



PREVALENCE AND DETERMINANT FACTORS OF HOSPITAL ACQUIRED PNEUMONIA IN POST OPERATIVE ADULT SURGICAL PATIENTS AT SPHMMC

PREPARED BY: TESFAHUN DEREJE (MD, GSR3)

EMAIL: tesfahundereje6@gmail.com

MOBILE NO: +251913779384

ADVISERS:

Dr. Maheteme Bekele/ Associate Professor of surgery, consultant general and renal transplant surgeon/

Dr. Gelan Gebremikael / Assistant Professor of surgery/

Mr. Abraham Getachew / MPH from research directorate /

/

December 06/2020

**PREVALENCE AND DETERMINANT FACTORS OF
HOSPITAL ACQUIRED PNEUMONIA IN POST OPERATIVE
ADULT SURGICAL PATIENTS AT SPHMMC**

**A RESEARCH REPORT SUBMITTED TO SAINT PAUL'S HOSPITAL
MILLENNIUM MEDICAL COLLEGE, DEPARTMENT OF GENERAL
SURGERY; IN PARTIAL FULFILLMENT FOR THE REQUIREMENT OF
SPECIALITY IN GENERAL SURGERY.**

PREPARED BY: TESFAHUN DEREJE (MD, GSR3)

ADVISERS:

**Dr. Maheteme Bekele/ Associate Professor of surgery, consultant general and
renal transplant surgeon/**

Dr. Gelan Gebremikael / Assistant Professor of surgery/

Mr. Abraham Getachew / MPH from research directorate /

/

Abstract

BACKGROUND:

Hospital acquired pneumonia is an inflammatory condition of the lung parenchyma that develops 48-72hours after hospital admission. Despite advances on surgical and anesthetic technique it persists as a frequent postoperative complication which is associated with significant morbidity and mortality.

OBJECTIVE OF THE STUDY

The aim of the research is to know prevalence and to identify modifiable and non modifiable risk factors of Hospital acquired pneumonia in post-operative adult surgical patients.

METHODS:

This was Hospital based Cross-sectional study for patients who were admitted and operated at SPHMMC. Secondary data were collected by reviewing patients' medical records with the aid of pretested structured checklist. The collected data cleaned, edited, entered and analyzed with *Statistical Product and Service Solutions* SPSS Statistics v. 23. Statistical test chi square at 0.05 level of significance was used to assess the significance of association between variables. A P-value < 0.05 was considered statistically significant. To identify the prevalence and potential risk factors for HAP, we performed a multivariable Binary logistic regression analysis.

RESULTS:

339 patients charts who fulfilled the inclusion criteria were revised .out of which 89(26.3%) developed hospital acquired pneumonia. Among patients who developed HAP; male to female ratio was 1:1.06 and 95.5% of patients were operated under general anesthesia.

Being diabetic (AOR=11.23(1.61;78.22)),patients with repeated surgeries(AOR=20.59(1.17;361.60)), emergency surgeries(AOR=18.71(3.00;116.14)),patients above ASA class1(AOR=35.38(5.59;223.75)), age above 55yrs(AOR=36.28(6.60;199.32)),durations of surgeries above 2:30hrs(AOR=483.05(40.12;5814.77)) were independently associated with HAP.

CONCLUSION:

This study shown us the burden of postoperative HAP at SPHMMC was high. We retrospectively derived six determinant factors for developing post operative HAP. Detailed history, physical examination and investigation must be done preoperatively. Limiting duration of surgery particularly for emergency cases can decrease occurrence of HAP.

CONTENTS

Abstract.....	3
I. INTRODUCTION.....	5
II. OBJECTIVES.....	8
GENERAL OBJECTIVE:.....	8
SPECIFIC OBJECTIVES:.....	8
III. METHODS AND SUBJECTS.....	9
IV. RESULT.....	12
Table 4.1 summary of sociodemographic and clinical variables.....	13
Table 4.2 Summary of locations of Incision.....	15
Table 4.3 Final Stepwise Binary Logistic regression result.....	17
V. DISCUSSION.....	18
VI. CONCLUSION.....	20
VII. RECOMMENDATION.....	20
VIII. LIMITATION OF THE STUDY.....	20
IX. REFERENCES.....	21

I. Introduction

Hospital acquired pneumonia (HAP) refers to pneumonia a patient develops in the hospital at least 48–72 hours after being admitted. It is the second common nosocomial infection ,but the common cause of death among all hospital acquired infections with a mortality rate of 20-50%[1].The highest rates of HAP are observed in the elderly, surgical patients, patients on mechanical ventilation and immunocompromised hosts. Basically, HAP occurs due to imbalance between host defense and colonization of microorganisms. Hap is frequently polymicrobial, commonly with highly resistant bacteria's [1].

