

**St. Paul's Hospital Millennium Medical College, Department of
Internal Medicine**



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St. Paul's Hospital Millennium Medical College**

**Diagnosis, Treatment and Outcome of Hospital Acquired
Pneumonia among Medical Patients at Saint Paul's Hospital
Millennium Medical College, Ethiopia, April to July 2019**

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August 2019

Addis Ababa, Ethiopia

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Pneumonia among Medical Patients at Saint Paul's Hospital
Millennium Medical College, Ethiopia April to July 2019**

**A Research thesis submitted to the department of Internal Medicine
of SPHMMC for partial fulfillment of the requirements for internal
medicine specialty**

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Addis Ababa, Ethiopia

Abstract

Background: Hospital acquired pneumonia (HAP) is the second most important cause of nosocomial infection and accounts for high morbidity and mortality and a relevant economic burden on health care services and resources worldwide. In sub-Saharan countries including Ethiopia, there is limitation of most of the diagnostic modality used to diagnose HAP. One of the most underutilized diagnostic modality is chest x-ray. The study tries to assess the practice of diagnosis, treatments and outcome of the patient with HAP. The topic is barely studied in Ethiopia.

Objective: To assess the diagnostic modalities utilized, antibiotic usage and the outcome of hospital acquired pneumonia.

Methods: The study was conducted using a prospective cohort study design from March 2019 to July 2019 on diagnosis, treatment and outcome of HAP among medical patient admitted at Saint Paul medical ward and medical Intensive care unit. Data was collected from 60 patients with HAP. For data entry and analysis SPSS version 25 was used. Frequencies and percentages were used to express descriptive statistics.

Results: Of 60 study participant, 39 (65.0%) were females and 21(35.0%) are from Oromia region. The median age was 35 years. Medical ward account 41(68.3%) of patient place of admission while medical intensive care unit account for 19(31.7%) of the patients. Acute kidney injury and chronic renal disease due to multiple cause were the most common underlying co morbidity in around 19(31.7%) of the patients. Diagnosis was made by radiologic confirmation in 25 (41.7%) while blood culture was requested in 21(35.0%) patients. Among the radiological confirmed patients lobar involvement is found in 13(52.0%) and multi-lobar in 12(48.0%) of patients. Only 3 blood cultures grew; *Staphylococcus Aureus* (Methcillin resistance *Staphylococcus Aureus*), *Enterococcus Faecium* and *Acinetobacter Baumannii* being the grown organisms. The mean duration of growth is 7 days. Complete blood count is requested in all patients for diagnosis and it turn out to be normal in 19(31.7%), leucopenia in 7(11.7%) and leucocytosis in 34(56.7%) of patients. Chest CT scan in 3(5%) of patients, left sided pleural effusion in 3(5%) of patients and right sided pleural effusion with pleural fluid analysis result in

1(1.7%) of patients were used as other diagnostic modality to reach at diagnosis. Ceftazidime and vancomycin combination antibiotics were used in 38(63.3%) of patients for treatment and 10 days being the commonest duration of antibiotic prescription in 37(61.7%) of patients. Of all patients 49(81.7%) of patient were alive and discharged home, 11(18.3%) of them were dead.

Conclusion: HAP was found to be more prevalent among adult females. The majority of patients were admitted at medical ward with AKI/CKD as commonest medical co morbidity. Diagnosis by CBC is found to be the most common means of HAP diagnosis followed by radiological confirmation and lastly by blood culture. Lobar and multi lobar involvement on the CXR is the most common radiologic report. Blood culture demonstrated growth in only 12% of patients for whom blood culture is requested. Other diagnostic modalities like chest CT scan performed for possible diagnosis. The most common antibiotics being utilized are a combination of ceftazidime and vancomycin and it's usually given for 10 days. Majority of the patients were alive and discharged home once their disease is addressed.

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Acronyms and Aabbreviations

A.A	Addis Ababa
AKI	Acute kidney injury
CBC	Complete blood count
CKD	Chronic kidney disease
CLD	Chronic liver disease
COPD	Chronic obstructive pulmonary disease
CXR	Chest X-ray
CT	Computed tomography
E.C	Ethiopian calendar
G.C	Gregorian calendar
HAP	Hospital acquired pneumonia
HIMS	Health Information Management System
IRB	Institution Review Board
MICU	Medical Intensive Care Unit
MV	Mechanical Ventilator
SPHMMC	Saint Paul’s Hospital Millennium Medical College
NG tube	Nasogastric Tube
SPSS	Statistical Package for the Social Sciences
US	United State

1. INTRODUCTION

1.1. Background

Hospital acquired pneumonia (HAP) represents one of the most common nosocomial infections, with significant impact on patient morbidity and mortality, as well as on the cost of health care (1). Accounting for 15% of all hospital-acquired infections, nosocomial pneumonia is a frequent lethal complication of hospitalization. At a rate of 3 to 10 cases per 1000 hospital admissions, HAP may increase a patient's hospital stay by more than a week, resulting in up to \$40,000 in additional costs and a threefold increase in mortality(1). For a patient being admitted for ailment source to develop HAP can be hematogenous dissemination, inhalation of exogenous organisms and aspiration of endogenous organisms. Micro aspiration is said to be the most important source for HAP acquisition in immunosuppressed medical patients.

united kingdom guidelines for the management of hospital acquired pneumonia published in 2008 try to explain the absence of universally accepted 'gold' or reference standard criteria to diagnose HAP(2). The European also believed that the diagnoses of HAP has to be based upon pulmonary infiltrate plus the clinical criteria mentioned in ATS/IDSA guideline plus etiology diagnoses by blood culture or sputum culture (2).it also try to point out the absence of key imaging investigation that can establish the diagnosis of hospital of HAP, though a normal CXR exclude HAP (2).

Hospital acquired pneumonia and its management by Natalie schellack 2015 try to explain the overly sensitivity of clinical diagnoses for HAP and also recommend combination of modalities to diagnose HAP (3).

A paper entitled by hospital acquired pneumonia pathophysiology ,diagnosis and treatment 2009 by Alicia etal has also come up with the absence of gold standard diagnostic modality and the need to combine clinical , radiological and microbiological criteria to diagnose HAP(1).

Hospital acquired pneumonia and its management by Natalie schellack2015 point out Initial antimicrobial therapy has to be started empirically in almost all cases of VAP and HAP. Delayed treatment could lead to increased mortality, a prolonged intensive care unit or hospital stay, and an increase in the need for or duration of mechanical ventilation(3).

In a large series involving patients with HAP, Alvarez Lerma et al revealed that patients who received adequate antibiotic treatment had lower mortality than did those who received inadequate therapy(16% vs. 25%)(4).

HAP patients who develop HAP in the intensive care unit(ICU)serious complications occur in approximately 50% of patients, including respiratory failure, pleural effusions, septic shock, renal failure, and empyema according to ATS/IDSA 2016 management of HAP/VAP(5).

Hospital acquired pneumonia and its management by Natalie schellack 2015 conclude by pointing HAP and VAP complicate patients' current treatment and patient outcomes, and can increase their length of hospital stay and risk of mortality(3).

A study by Sopena et al a multicenter study involving 165 patients with nosocomial pneumonia acquired in units other than the ICU. The overall mortality was 26 %(4).

A study by Soo-Hoo et al treatment adequacy and outcome has shown the 14-day mortality decreased from 27% to 8%. There were also differences with regard to hospital and 30-day mortality (4).

There is no single study done in Ethiopia regarding HAP. Diagnosis modalities, treatment and outcomes are unknown in Ethiopia.

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1.2. Statement of the problem

HAP is the most frequently diagnosed and well-known contributor for morbidity and mortality of patients admitted to medical ward (1). Despite being the most common cause of health care associated infection there has been diagnostic challenge in making firm diagnosis and reduces antimicrobial resistance (2).

