

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
(قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ)

صدق الله العظيم

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Republic of Iraq
Ministry of Higher
Education
& Scientific Research
University of Anbar
College of Medicine



Bacteriological study of lower respiratory tract in adult patients with COVID-19

Supervised by

Prof.Dr. Shehab A. Lafi

Prof.Dr. Haitham Noaman

1444 A.H

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Introduction

- The impact of the COVID-19 pandemic around the world and in Iraq was significant which led to high morbidity and mortality rates due to the secondary bacterial and fungal infections with COVID-19 patients.
- Secondary bacterial infections are a known complication to the viral respiratory infections, often leading to clinical deterioration. Secondary bacterial infections are causing morbidity and mortality through disruption of airway epithelium and its barrier function due to viral-induced immune-mediated damage, and dysregulation of both the innate and adaptive immune responses.

Aim of study

- The study aimed to detect the type of bacterial infections that are associated with COVID-19 patients.

The Patients

- Seventy-four (74) adult patients infected with COVID-19 were included in this study, out of them 36 patients were attending (Dar Alsalam Hospital and Al-Yarmouk Teaching Hospital) in Baghdad Governorate. Other patients (38) were attending (AL-Shifaa 17 hospital and Heet General Hospital) in AL-Anbar Governorate. The age of patients ranged from (20-95) years and all of them suffered from post-Covid-19 respiratory infection and complications.

Inclusion criteria:

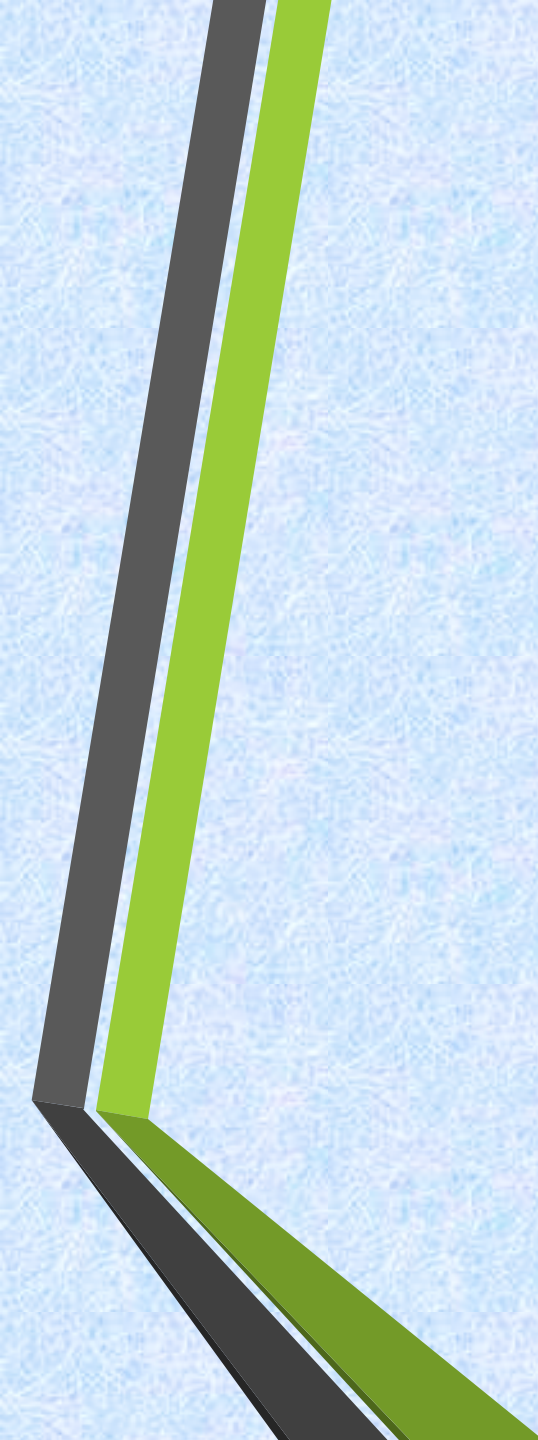
COVID-19 patients with a high possibility of secondary bacterial infection were included in this study. Patient complaining cough, neutrophilic leukocytosis with no response to the antiviral treatment.