The most common bacterias are Staphylococcal aureus including MRSA,Pseudomonas aeruginosa,Klebsiella pneumonia ,Enterococci coli,Non-enterobacteriaceae bacteria such as Staphylococci marcescens,acinetobacter species.....etc[1]

Clinical manifestations of HAP are non specific and there are no pathognomonic signs and symptoms that are unique to this condition. Commonly patients will present with productive cough, shortness of breath, high grade fever, chest pain, hypoxia and leukocytosis. Both laboratory and radiologic findings are not specific predictive of HAP. A microbiological approach to diagnosis of HAP can be done through non invasive or invasive techniques. Non invasive techniques include collection of spontaneously expectorated sputum and nasotracheal suctioning. Invasive techniques include protected specimen brush and bronchoalveolar lavage.BAL technique has sensitivity of 45%-100% with specificity of 89%-100%, but it is commonly practiced for patients with suspected VAP which is pneumonia occurring 48 Hours after but within 72 hours of the initiation of ventilation[2].

The Canadian Journal of Infectious Diseases and Medical Microbiology along with Canadian Thoracic Society recommend using clinical criteria in combination with radiologic finding.

- Fever –body temperature $>38^{\circ}\text{C}$ or $<36^{\circ}\text{C}$
- Leukocytosis or leukopenia-WBC $>12,000/\mu\text{l}$ or $<4000/\mu\text{l}$
- Purulent tracheal secretions or productive cough
- Decreased Partial pressure of oxygen or Oxygen saturation level $<90\%$

The presence of two or more of clinical features along with new onset or progressed pulmonary infiltrates either presence of alveolar infiltrates or air bronchogram can diagnose HAP[2].

Initiation of parenteral Antibiotics is the main medical management for patients with HAP. The infectious Diseases society of America and American thoracic society recommends that each hospital to generate an antibiogram to guide healthcare professionals with respect to the optimal choice of antibiotics [3].They also recommend initiation of antibiotics based on results of microbiologic results rather than empiric therapy. But for those who cannot perform microbiologic studies empiric therapy should cover MRSA and p. Aeruginosa for patients who are at risk for these infections [3].

Commented [u1]: HAP

In addition to the impact of complex surgical procedure, developing HAP adds profound morbidity and mortality to a patient. Demographic data in studies shows post operative HAP is common in male, elderly patients age>75, in patients with comorbidities and in those undergoing upper abdomen and chest surgeries.

The World Health Organization (WHO) conducted a prevalence survey in 55 hospitals Of 14 countries representing 4-WHO regions (Europe, Eastern Mediterranean, South East Asia and Western pacific). This survey found an average of 8.7% of hospital patients had nosocomial infection[4]. At any time, over 1.4 million people worldwide suffer from infectious complications acquired in a hospital. The most frequent nosocomial infections are urinary tract infections and lower respiratory tract infections. HAP accounts for 15% hospital acquired infections and has the highest morbidity and mortality of all hospital acquired infection. The highest prevalence of nosocomial infections occurs in intensive care units and in acute surgical wards. HAP also prolongs the hospital stay an additional 5-8 days on average which leads to higher cost for the patient and the health care system. Prolonged stays not only increase direct costs to patients or payers but also indirect costs due to lost work. Hospital-acquired infections add to functional disability and emotional stress of the patient and May, in some cases, leads to disabling conditions that reduce the quality of life.

Knowledge about disease burden and risk factors of post operative HAP is lacking in our set up. This study is done to know the prevalence and identify risk factors of post operative HAP in our set up and devise strategies for their prevention. We expect that the result will lead to developing organizational and national guidelines in preventing, diagnosing and management of HAP. Finally, we anticipate it will help in reducing HAP associated morbidity and mortality and would eventually ensure high-quality patient care.