The diagnosis of HAP is suspected if the patient has a radiographic infiltrate that is new or progressive, along with clinical finding suggesting infection, which includes the new onset of fever, purulent sputum, leukocytosis, and decline in oxygenation(2).

Most of literatures suggest having CXR as initial and confirmatory modality to diagnose HAP. Nevertheless the utilization is suboptimal and if the CXR turned out to be normal if there strong consideration of HAP there has to be means to have chest CT scan for confirmation.

Even if blood culture is routine in the diagnosis of hospital acquired infection including HAP from my observation most of the time the laboratory technicians report absence of bottle and most of all the results barely detected and growth responsible microorganisms.

Patients with suspected HAP (non-VAP) are treated according to the results of microbiologic studies performed on respiratory samples obtained noninvasively, rather than being treated empirically as most of guidelines recommended.

The other common pitfall that I usually observe is there over utilization of specific antibiotics group and the usage is not supported by local microorganisms' availability and susceptibility and resistance pattern to specific antibiotic.

The study tries to look and sort out the practice of diagnosis, antibiotic usage and outcome of HAP.

1.3. Significance of the study

This study main intention is to minimize patients cost and development of antibiotic resistance. The study might also reduce the cost by decreasing the length of hospital stay of the patient and decrease in hospital mortality which overall increase the care of the hospital. The study might also provide valuable asset to hospital to improve diagnostic modality. The study might also be a plat form for policy maker and researchers interested to dig more about disease entity.

1. LITERATURE REVIEW

2.1 Diagnosis of HAP

Hospital acquired infections continue to be an important cause of morbidity and mortality among hospitalized patients. The critically ill patient is at particular risk of developing ICU acquired infection, with the lungs being especially vulnerable. Hospital acquired pneumonia (HAP) is currently the second most common hospital infection accounting for 13 to 18% of all nosocomial infections, with estimates of associated mortality ranging from 20 to 50 percent(6).

Diagnosis of pneumonia calls for a combination of clinical awareness, appropriate microbiological tests, and radiological studies. Plain chest radiography is an inexpensive test that can rapidly demonstrate the presence of pulmonary abnormalities. According to American Thoracic society guidelines, poster anterior (PA) (and lateral when possible) should be obtained whenever pneumonia is suspected in adults (7). The role of chest radiography should be obtained either as a screening tool for the detection of new infiltrates or monitoring response to therapy. The diagnosis of hospital acquired pneumonia is difficult, and the criteria used for surveillance have been used on clinical finding of fever, cough, and the development of purulent sputum in combination with a new or progressive infiltrate on the chest radiograph (7).

A study by C.D. Russell et.al which is done at united kingdom include a total of 166 adult medical and surgical patients to evaluate the accuracy of the diagnosis of HAP and to describe the demographic and microbiological features of patients with HAP was concluded by pointing the over used diagnosis of HAP which will be inaccurate in 35% of cases when objective radiological criteria are applied (8). Of all 166 patients treated for a clinical diagnosis of HAP, 65.1% had radiological evidence of a new or progressive infiltrate at the time of commencement of HAP treatment. The patient with radio logically confirmed HAP appeared to have significantly higher levels of inflammatory markers (white cell counts, neutrophils and C - reactive protein, $p < 0.05$ for all) (8). Patients with radio logically confirmed HAP had a longer median minimum duration of treatment (3.5 days vs. 4 days; $p = 0.04$). The study also suggest the role of chest CT scan when the chest x-ray does not show a new/progressive infiltrates.

The study also shows that blood culture was drawn for the majority of untreated patients(75.9%) and bacteremia was found in four patients only. sputum culture was done 35(24.7%) of patients and it tend to identify bacterial pathogen in 17(48.7) of patients(8).

A study done by Esayag Y, et al enrolled 58 bed ridden patient suspected pneumonia done to assess the diagnostic value of chest radiograph for the diagnosis of pneumonia in bed ridden patients followed for a 5 month period and what they found is that the chest x ray has sensitivity of 65%, specificity of 93% and the positive predictive and negative predictive value of 83% and 65% respectively to diagnose pneumonia (9). What they conclude was that in doubtful case having chest CT scan will be needed.

There was another study which was, hospital- based, active surveillance study which include one hundred and forty-six adults' patients done at Division of Infectious Disease, Department of Medicine, Faculty of Medicine Sir raj Hospital, Mahidol University, Bangkok, Thailand from December 2007 to march 2009(10). The study was done to asses Etiology, Clinical Outcomes, and Impact of Antimicrobial Resistance pattern of hospital acquired and ventilator associated pneumonia. The study has shown from the 36 patient which was diagnosed to have hospital acquired pneumonia 19(52.8%) of the patients has chest x-ray evidence of bronchopneumonia, 8(22.2%) of them have multi-lobular and 9(25%) of patients has lobar infiltrate (8). The study has shown that chest x-ray is crucial for possible diagnosis of HAP (10).

Expert clinician from 10 Asian countries doing panel discussion and literature review of published information regarding the epidemiology, etiology and diagnosis of HAP and VAP in Asian countries considered the diagnosis of pneumonia should include the detection of a new or progressive radiologic infiltrate, along with clinical sign of infection (11).

The clinical prerequisite should consist at least 2 Of the 4 signs of infection (fever above 38'0c, purulent secretion, leukocytosis or leukopenia, decreasing oxygenation).

2.2. Treatment of HAP

A study done by C.D. Russell et.al also shows piperacilline-tazobactam was the most frequently used antimicrobial, prescribed to 57.2% of included patients. Co-amoxiclav was the second most widely prescribed antimicrobial, used in 12.5% of cases. Meticillin-resistant *Staphylococcus aureus* (MRSA) screening was performed in 80.7% of patients during their admission (8).

According the study which has been undertaken in Bangkok, Antibiotics were given to all patients. The commonly used initial antibiotics were carbapenems (45.9%), colistin (21.9), cephalosporin's (21.2%), penicillin's and derivatives (19.2%) and vancomycin (11.6%). the initial antibiotics were concordant with the isolated bacteria in 58.9% of the patients. initial antibiotic was modified in 44% of patients (10).

A large series involving patients with HAP, Alvarez Lerma et al [3] revealed that patients who received adequate antibiotic treatment had lower mortality than did those who received inadequate therapy (16.0% vs. 25.0%).

The study undertaken in 10 Asian countries with panel discussion and literature review also reveled empiric antibiotics is chosen based upon the knowledge of local pattern of antibiotics resistance and organism prevalence(11).

2.3. Outcome of HAP

In addition, the Alvarez Lerma et al a large series study, the numbers of complications, cases of septic shock, and cases of gastrointestinal hemorrhage were also lower in the group of patients receiving initial adequate antibiotic treatment(4).

The mortality rate during admission for patients with radio logically confirmed HAP was 20.4%, with 5.6% of patients requiring admission to the ICU and mechanical ventilation following HAP diagnosis according to C.D. Russell et.al study(8).

The study from Bangkok Mahidol university also come out with from 36 patents with HAP 21(58.3%) of patients required mechanical ventilator and median ventilator day was 10 days. it also found 25(69.4%) of patients improved, 8(22.2%) of patients has failed the initial treatment in the first 72 hours, and 14(38.9%) of patients died because of HAP (10).

Expert clinician from 10 Asian countries doing panel discussion and literature review also came out with the range of 25.0% to 58.0% mortality rate in the selected countries (11).

A multistate which represent more than 95% of the US population point prevalence survey using US national inpatient national sample entitled with the epidemiology of non ventilator hospital acquired pneumonia in the united states reveled patients with HAP has additional hospital stay day ranging from 4-15.9 days. Estimated acute care cost ranging from 28,000-40,000 USD and mortality rate of 13.1% were the finding that the survey revealed (12).

