongly associated with PPC helps to be ready and take all necessary measures including further investigations that should be taken to avoid postoperative pulmonary complication since the adverse outcome of PPC is found to be grave. If a surgical procedure is to be done in patients who have clear risk factors, It is also important to have proper ventilator support preparation since about 25% of patients with PPC required ventilator support. It is also important to be equipped with the best knowledge and prepared medications for proper management of pneumonia, since it is the most common PPC in surgical patients.

Further prospective research needs to be done to confer more accurate tangible data concerning PPC because of two main reasons. First, there are only few researches done on this topic especially in our country, and it is difficult to get the exact picture of the risk factors of postoperative pulmonary complication in a developing countries like ours. Second, this research is a retrospective cross-sectional study from chart review and some of the information needed are not easily available, if not at all.

Chapter 7

7. Limitations and Strength

As with other retrospective studies done from chart review, detailed information and sometimes important information was difficult to obtain. Percentage of patients having medical illness was only 15.6% but this figure might be higher and the reason is that the documentations of base line investigations like HIV tests were very poor and in some emergency surgical procedures, there is poor documentation of underlying medical illnesses.

In addition, it was difficult to find any local data on this topic, so most of the literatures were from western researchers.

The Strength of this study is that although there is lack of local research, it was able to identify the risk factors for PPC in SPHMMC which will enable the clinical practitioners to anticipate and make effort to prevent these complications in the presence of identified risk factors.

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Annex

Check List (Questionnaire)

I. Socio-Demographic factor

1. Chart number_____
2. Age: A. < 10 B. 11-50 C. >50
3. Sex: A. Male B. Female
4. Residence: A. Oromia B. Amhara C. Tigray D. SNNPR E. Addis Abeba F. Benishangul Gumuz G. Gambella H. Others specify_____
5. Marital Status: A. Single B. Married
6. Economic Status A. free patient B. Paying

II. Surgical and Anesthetics Characteristics

7. Is the patient smoker A. Yes B. No
8. If Yes to Question number 7, how long have the patient been smoking
A. < 1 year B. 1- 5 years c. 6- 10 years D. > 10 years
9. If yes to question number 8, average daily numbers of cigarette consumed is
A. 1 – 5 B. 5 – 10 c. > 10
10. Does the patient drink alcohol A. Yes B. No
11. If yes to question number 10, how much does she/he drink per day
A. 1- 7 drink per week B. 8- 15 drinks per week C. > 15 per week
12. Is there any other medical illness that the patient has A. Yes B. No
13. If yes to question number 12, specify the illness : A. Hypertension B. Diabetis Mellitus C. Asthma D. COPD E. HIV D. TB E. End Stage Renal Disease F. Others _____
14. Type of anesthesia A. spinal anesthesia B. General anesthesia
15. Was there any intra operative bleeding? A. Yes B. No
16. If yes to question number 15, how much was the bleeding? A. <, = 500 ml B. > 500 ml
17. How was the patient admitted A. Elective B. Emergency
18. What type of surgery was it? A. head and neck B. Upper abdominal C. Lower abdominal
D. Thoracic D. Extremities E. Genito-urinary
19. Duration of surgery: A. less than 1 hour B. 1-3 hours C. 3- 5 hours D. > 5 hours

20. Method of surgical procedure A. Open surgery B. Laparoscopic surgery
21. Was prophylactic antibiotics given? A. yes B. No
22. Was analgesics given post operatively? A. yes B. No

III. Complications associated with the surgery

23. Was there any pulmonary complication after the surgery? A. Yes B. No
24. If Yes to question 24, what was the diagnosis A. Pneumonia B. Atelectasis C. Respiratory Failure D. Acute Respiratory distress syndrome E. Bronchitis F. Hemothorax G. others_____
25. What was clinical presentation of the patient? A. Tachypnea B. Desaturation C. Cough D. Tachycardia E. Respiratory distress E. others
26. What investigations were done for diagnostic purpose? A. CBC B. Chest x-ray C. chest CT D. Others_____
27. What was the result of the investigations? A. WBC> 12,000 B. Consolidation C. Pleural effusion D. Pulmonary Edema E. Others_____
28. Was there a need for ventilatory support for the patient A. Yes B. No
29. How long did the patient stay in the hospital A. < 1 week B. 1- 2 weeks C. 2 weeks to 1 month D. > 1 month
30. Did the patient die of the complication
- A. Yes B. No