A prospective, observational study on postoperative pulmonary complications and associated factors among surgical patient was conducted at Gondar University Hospital, Ethiopia. Four hundred five patients were included in this study using systematic sampling technique [14]. 88(21.7%)Patients developed postoperative pulmonary complications. Among the postoperative pulmonary complications evaluated, majority were postoperative pneumonia (85.2%) followed by Bronchitis (11.4%), respiratory failure (1.1%) laryngeal edema (1.1%) and heamothorax (1.1%).in this study use of General anesthesia, intra operative blood loss greaterer than 500ml, poor post-operative pain control and prolonged surgery greater than 1hour were independently associated with PPC.

A cross-sectional study was performed Dr Valentin Gomez Farias hospital in Mexico, evaluating risk factors for nosocomial pneumonia in patients with abdominal surgery [6].

Commented [u2]: This should be written at the end of literature review. The order of literature reviews are 1st you start globally then you will proceed literature in Africa, suseharan Africa and at last to literature in Ethiopia.

Incidence and mortality rate of nosocomial pneumonia were 9.2% and 8.8% respectively. Age >60, chronic obstructive pulmonary disease, emergency surgery, surgical time >120 min and postoperative hospitalization time >15 days were significantly associated with nosocomial pneumonia.

A retrospective study in Japan at Kobe University Hospital on post operative HAP after gastrectomy for gastric cancer, among 250 patients who underwent curative gastric resection 12.8% (32) patients developed HAP[7]. Males accounted for about 68.2% and 70% of the HAP cases were in patients over the age of 65 years. HAP was more also common in patients who had undergone D2 gastrectomy compared to D1 gastrectomy.

A retrospective study evaluating patients who had received surgery for acute abdomen or trauma was done in the surgical ward at the Linköping University Hospital, Sweden. Pneumonia was reported in 266(2.6%) patients in the emergency. There were significantly more men (58.8) than women who had pneumonia. 23.3% of patients were older than above 85 years [8].

Retrospective study done from Zimbabwe on postoperative pulmonary complications after thoracic and abdominal surgery [9], evaluated a total of 92 patients and 39(42.2%) subjects developed postoperative pulmonary complications. The common complication was HAP in 21 subjects (22.8%), followed by ventilator associated pneumonia (12%) and atelectasis (6.5%). The common comorbidities were HIV infection noted in 14 subjects (15.2%) and DM in 10 (13%). Majorities of the subjects were male (66.7%). History of alcohol consumption was found to be significant risk factor ($p=0.038$).

A study conducted on 994 hospitals in the USA including 618,495 patients who underwent intrabdominal surgery. 10.7% (13,292) patients developed Hospital acquired pneumonia [10]. The ratio of Women to men among patients with HAP was 2:1. The incidence of Hospital acquired pneumonia was greatest in patients undergoing feeding gastrostomy, followed by gastrectomy, small bowel resection, nephrectomy, colorectal resection, colostomy, renal transplant, ileostomy and cholecystectomy. The mortality rate of hospital acquired pneumonia was 10.69%. HAP was associated with a 55% increase in hospital stay, which represents increased hospital stay by 11 days and with mean increase in total hospital discharges of 75 % (\$28,160.95).

A study published in India on predictors of postoperative pulmonary complications after liver resection found that; of 117 patients with hepatic resection 28 developed Postoperative pulmonary complications. Among these nosocomial pneumonia occurred in 12 patients (42.8%), atelectasis in 8 (28.5%) and pleural effusion in 3 (10.7%)[11]. Sixteen patients (57.1%) were over the age of 70 years old, 21 patients were smokers (75%) and 8 patients had COPD.

II.OBJECTIVE

General Objective

To assess prevalence and determinant factors of Hospital acquired pneumonia in post-operative adult surgical patients at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from 1st 2017 to July31st 2017GC.

- .

Specific Objectives

- To determine the prevalence of Hospital acquired pneumonia In post operative patients in surgical wards of SPHMMC .
- To determine the potential risk factors of Hospital acquired pneumonia.