When we come to our country Ethiopia there is no single study done on the diagnostic modalities used, antibiotic usage and outcome of hospital acquired pneumonia and . Some study has shown that it is the second infection accounting (18.5%) among hospital acquired infection (13).

3. OBJECTIVES

3.1 General objective

- To assess the diagnostic practice, antibiotic usage and outcomes of HAP among medical patients admitted to SPHMMC in medical ward and medical ICU April to July 2019.

3.2. Specific objectives

- To assess the diagnosis of HAP among medical patients admitted to SPHMMC in medical ward and medical ICU April to July 2019.
- To assess treatment of HAP among medical patients admitted to SPHMMC in medical ward and medical ICU April to July 2019.
- To assess the outcome of a patient with HAP among medical patients admitted to SPHMMC in medical ward and medical ICU April to July 2019.

4. Methods and Materials

4.1. Study Area and Period

This study was conducted in the in-patient department of internal medicine in SPHMMC. SPHMMC is one of the two biggest specialized referral hospitals in Addis Ababa and in the country at large. It is a hospital on advance and accelerated expansion and development after it started working as a medical college since 2000 E.C/2007G.C.the College is currently giving residency and subspecialist program. It also opens a new burn, emergency and trauma center and get involved in outreach services to fulfill the community demand in health. The hospital has over 45 beds in medical ward and 6 beds in ICU. Patients admission per month is usually 100 and above with over-1000 admissions per year. From the admitted once 20% of them will have diagnosis of HAP while in the ward. The studies addressed the medical ward and medical ICU.

The study was conducted from April to July 2019.

4.2. Study design

Descriptive prospective cohort study

4.3. Source population

All Patients 18 and above age of 18 years admitted to medical ward and medical ICU at SPHMMC with a different diagnosis and who developed HAP from April 2019 to July 2019 who fulfill the inclusion criteria.

4.4. Study population

All Patients 18 and above age of 18 years admitted to medical ward and medical ICU at Saint Paul hospital millennium medical college with a different diagnosis and developed HAP from April 2019 to July 2019 that fulfills the inclusion criteria.

4.5. Inclusion criteria

- Age 18 years and above
- Patients who had chest x-ray result attached in the chart or obtained from electronic data from radiology department.
- Patients whose ancillary diagnostic modalities result attached in the chart or found in electronic data in the laboratory
- Patients whom the antibiotics prescribed is clearly written in the chart
- Patients with clearly known outcome(alive or death)

4.6. Exclusion criteria

- Patient whose HAP diagnosis is dropped because of non-supporting evidence
- Incomplete data or unknown outcome
- Patient with Ventilator associated pneumonia

4.7. Sample size

All patients who were diagnosed with HAP admitted from April 2019 - July 2019 fulfilling the inclusion criteria was included in the study.

4.8. Sampling procedure and technique

Using Non-Probability sampling (convenience sampling) method, all patients admitted during the study period who fulfilled the inclusion criteria was selected.

4.9. Data collection procedures instrument

Among Patient admitted to SPHMMC ward and medical ICU with different diagnosis and who developed HAP were identified and once I communicated the study with the assigned residents at each place. A non probability convenience sampling method will be used to get a patient with HAP diagnosis. Data was collected using modified structured questionnaires which adapted from previous studies from other countries.

It contains information about socio demographic characteristics, patient clinical profile, CXR confirmation, other investigation modalities utilized, antibiotics usage, patient outcomes and more.

The data extraction form has 5 parts. First part contains socio demographic data having 3 questions, Second part is about patient clinical profile having 3 questions ,7 question inquiring about diagnosis is the third part and Subsequent portions include 4 question to assess the treatment and 1 questions about outcome of HAP.

Data collection instrument is developed in English and was translated in to Amharic. Data was collected by two assigned data collector after being trained ahead of data collection. Informed consent was obtained from the patient by the treating physician. Data collectors reviewed charts and electronic data from radiology and laboratory department.

4.10. Study variables

4.10.1. Independent variables

- Age
- sex
- Co morbidity
- HAP
- Chest x-ray confirmation
- ancillary diagnostic modalities
- Antibiotic usage

4.10.2. Dependant variables

- Alive
- Death

4.11. Operational Definitions

- **Pneumonia-** acute infection of the pulmonary parenchyma characterized by cough, fever, fast breathing, crepitation with/without radiologic evidence.
- **Clinical pneumonia-** infection of the pulmonary parenchyma characterized by cough, fever, fast breathing, crepitation or any physician diagnosis of pneumonia without radiologic evidence
- **Radiologic pneumonia-**patients with chest x-ray feature of pneumonia commented by radiologist or radiology resident
- **Hospital acquired pneumonia(HAP)** –pneumonia acquired after 48 hours of admission to hospital

4.12. Data Processing and Analysis

Each questionnaire was checked for completeness, missed value. Data were cross checked for consistency and accuracy. The collected data was entered and analyzed by using SPSS version 25 by the investigator. Descriptive analysis will be done by simple frequencies, proportions and cross tabulation and the results will be presented by tables, pie charts and graphs.

4.13. Ethical Consideration

Ethical clearance was obtained from ethical review board of SPHMMC AND Confidentiality was maintained at all levels of the study by avoiding the use of names and any identifiers.

4.14. Dissemination and Utilization of Results

The final result of the research will be submitted to SPHMMC. Furthermore, the finding will be presented on appropriate seminars, conferences and workshops, and publishing with scientific journal will be considered.

5. Results

5.1.Socio-Demographic characteristics

In this assessment of diagnosis, treatment and outcomes of HAP, 60 patients were involved of whom 39 (65.0%) were females. The IQR age was 24 years and the minimum and the maximum ages being 18yrs and 90yrs respectively. Majority patients 41 (68.3%) were admitted to medical ward and 19 (31.7%) were admitted to MICU. There were a total of 390 patients at two sites during this study period making the pattern of HAP for the admitted patient to be 15.0%. (Table 1)

Table 1: Socio-demographic characteristics of patients with HAP admitted to SPHMMC medical ward and medical ICU from April to July 2019

<i>Ser. No.</i>	<i>Variable</i>	<i>Category</i>	<i>Frequency</i>	<i>Percent (%)</i>
1	Gender of a patient	Male	21	35.0
		Female	39	65.0
2	Place of admission	Medical ward	41	68.3
		MICU	19	31.7

The address wise distribution in the study showed how the catchment area of SPHHMC has affected the patient area of residence. Address wise allocation of patient is Oromia 32(53.3%) of patients, Addis Ababa 22(36.7%) of patients, SNNPR 4(6.7%) of patients and Amhara 2(3.3%) of patients. (Figure 1).