- **Exclusion criteria :**

COVID-19 patients with only cytokine storm or severe lung damage caused by severe COVID -19 viral infection without evidence of secondary bacterial infection were excluded.

Methods

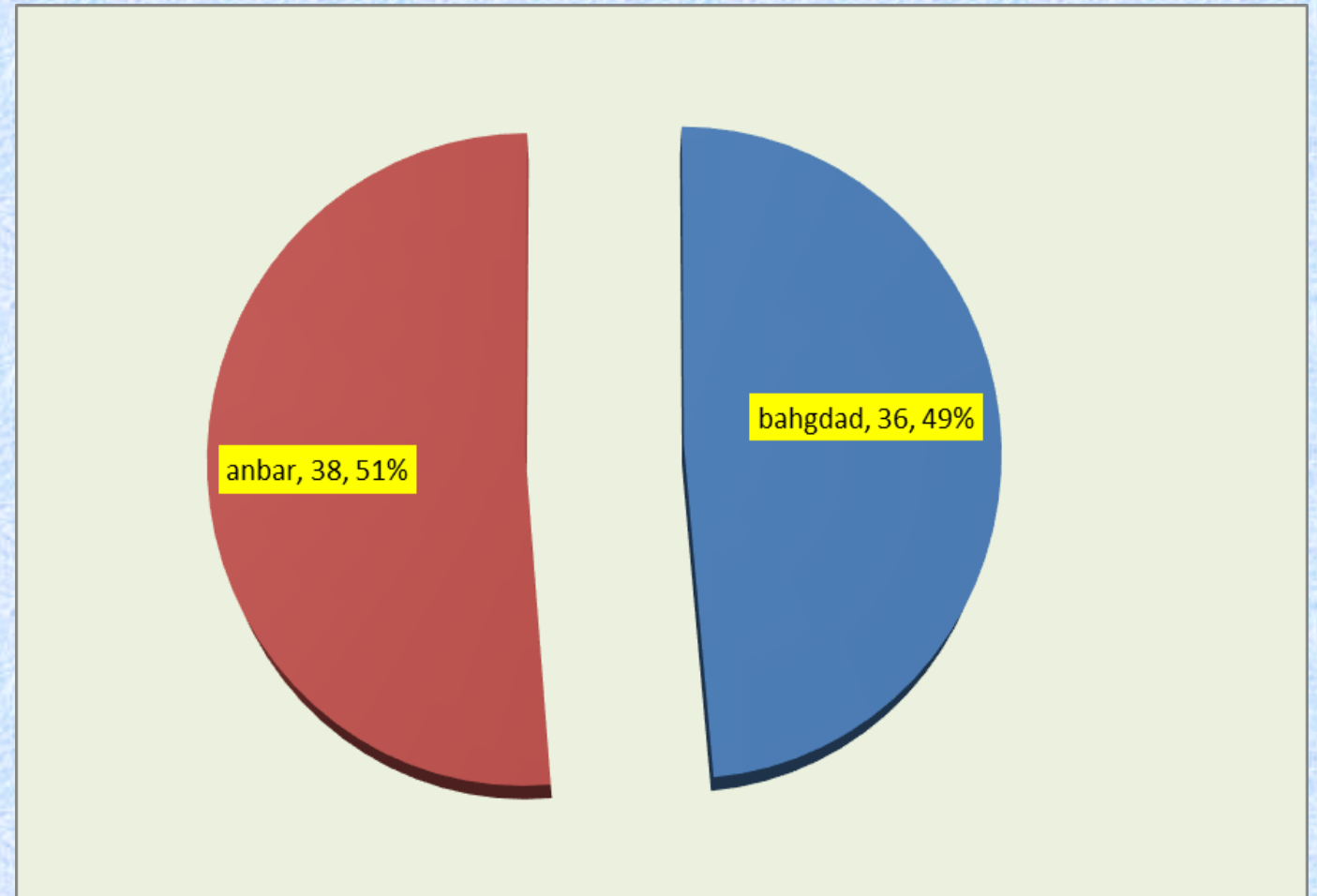
- Sputum specimens were taken from each patient at multi-isolation Hospitals in Iraq (Baghdad and Al-Anbar Governorates). Sputum specimens were studied by sputum direct smear, cultured on blood agar, MacConkey agar, and Chocolate agar incubated (48 hours) bacterial isolates were identified using (VITEK-2) system, *Mycoplasma pneumoniae* was diagnosed by RT-PCR. Haematological parameters were studied as a part of this research including white blood cell total and differential counts. C-Reactive protein, D-Dimer as an inflammatory immunological marker was determined using a quantitative serological assay. Procalcitonin was detected by (Cobas e411).