III. Methods and subject

Study setting

The study was conducted at St. Paul's Hospital Millennium Medical College which is located in the north western part of Addis Ababa and serves as a referral center for patients from Addis Ababa and all over the country [12]. On average it provides health service for more than 2000 inpatient and 200,000 outpatients annually and more than 5000 surgeries annually the hospital currently provides undergraduate, postgraduate and fellowship programs. The department of surgery includes general surgery, urology, plastic, and pediatrics surgery units.

Study Design

A retrospective cross-sectional study was conducted in post operative adult surgical patients at Saint Paul Hospital Millennium Medical College, Addis Abeba, Ethiopia from April 1st 2017 to July 31st 2017 GC. □

Source population

All patients who were admitted and operated at SPHMMC, surgical ward during study period will be the source population of the study.

Commented [u3]: Does this include pediatric patients. This group patients are excluded from the topic you selected for research.

Study Population

All adult patients who were admitted operated and stayed in the surgical ward for more than 48hrs from April 1st 2017 to July 31st 2017 GC. □

- **Inclusion Criteria**

All adult patients who were operated and stayed in the surgical ward for more than 48hrs at St. Paul's Hospital Millennium Medical College and affiliated centers, in the study period.

Exclusion Criteria

- All Patients whose age is <18.
- All patients who with postoperative hospital stay less than 48hrs.

Commented [u4]: What about patients with incomplete data. Patient transferred to ICU.

Study Variables

- **Independent Variables**-age,sex,comorbidities,smoking,ASA classification, schedule of surgery, type of anesthesia,location of incision,Duration of surgery, amount of blood loss,naso gastric tube, reoperation
- **Dependent variable**-HAP.

Sample size and Sampling

Using single population formula $n = \frac{Z^2 p (1-p)}{d^2}$ (n= minimum required sample size, p=population proportion in problem (estimated prevalence of HAP in) =0.54% in our literature review incidence of post operative pneumonia 0.5-54% [13], D=degree of accuracy (estimated error)=5% or 0.05,Z=the standard normal value at confidence interval of 95%=1.96). Sample size become 309, taking into consideration non response of both unit and item 10 % ,the sample size become 339.

Data collection

Primary data were collected by reviewing patients' medical records with the aid of pretested structured checklist by five well trained general interns. Data filling were checked and supervised by the Principal investigator and co investigators (advisors) .The data extraction tool was prepared in English.

Data processing, interpretation and analysis

The collected data were cleaned, edited,entered and analyzed to *Statistical Product and Service Solutions* SPSS Statistics v. 23. Statistical test (chi square at 0.05 level of significance was used to assess the significance of association between variables). A P-value < 0.05 will be considered statistically significant. Reference ranges for each measurement will be calculated using 95% reference range (mean±2standard deviation).Results will be presented using text and tables.

Ethical Consideration

Ethical approval for the research was granted by review boards of SPHMMC. A permission to conduct this study was granted from SPHMMC, Surgical Department. There was no any harm to individual patients. There was no personal identifier included in the data collection form. The data obtained was not be accessed by a third person, except the principal investigator.

Operational definition

Postoperative HAP-a pneumonia patient developed post operatively after 48hrs being admitted to the hospital. It was Defined as based on clinical diagnostic algorithm of Canadian thoracic society [2].

Adult patient- A patient with age >18yrs old.

Post operative patient-patient who underwent surgery.

Emergency -Surgical emergency is a medical emergency for which immediate surgical intervention is the only way to solve the problem successful.

Elective surgery-surgical procedure done on the patients on scheduled date.

Improved-A patient treated for HAP with antibiotics and discharged from the hospital without complication.

Mortality rate-number of patients who died after developing Hospital acquired pneumonia per total number of patients included in the research.

Commented [u5]: Is this definition appropriate for your study population . Because it include patient who are nor operated and yet developed pneumonia after 48 hrs of admission to the hospital. I it is good to communicate with your advisors. I suggest it woul better to define postoperative HAP a pneumonia developed in post operative patients after 48hrs admitted to a hospital. I rely doubt the diagnosis pneumonia made in our hospital based on cilinical diagnostiic of Canadian thoracic society. Rather you include all patients diagnosed with HAP in the study period for post operative patients.