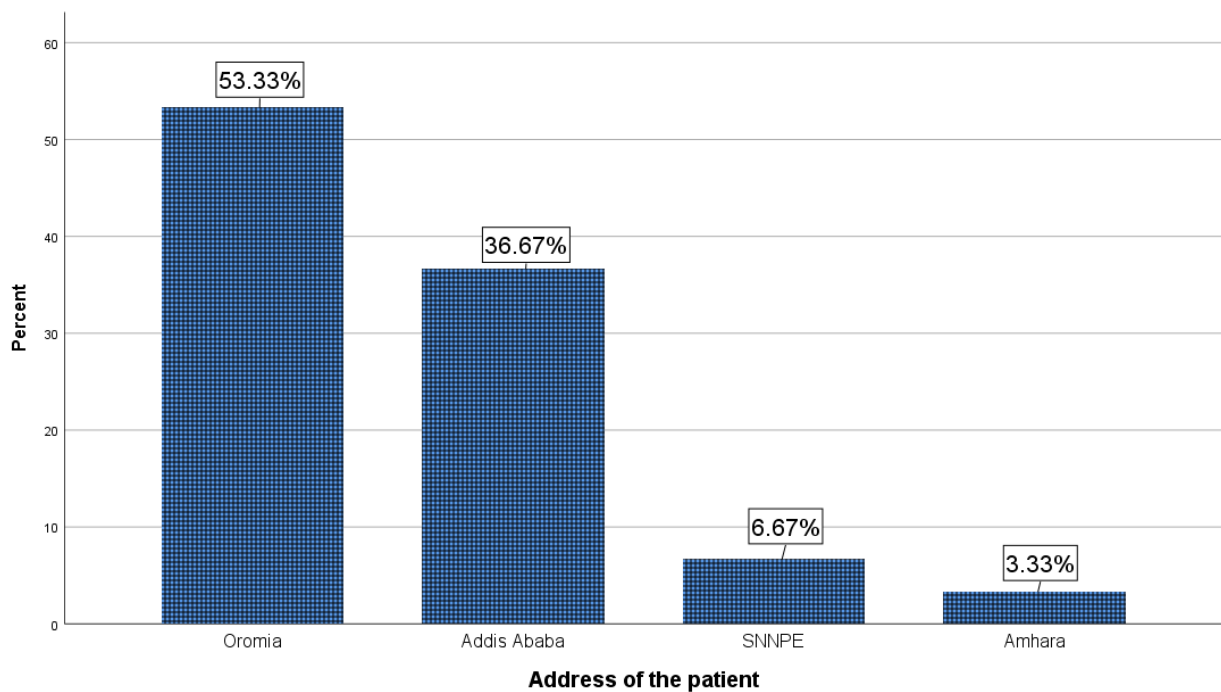


Figure 1: Address of a patient with HAP admitted to SPHMMC medical ward and medical ICU from April to July 2019

Majority of patients were admitted to medical ward and MICU because of AKI/CKD shown in the study in 19(31.7%) of patients. Most of the cause for CKD is diabetes mellitus and hypertension. Patient with heart failure of various cause where found in 9(15.0%) of patients. Pregnancy related complication with majority being Severe Preeclampsia –eclampsia were being transferred to medical ward and MICU were found in 6(10.0%) of patients.

Surgical patients with generalized peritonitis secondary to mesenteric vascular insufficiency and viscus perforation after exploratory laparotomy was done where transferred to MICU in 5 (9.3%) of the study patients. Patient with stroke and CLD were found in 4(6.7%) among the study patients.

Endocrinopathy with one patient having thyrotoxicosis and two of them having type I DM with complication were found with total of 3 (5%) of the study patients.

Hematologic malignancy with subtype of acute myelogenous leukemia in two of the patients and non Hodgkin lymphoma in one patient making 3(5%) of the study patients were also found in the study. Retroviral infection with underlying immunosuppression was also found in 3(5%) of the study patients.

One patient with systemic lupus erythematosus and another patient with Anti-phospholipids' antibody syndrome with a total of 2(3.3%) of patients were having Rheumatologic disorders in the study.

Patient with post TB fibrosis and post TB bronchiectasis were the 2(3.3%) of patients that the study identified as other pulmonary disorder for possible co morbidity. (Figure 2)

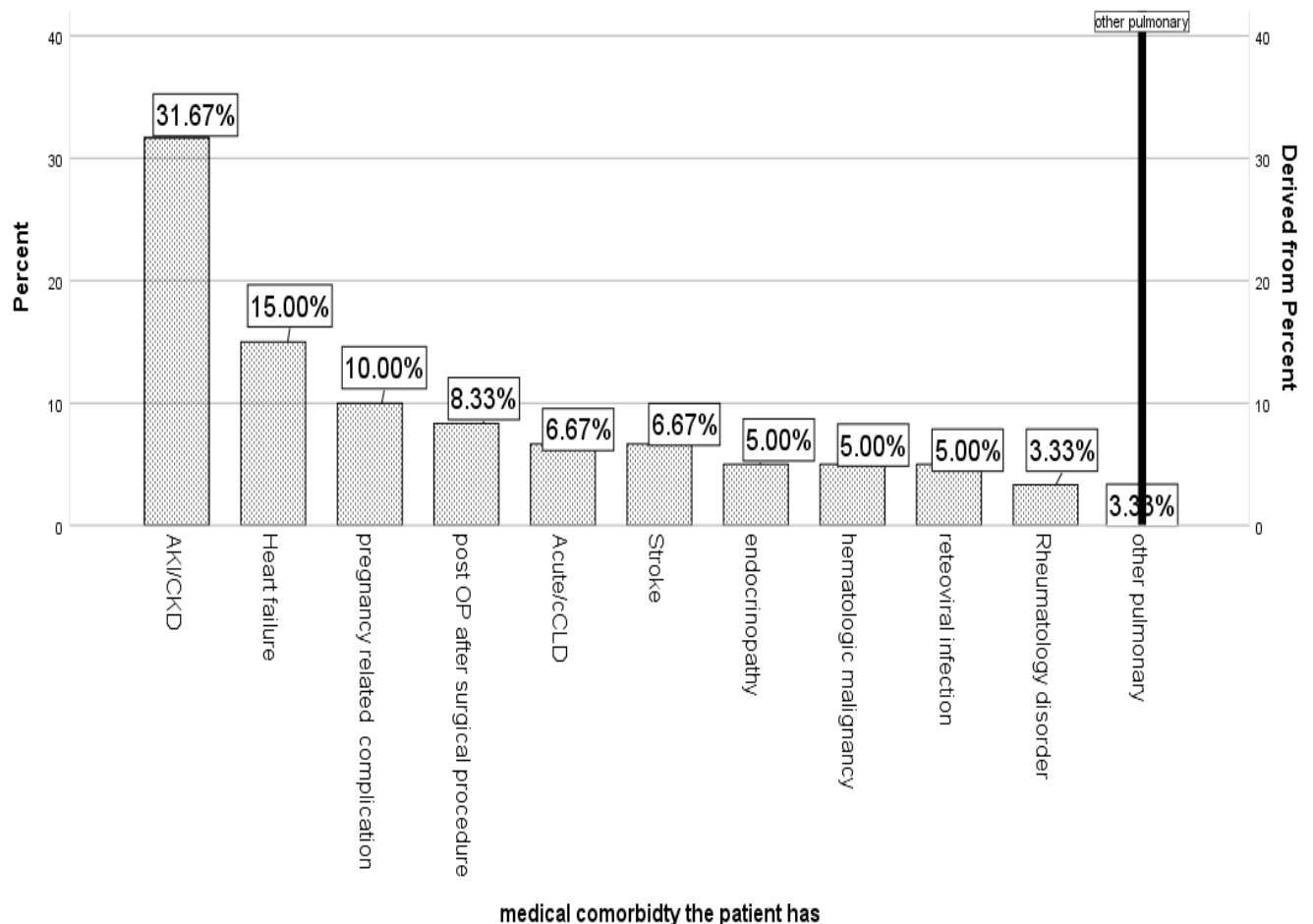


Figure 2: Medical co morbidity distributions of HAP patients admitted to SPHMMC medical ward and medical ICU from April to July 2019

5.2. Diagnosis

Among the study participant with fever and difficulty of breathing as the most common symptoms and new onset fever and desaturation as the most common physical finding the diagnosis of HAP with radiologic confirmation was found in 25(41.7%) of patients, Blood culture requested in 21(35.0%) of patients and CBC was requested in all patients. (Table 2)

Table 2: Diagnostic modality used for HAP patients admitted to SPHMMC medical ward and medical ICU from April to July 2019

<i>Ser.No.</i>	<i>Category</i>	<i>Characteristics</i>	<i>Frequency</i>	<i>Percentage (%)</i>
1	Radiologic confirmation	Yes	25	41.7
		No	35	58.3
2	Blood culture Done	Yes	21	35.0
		No	39	65.0
3	CBC Done	Yes	60	100
		No	0	0