Results

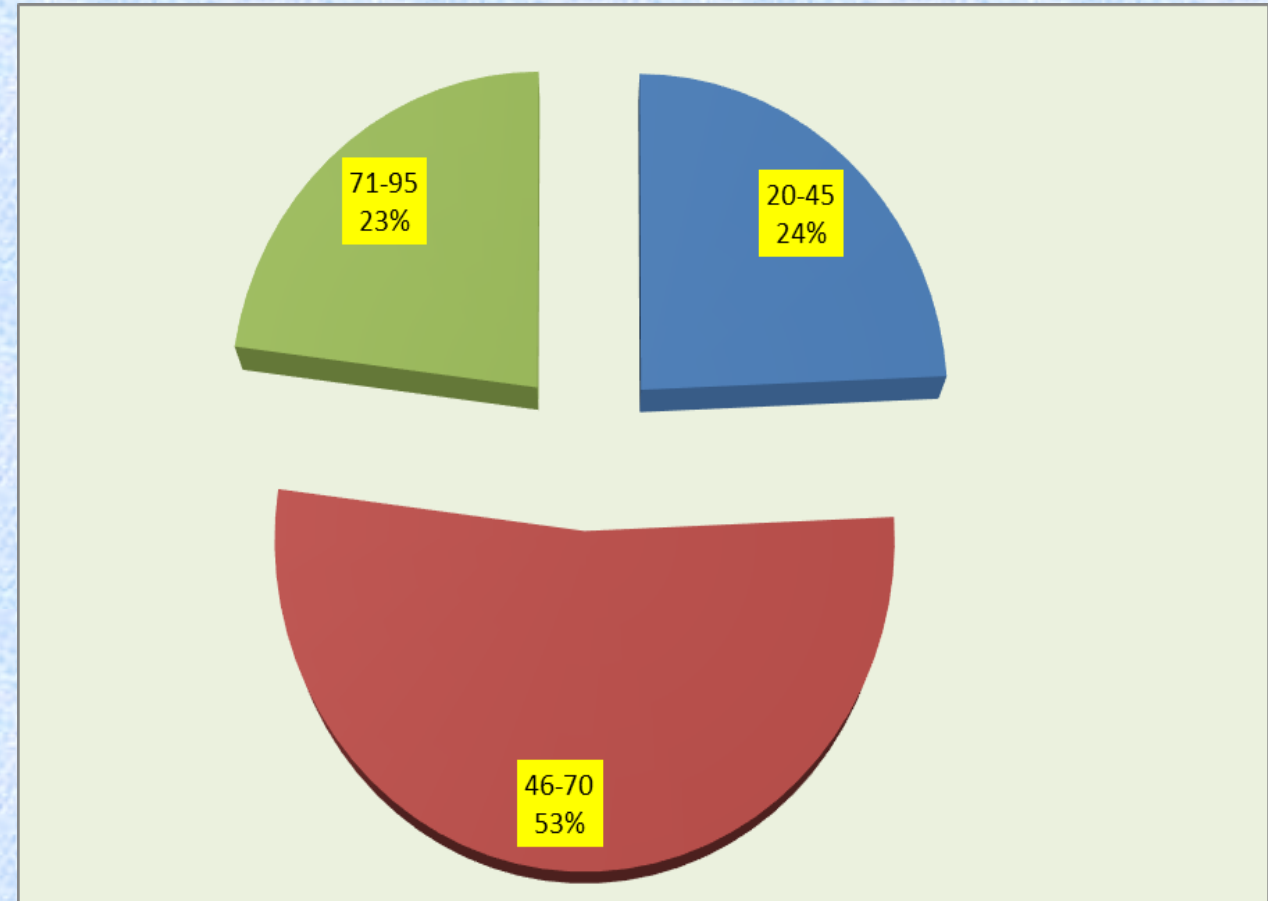
Geographic distribution of patients

- Among patients included in the study, (38) patients (51%) were from AL-Anbar Governorate while 36 patients were from Baghdad Governorate (49%)