IV.RESULT

During 4 months of the study,788 operations were performed ar SPHMMC and 339 patients stayed in the surgical ward more than 48 hours.The mean age of patients involved in the study is 43.6 +/-14.1 and 176 male(51.9%) with male to female ration of 1.06/1 were included in this study.

Among 339 patients who were operated and stayed in the ward for more than 48hrs,89(26.3%) patients developed HAP and 31(9.1%) patients died due to respiratory failure secondary to septic shock of chest focus.

86(25.3%) patients have comorbidities; 31(9.1%) cardiovascular disease, 22(6.4%) diabetic, 15(6.4%) respiratory disease (9(2.6%) asthmatic and 6(1.7%) COPD), 10(2.9%) patients have RVI, 5 (1.4%) renal diseases and 3(0.8%) liver disease.13 (3.8%) patients were smokers and 53.8% of the smokers developed post operative HAP.

248(73.1%) of the patients were ASA1 and 28(8.2%) patients have undergone repeated surgery due to surgical complications. From all patients 82% patients were operated under general anesthesia and 62.8% patients were elective cases.

68(20%) patients undergone surgeries with blood loss greater than 500ml and 69.1% of the patients with blood loss above 500ml developed HAP post operatively.271(79.9%) patients had blood loss less than 500ml and only 42(12.3%) patients developed HAP post operatively.

58(17.1%) of patients undergone surgery with duration greater than 2:30hrs and 89.6% of them developed HAP. Summary of sociodemographic and clinical variables is presented in table 4.1

255(75%) patients have undergone surgeries with abdominal wall incisions(83(24.4%) lower abdominal,81(23.8%)midline and 47(13%) upper abdominal,44(12.9%) flank),33(9.7%) neck surgeries,22(6.4%) endourology procedures,15 (4.4%)breast surgeries,13(3.8%) perinial surgeries and 3(0.8%) vascular surgeries for Peripheral vascular disease.

Table 4.1 Summary of sociodemographic and clinical variables		
Variables	Frequency	Percentage
Age		
<55yrs	251	74%
>55yrs	88	26%
Sex		
Male	176	51.9%
Female	163	48.1%
DM		
Yes	22	6.5%
No	317	93.5%
Respiratory disease		
Yes	15	4.4%
No	324	95.6%
Cardiovascular disease		
Yes	31	9.1%
No	308	90.9%
Renal disease		
Yes	5	1.5%
No	334	98.5%
Liver disease		
Yes	3	0.9%
No	336	99.1%
Smoking		
Yes	13	3.8%
No	326	96.2%
Retroviral infection		
Yes	10	2.9%
No	326	97.1%
ASA classification		
ASA 1	248	73.2%
ASA2	72	21.2%
ASA3	17	5%
ASA4	2	0.6%

Repeated surgery		
Yes	311	8.3%
No	28	91.7%
Post operative NG tube		
Yes	60	82.3
No	279	17.7
Type of anesthesia		
General anesthesia	278	82%
Spinal anesthesia	61	18%
Schedule status		
Elective surgery	213	62.8%
Emergency surgery	126	32.2%
Blood loss		
<500ml	271	79.9%
>500ml	68	20.1%
Duration of surgery		
<2;30	281	82.9%
>2;30	58	17.1%

Table 4.2 Summary of postoperative HAP with sociodemographic and clinical variables

Variables		HAP		p-value
		No	Yes	
ASA classification	ASA1	229/91.6	19/21.3%	0.000
	ASA2-5	21/8.4%	70/78.7%	
Age	Age<55	208/83.2%	43/48.3%	0.000
	Age>55	42/16.8%	46/51.7%	
Sex	Female	120/48.0%	43/48.3%	0.059
	Male	130/52.0%	46/51.7%	
Diabetic mellitus	Yes	11/4.4%	11/12.4%	0.021
	No	239/95.6%	78/87.6%	
Respiratory disease	Yes	2/0.8%	13/14.6%	0.000
	No	248/99.2%	76/85.4%	
Cardiovascular disease	Yes	22/8.8%	9/10.1%	0.071
	No	228/91.2%	80/89.9%	
Renal disease(CKD)	Yes	2/0.8%	3/3.4%	0.084
	No	248/99.2%	86.96.6%	
Liver disease	Yes	1/0.4%	2/2.2%	0.021
	No	249/99.6%	87/97.8%	
Retroviral infection	Yes	5/2.0%	5/5.6	0.000
	No	245/98.0%	84/94.4%	
Smoking	Yes	6/2.4%	7/7.9%	0.000
	No	244/97.6%	82/92.1%	
Type of anesthesia	Spinal anesthesia	57/22.8%	4/4.5%	0.000
	General Anesthesia	193/77.2%	85/95.5%	
Schedule status	Elective	191/76.4%	22/24.7%	0.000
	emergency	59/23.6%	67/75.3%	