Among patient with radiologic confirmation 13(52.0%) of the patient had lobar involvement in the radiologic report and 12(48.0%) had multi-lobar patchy involvement. (Figure 3)

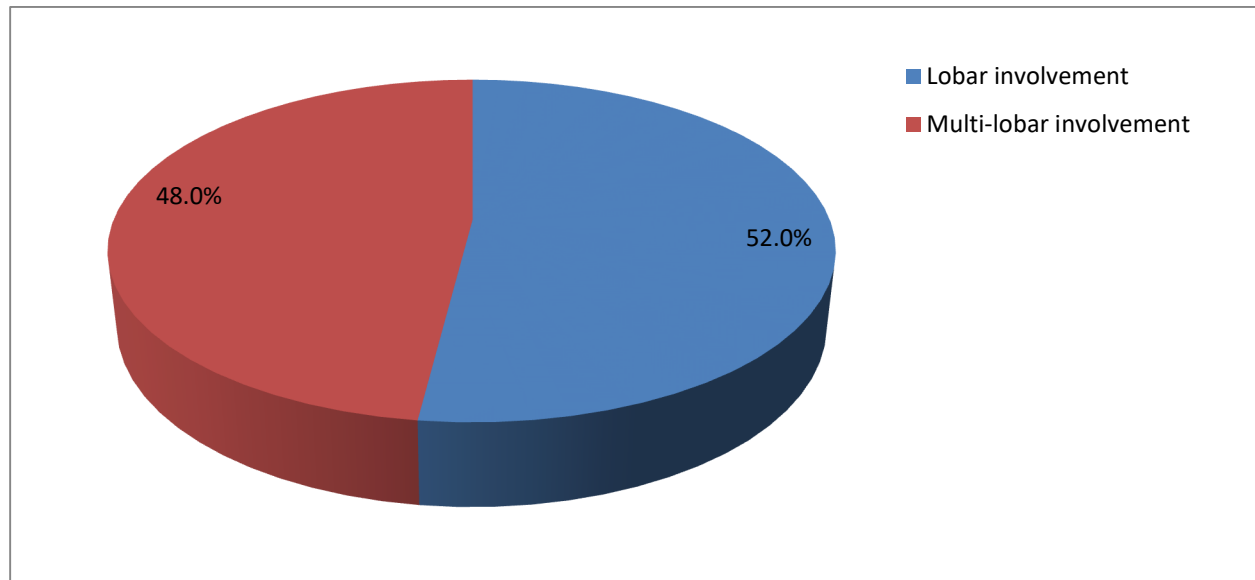


Figure 3: Pattern of CXR involvement of HAP patients admitted to SPHMMC medical ward and medical ICU from April to July 2019

Blood culture detected growth in only 3(14.2%) of the patient for whom blood culture was requested. *Staphylococcus Aureus (MRSA)* was detected alone in 1 of growth media and with *Enterococcus faecium* in other media. The third blood culture with detectable growth with the identified organisms being *Acinetobactor baumannii* and *enterococcus faecium*. (Table 3)

Table 3: Type of organisms grown of HAP patients admitted to SPHMMC medical ward and medical ICU from April to July 2019

Ser.No.	Organisms grown	Frequency	Percent (100%)
1	<i>Staphylococcus aureus (MRSA)</i>	1	4.7
2	<i>Stap.aureus(MRSA) and Enterococcus</i>	1	4.7
3	<i>Enterococcus and acinteobacter</i>	1	4.7
	Total	3	14.2

Majority of patients 34(56.7%) has peripheral leucocytosis while 19(31.7%) of them has normal CBC result. Peripheral Leucopenia was found in 7(11.7%) of patients. (Figure 4)

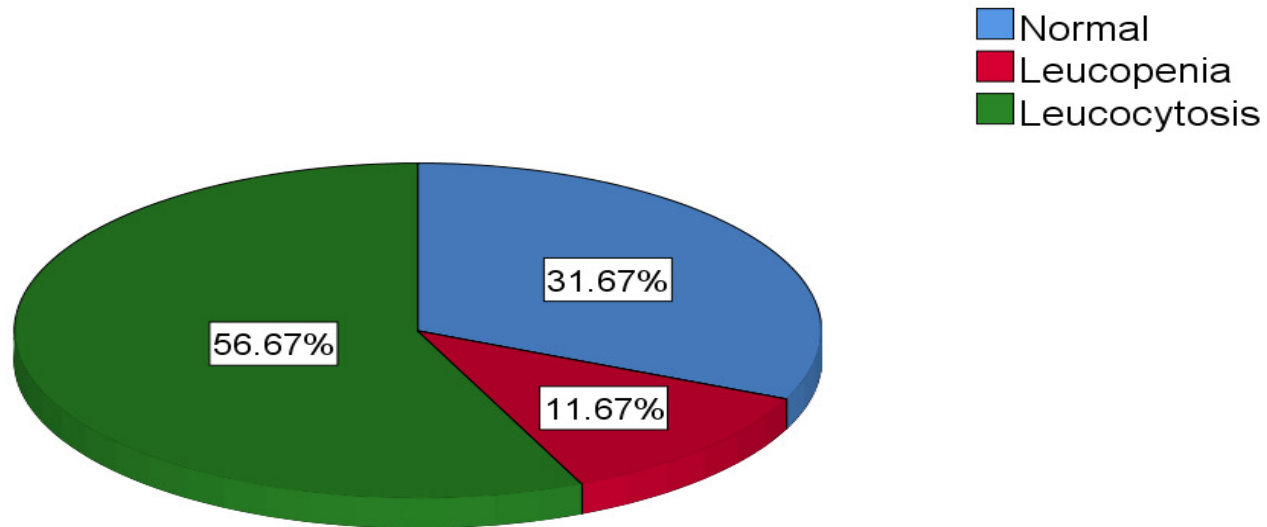


Figure 4: Results of CBC of HAP patients admitted to SPHMMC medical ward and medical ICU from April to July 2019

Chest CT scan in 3(5.0%) of patients, left pleural effusion in 3 (5.0%) of patients and right pleural effusion analysis in 1(1.7%) of patients were used as other diagnostic modality for diagnosis of HAP. (Table 4)

Among the patient having radiological confirmation that is 25 patients 14(56.0%) of patients had leucocytosis, 7(28.0 %) of them had normal CBC result and 4(16.0%) of patients had leucopenia. Blood culture was requested in this patient only in 6(24.0%) of patients.

Table 4: Ancillary diagnostic modality used for HAP patients admitted to SPHMMC medical ward and medical ICU from April to July 2019

<i>Ser.No.</i>	<i>Category</i>	<i>Characteristics</i>	<i>Frequency</i>	<i>Percent (100%)</i>
1	Other diagnostic modalities used	Chest CT scan	3	5.0
		Left pleural effusion	3	5.0
		Right pleural effusion analysis result	1	1.7

5.3. Treatment

Ceftazidime and vancomycin combination antibiotics were used in 38(63.3%) of patients followed by Meropenem combined with vancomycin in 12(20.0%) of patients. Combination of cefipime and vancomycin were the third used in 5(8.3%) of patients. (Figure 5)