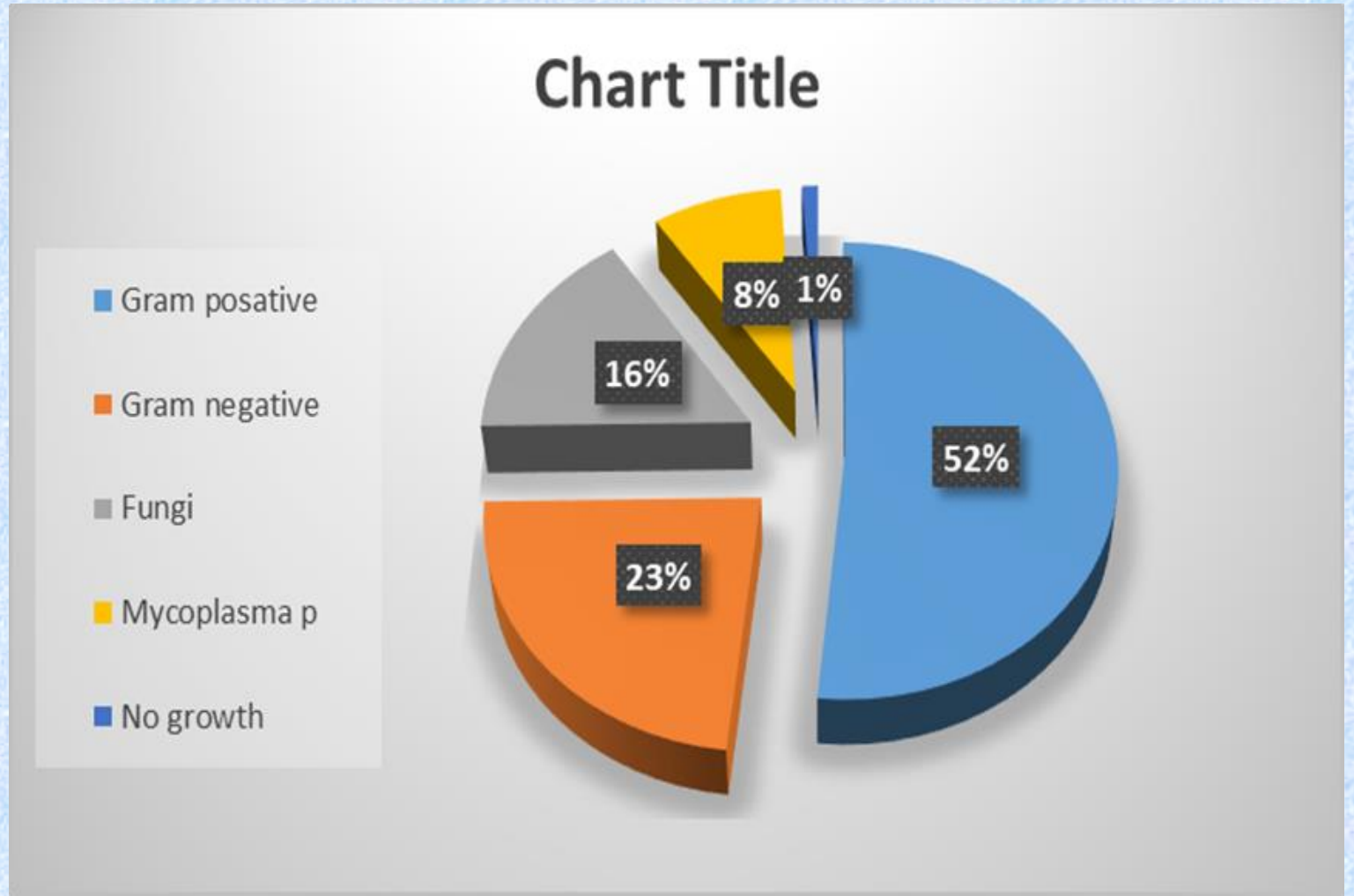
Age group percentage among patients with COVID-19.