Duration of surgery	<2:30hrs	244/97.6%	37/41.6%	0.000
	>2:30hrs	6/2.4%	52/58.4%	
Blood loss	<500ml	229/91.6%	42/47.2%	
	>500ml	21/8.4%	47/52.8%	
Post-operative nasogastric tube	Yes	25/10%	35/39.3%	0.000
	No	225/90.0%	54/60.7%	
Repeated surgery	Yes	5/2%	23/25.8%	0.000
	No	245/98.0%	66/74.2%	
Locations of incision	Midline abdomen	27/10.8%	54/60.7%	0.063
	Upper abdomen	37/14.8%	10/11.2%	
	Lower abdomen	76/30.4%	7/7.9%	
	Flank	38/15.2%	6/6.7%	
	Neck	29/11.6%	4/4.5%	
	Chest	12/4.8%	3/3.4%	
	Perineum	12/4.8%	1/1.4%	
	Lower extremity	3/1.2%	0/0%	
	Endourology procedures	16/6.4%	4/4.5%	

Factors associated with postoperative HAP

Being elderly(age>55yrs),diabetic patients,patients with ASA class above1 and repeated surgeries,emergency surgeries and those with duration of surgeries above 2;30hrs are significantly associated with developing hospital acquired pneumonia.

Summary of final result of stepwise binary logistic regression Model is presented in table

Table 4.3 final result of stepwise binary logistic regression Model				
variables	Sig.	Exp(B)	Lower	Upper
Repeated surgery	.035	.047	.003	.803
DM	.014	.088	.013	.613
emergency	.002	.057	.010	.338
Duration >2;30	.000	.002	.000	.025
ASA>1	.000	.031	.005	.179
Age>60	.000	.028	.005	.153
Smoking	0.200	.211	0.20	2.279
Post-operative NG tube	0.848	0.851	.165	4.390
Respiratory disease	0.190	.120	0.009	1.595
General anesthesia	0.025	.098	0.013	.746
Bloodloss >500ml	0.392	0.471	0.84	2.638
Constant	.000	12126155 9.128		

I. Discussion

Our study has shown the prevalence of HAP in post operative adult surgical patient is 26.2%.this rate is higher than reported rates in study at Mexico by Gerardo Evaristo et al [6] and British by Kamelesh Patel et al [14] which were 9.2% and 8.2% respectively. Where as compared to study in Ethiopia by Zewditu Abdissa et al [5] where the rate is 18%,our reported rate of HAP is low. The above mentioned statistics clearly depict a wide range of HAP incidence because of difference in patient population and criteria to define HAP.

Commented [u6]: Still high

Pulmonary adverse events after surgery are the commonest one.HAP is the commonest post operative pulmonary complications in the studies conducted at Zimbabwe by Tadyanemhandu et al [9] and India by Choudhuri AH,et al [11].post operative HAP increases significantly morbidity and mortality of the patient, Managing HAP requires much resource in terms of human resource, material and finance. All possible risk factors should be evaluated so as to devise preventive strategies leading to reduction in the rate of HAP. This study show being elderly, diabetic patient, ASAclass above1,having repeated surgery, emergency surgeries and long surgical time were significant predictors of HAP.

In Our study, frequency of HAP in elderly patients age>55yrs old was 52.2% which is significantly higher than in patients with age<55yrs old which is 17.1%.Similarly in a study done at USA by Peter R.Smith et al[15].elderly patient's age above 63 years old were independently associated with post operative HAP. This can be explained elderly patients have prolonged immobility which leads to increased pulmonary secretions and they might also at higher risk of having associated comorbidities.