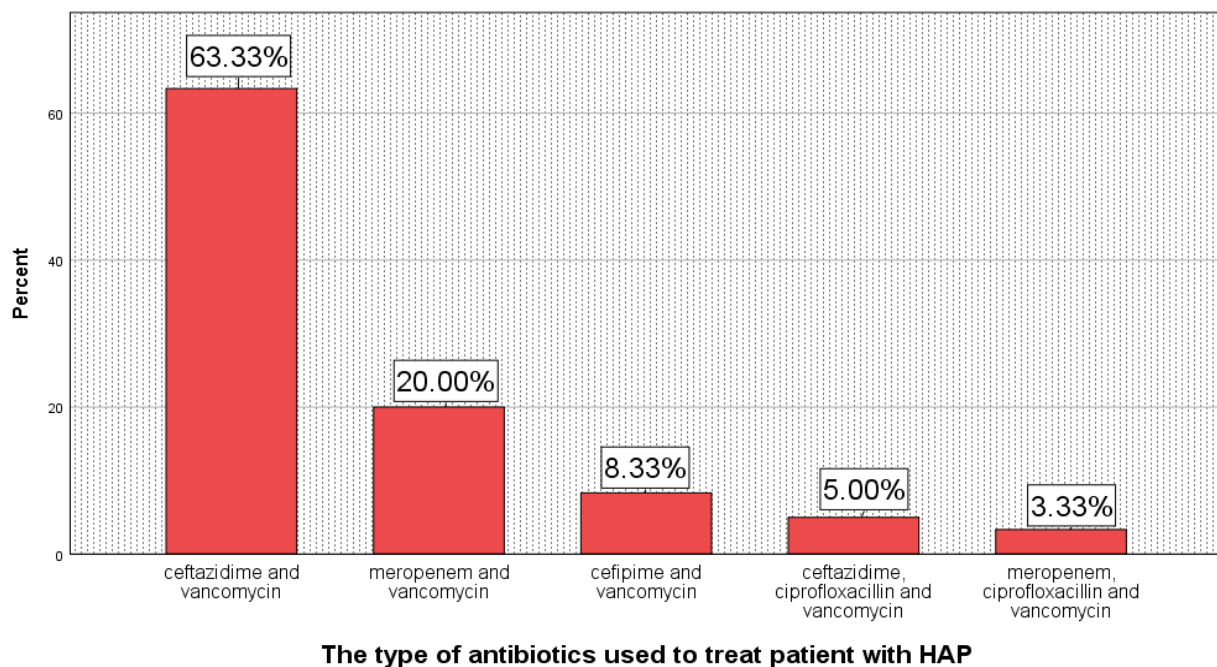


Figure 5: Type of antibiotics used for treatment of HAP patients admitted to SPHMMC medical ward and medical ICU from April to July 2019

Majority of the antibiotics were used in 37(61.7%) for duration of 10 days and 16(26.7%) of patients used the antibiotics for 5-7 days length of period. Therapies were used in 7(11.7%) of patients for 14 days. (Table 5)

Table 5: Duration of antibiotics used for treatment of HAP patents admitted to SPHMMC medical ward and medical ICU from April to July 2019

<i>Ser.No</i>	<i>Category</i>	<i>characteristics</i>	<i>Frequency</i>	<i>Percent (%)</i>
1	Duration of antibiotics	5-7 days	16	26.6
		10 days	37	61.7
		14 days	7	11.7

5.4.Outcome

From study patients 49(81.7%) of them were treated for their disease entity and discharged alive home with average length of stay 20 days while 11(18.3%) of patients were dead. Meropenem and vancomycin combination antibiotics were initially given as ceftazidime and vancomycin for 2 days in 7 of 12(58.3%) patients for whom they were given. Ciprofloxacin was added as a triple agent on the third day of two drug combination therapy. Among the 11 death patients with radiological confirmation account 7 of the death that is 63.6% of mortality and 6(54.5%) of mortality occurred in a patient who took ceftazidime and vancomycin combination antibiotics.(figure 6) and table(6)

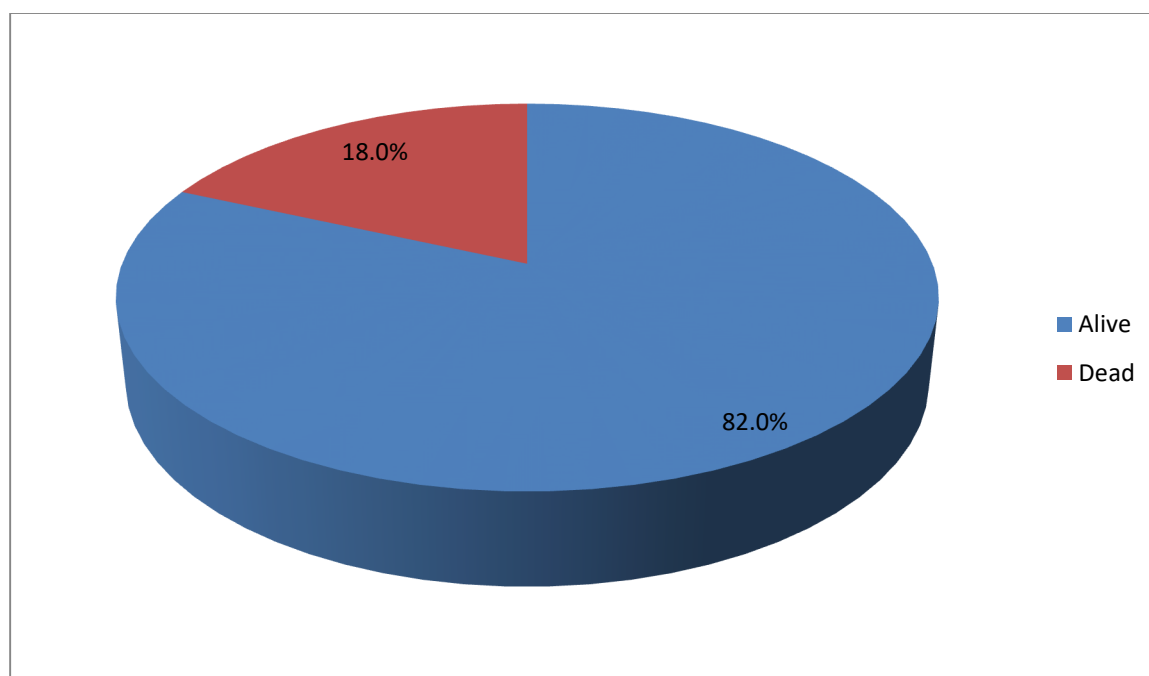


Figure 6: Outcome of a patient with HAP admitted to SPHMMC medical ward and medical ICU from April to July 2019

Table 6: antibiotics therapy and outcome of patients admitted to SPHMMC medical ward and medical ICU from April to July 2019

	Count/percentage (%)	Outcome		
		Alive	dead	Total
Antibiotics used	Ceftazidime and vancomycin	32/84.2	6/15.8	38/100.0
	Meropenem and vancomycin	8/66.7	4/33.3	12/100.0
	Cefipime and vancomycin	5/100.0	0/0.0	5/100.0
	Ceftazidime,ciprofloxacillin and vancomycin	2/66.7	1/33.3	3/100.0
	Meropenem ,ciprofloxacillin and vancomycin	2/100.0	0/0.0	2/100.0
Total		49/81.7	11/18.3	60/100.0

6. Discussion

In this study, which is a 4 month prospective cohort chart review study for which clinical diagnosis of HAP was made excluding VAP, 60 patients were involved of whom 39 (65.0%) were females. In United Kingdom, age and ageing study also agree with this result ,HAP was much more common among females in 59.0% of case and it found 82 years as median age in both sexes because the study address old age peoples >65 years of age (14). Unlike both study, Vasuki V , south Indian study came up with more male representation in 64.0% of study patient and the median age was 59.96 years and the minimum and the maximum ages were being 15 yrs and 80yrs,respectively(6). The sex wise distribution is not well understood.

The study also shows the IQR age was 35 years and minimum and maximum age being 18 yrs and 90 yrs respectively. Most of the patients were admitted to medical ward as 41(68.3%) and while 19(31.7%) were admitted to MICU. Multicenter, nationwide American study was also come up with result of 50.9% representation of patient <65 years of age and roughly 7 in 10 patients (70.8%) of HAP were acquired outside the ICU (12).