- The highest percentage (53%) of patients was found within the age group (46-70) years. while(24 %)of patient were found within age group(20-45) years. Lowest ratio (23%) of patients were within age group (71-95) years



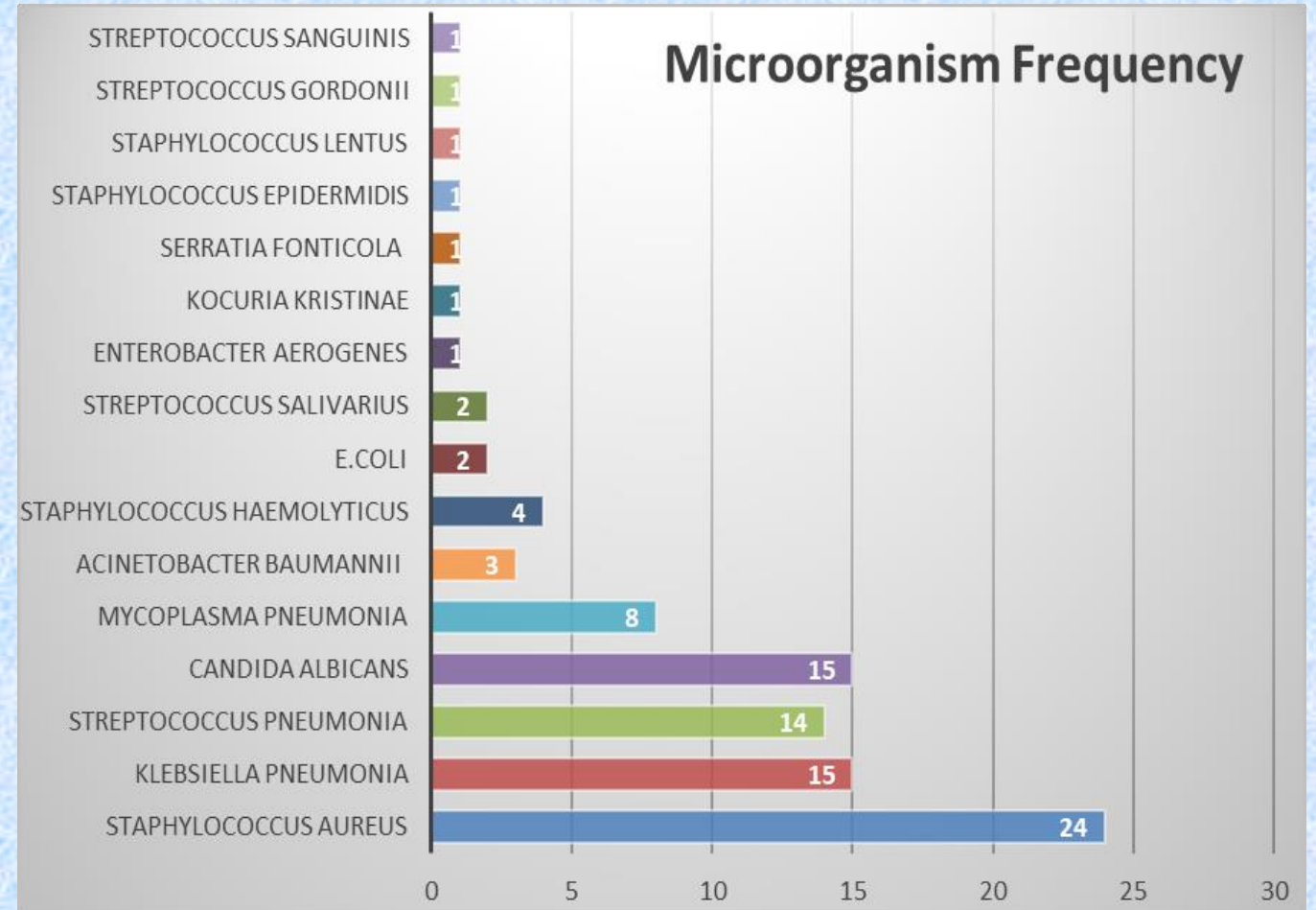
Type of Isolated Organisms

Gram-positive bacteria took the first rank of isolation (52 %) followed by Gram-negative (23%) and Fungi (16%) while Mycoplasma pneumonia was isolated with the ratio (8 %). Other specimens were showing negative result of isolation (1 %).



types of bacterial isolates from patient with covid -19

- *Staphylococcus aureus* ranked the first (24) followed by *Klebsiella pneumonia* (15) and *Streptococcus pneumonia* (14), while *Candida albicans* had a high frequency of isolation (15), and *Mycoplasma pneumonia* was isolated for (8) of specimens. Isolation rate of other organisms was (1-4).