Similarly being diabetic is significantly associated with HAP in our research..This is in line with Retrospective study done from Zimbabwe by Tadyanemhandu et al [9] on postoperative pulmonary complications where patients with comorbidities were at higher risk of developing Post operative pulmonary complications, but,smoking and having underlying respiratory disease were not independently associated with HAP. A study done at India on predictors of postoperative pulmonary complications by SiddharthaVerma et al[16] smoking and having COPD were independently associated with post operative HAP. This is due to low sample size in our study and low prevalence of smoking in population.

Commented [u7]: Correct the gramer

Another factor that showed association with postoperative HAP is patients with above ASA class 1. A published article by Dr Rudra A and Dr Sudipta Das on postoperative pulmonary complications in 2006,ASA class>1 were among patient related risk factors for PPC[17] . The explanation for this is

patients with higher ASA class have systemic diseases which interferes with the normal auto regulation mechanisms of respiratory as well as other systems of the body.

In our study 58% of our patients have undergone a surgery that lasts more than 2:30hrs and from these 89.6% of the patients have developed HAP post operatively. patients with duration of surgery >2:30 hrs were at high risk of developing HAP post operatively. A cross-sectional study was performed at Mexico by GerardoEvaristo et al[6] on risk factors for nosocomial pneumonia in patients with abdominal surgery have identified surgical time >120 min as independent risk factor for .A prospective, observational study on postoperative pulmonary complications and associated factors among surgical patient was conducted at Ethiopia by Zewditu Abdissa et al[5] , have identified Duration of surgery greater than 1hour, General anesthesia and intra operative blood loss above 500ml were strongly associated with PPC.However,our result have not shown association between general anesthesia and amount of blood loss with post operative HAP. The possible explanation for this is limited number of sample size and most of trauma patients were not part of these research.

Emergency surgeries are another factor that showed significant association with postoperative HAP. This finding is consistent with the study conducted in Mexico by GerardoEvaristo et al[6] and study done at USA by PeterR.Smith et al[15] frequency and risk factors of Postoperative pulmonary complications after laparotomy. In our study 126 patients were operated in emergency bases and 53.1% of the patients developed HAP. This can be explained by, there will be inadequate time for evaluation,investigating and preparing patients for both surgical and anesthesia team .so ,this will cause hemodynamically unstable patients to undergo major surgeries which further compromise the functions of every systems of the body.

Another factor that showed association with postoperative HAP was having repeated surgery with the same admission due to surgical complications. In our research 28 patients have undergone repeated surgery and 82.1% of the patients developed HAP. Similar finding were noted in study done at USA by PeterR.Smith et al,there was a 7 fold greater risk for PPC after reoperation[15].This can be explained by most of the repeated surgeries are done under emergency bases, there will be drainagement on immunologic and metabolic functions of the body from two surgeries and finally leading to decreased mobility of patients and increased pulmonary secretions. This also leads to increased hospital stay and exposure to hospital acquired pathogens.

Postoperative pulmonary complications are associated with substantial morbidity and mortality. Our research shown mortality rate of 9.1%. A study conducted in Mexico by GerardoEvaristo et al [6] shown mortality rate of 8.8%.this difference can be explained by difference in set up.

Commented [u8]: Is it from patients who are operated on emergency bases or from pt,s who developed pos. HAP.

Conclusion

The burden of postoperative hospital acquired pneumonia in SPHMMC was high. HAP is associated with increased morbidity and mortality, as shown HAP associated mortality is 9.1% at SPHMMC. elderly(age>55yrs),diabetic patients, patients with ASA class above1 ,repeated surgeries, emergency surgeries and long surgical time were associated factor for the development of postoperative HAP. The ability to anticipate and prevent modifiable adverse clinical events such as postoperative HAP should become a principal measure of the quality and safety of hospital care.

Recommendation

From the above results shown up, the author strongly recommends the following important points regarding HAP.

- Since emergency cases are significantly associated with the post operative HAP,atleast limitation of duration of surgery plays great role in decreasing HAP and associated mortality.
- We strongly recommend the hospital should have its guideline for preventing, diagnosing and managing HAP.
- We strongly recommend to have further observational prospective study regarding risks of HAP including trauma centers.