Patient make their residence at four region of the country of which Oromia makes 32(53.3%) of patients, Addis Ababa 22(36.7%) of patients, SNNPR 4(6.7%) of patients and Amhara 2(3.3%) of patients. With regard to medical co morbidity AKI/CKD was found to be in 19(31.7%) of patients followed by heart failure in 9(15.0%) of patients. Among ICU admitted patients pregnancy related complication like Preeclampsia was found in 6(10.0%) of patients. Unlike this study there were study published with different co-morbidity as the cause of admission. A multicenter prospective observational study in 55 hospitals in Italy come up with a dementia (36.7%) followed by pulmonary disorder majorly COPD (34.7%) as the most common medical co-morbidity (15). Another study which was a one year retrospective cohort on large US inpatient database found chronic lung disease in (51.6%) of patients and cardiovascular disease in (47.6%) of patients as the most common medical co-morbidity (16).

A third study which was a prospective study over a period of one year among patient admitted to MICU in India hospital shows neurologic event in (31.1%) of patients and cardiac and pulmonary emergency in (26.6) of patients as the two sole reasons for patients' admission to MICU (6).

With regard to diagnosis of patients with HAP a combination of clinical and diagnostic modalities were implemented. Among the study population radiologically confirmed HAP was found in 25(41.7%) of patients and among this patients 13(52.0%) of patient has lobar involvement in the radiologic report and 12 (48.0%) of them have multi-lobar patchy infiltrate in the report.

A study by C.D. Russell a retrospective cohort one year study in UK tertiary hospital found from 166 study patients 101(61.1%) of them had radiological evidence of new or progressive lung infiltrate which is much better utilization of CXR than this study but it conclude the over diagnosis of HAP in one third of case like this study(8).

Another study which retrospective chart review of 105 hemodialysed patients in USA entitled by pneumonia in hemodialysis patients found radiologic confirmation in 21.0% of patients and concluded the over diagnosis of pneumonia and absence of chest x ray infiltrate can be used in ruling out of pneumonia in majority of patients(17).

A single center observational prospective study conducted in the intensive care unit of one of Kuwait hospital with enrollment of 92 study patients has found radiological confirmation in 40(54.8%) of patients almost similar to this study (18).

A multicenter prospective observational study in 55 hospitals in Italy showed that multi-lobar infiltrate 38.8% of the study patient which is comparable to this study (15).

Blood culture were requested in 25(35.0%) of the study patients and growth were detected in only 3(14.2%) of the specimen. The grown organisms were *staphylococcus Aureus*, *Acinetobactor Baumanii* and *Enterococcus Faceicum* .

Unlike this study a study by C.D. Russell a retrospective cohort one year study in UK tertiary hospital blood culture were drawn in the majority of study patient treated for HAP(75.9%) and it turned out to be demonstrate growth in only four patients . Gram negative bacteria account for two the patients while MRSA and streptococcus pneumonia account one each (8).

A prospective cohort of 200 study patients from six medical and surgical ICU teaching hospital in Spain blood culture was requested in 158(79%) Of patients and it turns out to be positive in

14(7%) of patients. In this study the requesting is quite significantly higher than this study and more importantly it advice a combination of invasive and noninvasive diagnostic modality for more yield. The most common identified pathogens were gram negative non fermenting bacteria (39%) followed by staphylococcus aureus (24%) unlike this study (19).

Another prospective hospital based active surveillance study on HAP and VAP in hospitalized 146 patient from which HAP patients were 36 in one of Thailand hospital showed with unilateral lobar CXR finding 25.0% of patients and multi-lobar in 22.2% of patients quite different from this study. The study also shows requesting of blood culture in all of patients unlike in our case and it turn out to be positive 3(8.3%) of patients (10).

From this study all patient has CBC requested as one armamentarium and leucocytosis was found in 34(56.7%) of patients, it was normal in 19(31.7%) of patients and leucopenia in 7(11.7%) of patients. A similar result was found in multicenter prospective observational study in 55 hospitals in Italy with 53.1% leukocytosis among the study patients (15).

A prospective survey of hospitalized 1342 older patients >65 years of age in a single center in UK found 143 patients suspected to have HAP. Among this patient only 76(5.8% of admissions) were the one who met the diagnostic criteria for HAP. The reason for failure to met diagnostic criteria is because of lack of radiologic confirmation 60/75 of patients and lack of inflammatory marker in 42/75 of patients which also solidify the notion of over diagnosis of HAP (14).

In this study 3(5%) of patient has their diagnosis of HAP made by chest CT scan. All the three CT scan result report multifocal patchy infiltrate as radiological finding. A study by C.D. Russell has shown 43.7% more advantage of CT scan over CXR and it recommend to have chest CT scan in doubt full situation (8). The other three (5%) patient had left sided effusion, one being loculated effusion. An Italian prospective study has shown even higher result of pleural effusion in 38.8% of study patients (15). One (1.7%) of patients had right side pleural effusion and pleural fluid analysis reveled exudative effusion amid with clinical suspicion HAP was considered.

The study also found ceftazidime and vancomycin combination antibiotics usage in 38(63.3%) of patients and meropenem and vancomycin in 12(20%) of patients as the two most common

antibiotics prescriptions. The duration of antibiotics in 37(61.7%) of patients was 10 days followed by 5-7 days in 16(26.6%) of patients.

Unlike this study the study by C.D. Russell .etal. showed piperacillin- tazobactam in 57.2 % of patients followed by co amoxiclav in 12.5% of patients as the most common antibiotics used for treatment of HAP. In the study 5-7 days of duration were also the commonest duration that antibiotics prescribed (8).

Another contradictory prospective hospital based active surveillance study on HAP and VAP in hospitalized 146 patients in one of Thailand hospital result showed mono-therapy is common in 58.3% of patients and combination antibiotics in 41.7% of patients. Carbapenems like meropenem were used in 50% of patients followed by cephalosporin in 19.4%.The reason behind for utilization of mono-therapy is bacterial isolate with resistance pattern was known (10).

In the study 49(81.7%) of patients were treated and discharged home while 11(18.3%) of patients were dead.

A retrospective cohort study based on a total of 4,543 patients with culture-positive pneumonia admitted into 59 US hospitals between January 1, 2002, and December 31, 2003 found the mortality rate associated with HAP to be 18.8% almost comparable to this study (16). Another study which is an Italian multi center study also found the mortality to be similar to the above two study that is 18.4 %(15).

A study by C.D .Russel.etal. was another study which showed among the study patient death was found in 32(19.3) of patients like the above study

7. Limitations

- Radiological confirmation of HAP was made primarily derived from the result of chest x ray (only 3 of the 60 patient undergone chest CT scan) which may lead to under detection of pulmonary infiltrate compared to CT scan
- A larger sample size with large number of study population is required to further evaluate the practice of diagnosis, treatment and outcome of HAP.
- This is a single center study with limited number of patients and cannot be generalized to the whole population. Therefore, a multicenter study with large number of patients is recommended to study the topic well
- Risk factor for possible development of HAP both in the ward and MICU is not addressed so it's difficult to suggest some prevention methods

8. Conclusion

HAP was more common among adult females than males. AKI/ CKD were the most common medical co-morbidity. Majority of the patients came from Oromia and Addis Ababa. Medical ward was the common admission place in 68.3% of patients. Radiological confirmation was made in 41.7% of patients and of whom lobar in (52%) of patients and multi-lobar (48%) of patients were the reported CXR infiltrate. Blood culture was requested only in 35% of patients and positivity is only in 5% of patients. While *Staphylococcus Areus* and *Entreococcus Faceium* were grown in two growth media *Acintenobacter Baumannii* was grown in only one. All patients had CBC requested and leucocytosis was turned out to be commonest result in 56.75% of patients. Chest CT scan, pleural fluid and result of pleural fluid analysis were the other diagnostic modalities that has been used in 11.7% of patients to diagnose HAP. Cefatzidime and vancomycin combination antibiotics were used in 63.3% of patients for duration of 10 days in 61.7% of patients. The majority of patients that is 81.7% was alive and discharged home improved. HAP is common but over diagnosed in majority of patients.