Commented [u9]: Have you rely access the relationship b/n the duration of surgery and development of post operative HAP specifically for emergency surgeries. Your association talks about duration of surgeries and HAP for all pt,s who developed post op HAP.

Limitation of the study

- Orthopedics, plastic surgery and neuro surgery patients are not included in this research. Further studies should be done involving this unit to validate the determinant factors and prevalence of HAP.
- Because of retrospective nature of this research, it was difficult to find all important variables like blood transfusion,postoperative analgesia dose and frequency.
-

REFERENCES

1. Ofelia C. Tablan, M.D., Larry J. Anderson, M.D., Nancy H. Arden, et al, Guidelines for Prevention of Nosocomial Pneumonia, CDC, January 3, 1997 / Vol. 46,3-5
2. Coleman Roster, Gerald Evans, George G Zhale et al Canadian journal of infectious diseases and medical microbiology along with Canadian thoracic society HAP and VAP guidelines, Can J Hosp Pharma, May-June 2017, 70(3);251-253
3. Andre C. Kalil, John, G. Bartlett, Mark, L. et al Management of Adults With Hospital-acquired and Ventilator-associated Pneumonia: 2016 Clinical Practice, Guidelines by the Infectious Diseases Society of America and the American Thoracic Society, AJRCCM, July 2016, Vol 194, 89-102,
4. G. Duce, J. Fabry, L. Nicolle et al A practical guide Prevention of hospital-acquired infections, 2nd edition, 2002 GC. 12, vol 2, 1-7
5. Zewditu Abdissa Denu, Mensur Osman Yasin, Tadesse Belayneh Meleki et al, Postoperative Pulmonary Complications and Associated Factors among Surgical Patients, J Anesth Clin Res, August 2015, vol 6, 6-9,
6. Gerardo Evaristo, Méndez, César Haydn, Rocha-Calderón, Risk factors for nosocomial pneumonia in patients with Abdominal surgery, Cirugia y cirujanos, 2016;84, 21-27,
7. Chikashi Shibata, Hitoshi Ogawa, Toru Nakano, et al Long-term impact of postoperative pneumonia after curative gastrectomy for elderly gastric cancer patients, Ann Gastroenterol Surg. 2018;2:72-78.
8. STENLUND, Pia Yngman-Uhlin, St. Larsgåtan incidence and potential risk factors for hospital-acquired pneumonia in an emergency department of surgery, International Journal for Quality in Health Care, 2017, 29(2), 290-294
9. Tadyanemhandu C, et al, the prevalence of pulmonary complications after thoracic and abdominal surgery and associated risk factors, Bio med central, 2017, 6(11), 2-8
10. David A Thompson, clinical and economic outcomes of Hospital acquired pneumonia in intra-abdominal surgery patients, NIH, 2006, 7(10), 40-46,
11. Choudhuri AH, et al, predictors of Postoperative pulmonary complications after liver resection, India, Indian J crit care Med. 2014 June, 18(6), 358-362
12. History of St Paul Hospital Millennium Medical College, <http://www.sphmmc.gov.et/>
13. Morad Chughtai, Chukwuweike U. Gwam, Nequesha Mohamed et al The Epidemiology and Risk Factors for Postoperative Pneumonia, J Clin Med Res. 2017;9(6):466-475

14. Kamelesh Patel, Fatemeh Hadian, Ayesha Ali, Graham et al, incidence and effects of Postoperative pulmonary complications on patients undergone elective abdominal surgery, *perioperative medicine*, 2016, 5; 10
15. Peter R. Smith, Muhammad, A. Baig, Veronica, et al frequency and risk factors of Postoperative pulmonary complications after laparotomy, *Respiration* 2010; 80: 269–274
16. Siddhartha Verma, Ankur Bhardwaj, Sagar Manohar Patil, post-operative pulmonary complications in patients of emergency abdominal surgeries, *Int Surg J.* 2018 Sep; 5(9): 3057-3065
17. Dr Rudra A and Dr Sudipta Das on postoperative pulmonary complications *Indian J. Anaesth.* 2006; 50(2): 89-98