9. Recommendations

Based on the study the following recommendations are forwarded;

- To improve ordering of imaging modalities so that the diagnosis will be made accurately.
- To improve chest US skill for diagnosis of HAP of physician especially in MICU because many study suggest it is currently being utilized as gold standard for pneumonia diagnosis.
- To improve microbiological diagnosis and antibiotics resistance of the microbes by utilization invasive and non invasive diagnostic modalities
- To sort out and develop local antibiogram so that rational use of antibiotics can be implemented
- Further study to identify the commonest risk factors for development of HAP especially for MICU so that prevention will be made

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11. ANNEX

11.1. Information sheet

Name of the principal investigator: Abebayehu Yosef Gutema (MD, final year internal medicine resident)

Name of the organization: St. Paul's Hospital Millennium Medical College, Department of internal medicine.

Name of the sponsor: Self sponsored

This information sheet is prepared by the principal investigator whose main objective is to assess diagnosis, treatment and outcome of HAP among medical ward and MICU admitted patients from time period of April 2019-july 2019.

Purpose: The purpose of this research is to investigate and analyse the practice of diagnosis, antibiotic usage and outcome of HAP. Age and sex wise distribution of the disease entity and associated medical co-morbidities. The study also tries to sort out what diagnostic modalities like CXR, CBCS and blood culture has been implemented for possible diagnosis of clinical suspected HAP.

This study main intention is to minimize patients cost and development of antibiotic resistance. The study might also reduce the cost by decreasing the length of hospital stay of the patient and decrease in hospital mortality which overall increase the care of the hospital. The study might also provide valuable asset to hospital to improve diagnostic modality. The study might also be a plat form for policy maker and researchers interested to dig more about disease entity.

Procedure: In order to assess diagnosis, treatment and outcome of HAP among patients who were admitted to medical ward and MICU in St. Paul's Hospital Millennium Medical College, Ethiopia from April to July 2019. Patients' card will be reviewed and a structured data extraction form will be used to collect necessary information.

Risk and/or discomfort: This research doesn't have any risk

Benefits: even if this research might not have a direct benefit for the study participants, the findings will provide information that might be helpful & improve the quality of care for patients who will be admitted in the hospital.

Incentives: There will not be any incentives provided to the study participants.

Confidentiality and anonymity: The information that we will collect from this study will be kept confidential. Card numbers and codes will be used instead of names and the findings will be stored in a file.

Persons to contact: If you have any question you can contact the principal investigator by the address stated below.

Abebayehu Yosef Gutema, Tel: 0911876284, E-mail: misababylove143@gmail.com

11.2. Data extraction form

I. Socio demographic characteristics

1.	Date	__ / __ / __ dd/mm/yy								
2.	Card number	_____								
3.	Age of the patient	_____								
4.	Sex	1. Male 2. Female								
5.	Address	<table border="0"><tr><td>☐ 1. Addis Ababa</td><td>☐ 5. Somalia</td></tr><tr><td>☐ 2. Oromia</td><td>☐ 6. Afar</td></tr><tr><td>☐ 3. Tigray</td><td>7. Others, specify _____</td></tr><tr><td>☐ 4. SNNPE</td><td></td></tr></table>	☐ 1. Addis Ababa	☐ 5. Somalia	☐ 2. Oromia	☐ 6. Afar	☐ 3. Tigray	7. Others, specify _____	☐ 4. SNNPE	
☐ 1. Addis Ababa	☐ 5. Somalia									
☐ 2. Oromia	☐ 6. Afar									
☐ 3. Tigray	7. Others, specify _____									
☐ 4. SNNPE										

II. Patient clinical profile

6.	Place of admission	1. MICU 2. Medical ward												
7.	Medical co morbidity	<table border="0"><tr><td>1. Heart failure</td><td>☐ 7. Solid malignancy</td></tr><tr><td>2. Stroke</td><td>☐ 8. hematologic malignancy</td></tr><tr><td>3. CLD</td><td>☐ 9. Diabetes mellitus</td></tr><tr><td>4. AKI/CKD</td><td>☐ 10. Other pulmonary disease</td></tr><tr><td>5. Asthma</td><td>☐ 11. combination of the above</td></tr><tr><td>6. COPD</td><td>12. other(specify) _____</td></tr></table>	1. Heart failure	☐ 7. Solid malignancy	2. Stroke	☐ 8. hematologic malignancy	3. CLD	☐ 9. Diabetes mellitus	4. AKI/CKD	☐ 10. Other pulmonary disease	5. Asthma	☐ 11. combination of the above	6. COPD	12. other(specify) _____
1. Heart failure	☐ 7. Solid malignancy													
2. Stroke	☐ 8. hematologic malignancy													
3. CLD	☐ 9. Diabetes mellitus													
4. AKI/CKD	☐ 10. Other pulmonary disease													
5. Asthma	☐ 11. combination of the above													
6. COPD	12. other(specify) _____													
8.	Admission CXR	☐ 1. Yes ☐ 2. No												

III. Diagnosis of HAP

9.	Radiology confirmation of HAP	☐ 1. Yes ☐ 2. No
10.	If the answer for the above question is yes, Pattern of CXR involvement	☐ 1. Patchy infiltrate ☐ 3. Multi-lobar involvement ☐ 2. Lobar involvement 4. Others specify _____
11.	Blood culture requesting for diagnosis	☐ 1. Yes ☐ 2. No
12.	If the answer for the above question is yes, the result of blood culture	☐ 1. Growth detected ☐ 2. No growth detected
13.	If growth is detected for the above question, the type of organisms detected	☐ 1. Klebsiella pneumoniae ☐ 2. Staphylococcus aureus (MRSA) ☐ 3. Proteus mirabilis ☐ 4. Streptococcus pneumonia 5. Other (specify) _____
14.	Requesting of CBC for diagnosis	☐ 1. Yes ☐ 2. No
15.	If the answer for the above question is yes, the result of CBC	☐ 1. Normal ☐ 3. Leucocytosis ☐ 2. Leucopenia
16.	Other diagnostic modality utilized; specify	_____

IV. Treatment of HAP

17.	The type of antibiotics used	☐ 1. Ceftazidime ☐ 2. Cefipime ☐ 3. Vancomycin 7. other (specify)	☐ 4. Ciprofloxacin ☐ 5. Meropenem ☐ 6. combination of the above
18.	Duration of antibiotic usage	☐ 1. 5-7 days ☐ 2. 10 days	☐ 3. 14days 4. other (specify) _____

V. Outcome of HAP

19.	Outcome of a patient	☐ 1. Alive ☐ 2. Died
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Declaration

I undersigned, declare that this thesis is my original work in partial fulfillment for the requirement of Specialty Certificate in Internal Medicine. All the resources of the materials used for this thesis work and all people and institutions who gave me support for this work were fully acknowledged.

Name of the student: Abebayehu Yosef (MD)

Signature_____

Place of submission- **Department of Internal Medicine and Public Health**

Saint Paul's Hospital Millennium Medical College

Post Graduate Coordinators Office

Date of submission_____

This thesis work has been submitted for examination with my approval as College advisor

Name of the advisors:

Dr. Tola Baysia (Internist, consultant pulmonologist) Signature_____

Dr. Yoseph Worku (MD, MPH)

Signature_____