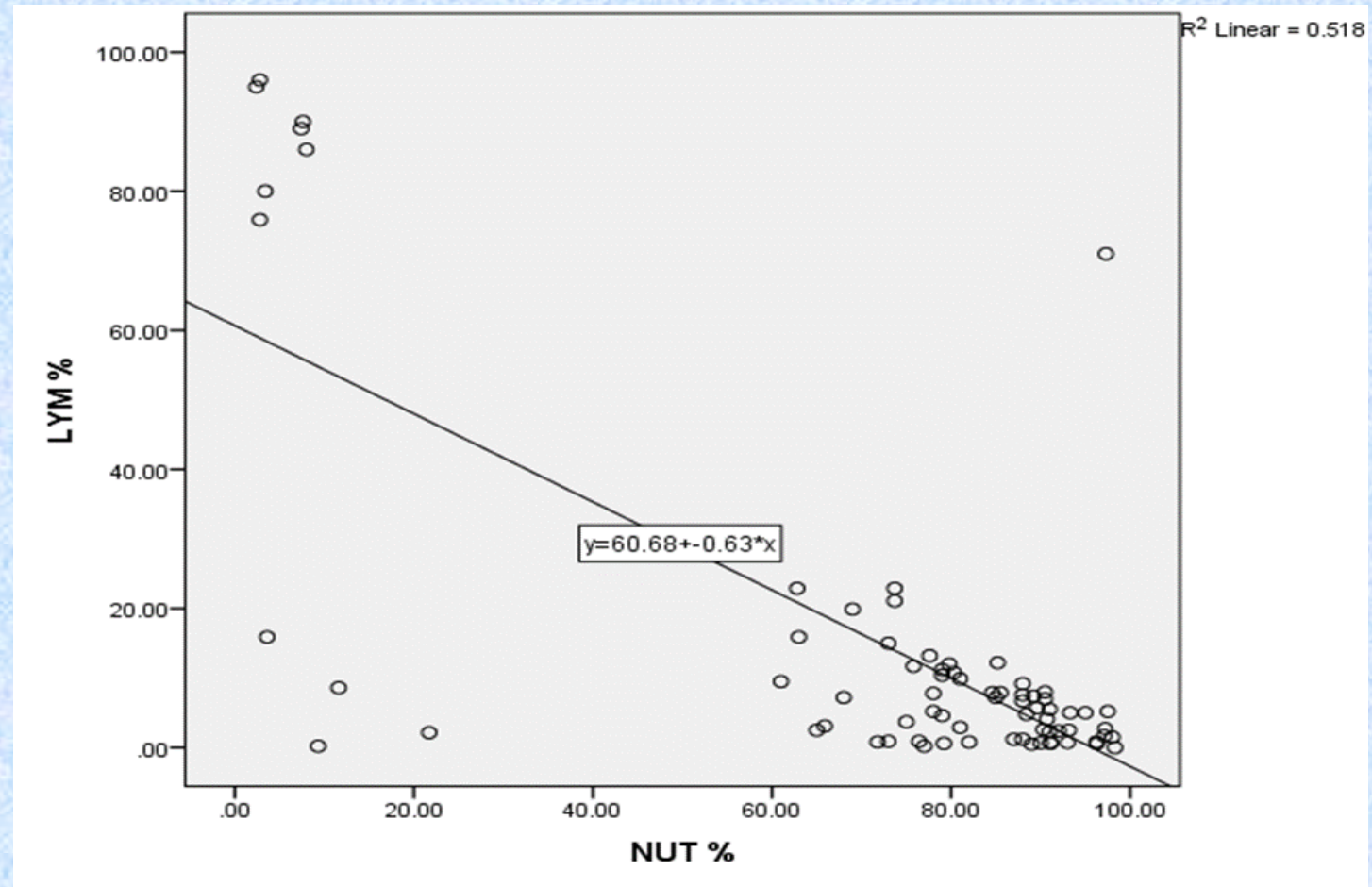


Mix microorganisms isolated from patient with COVID -19.

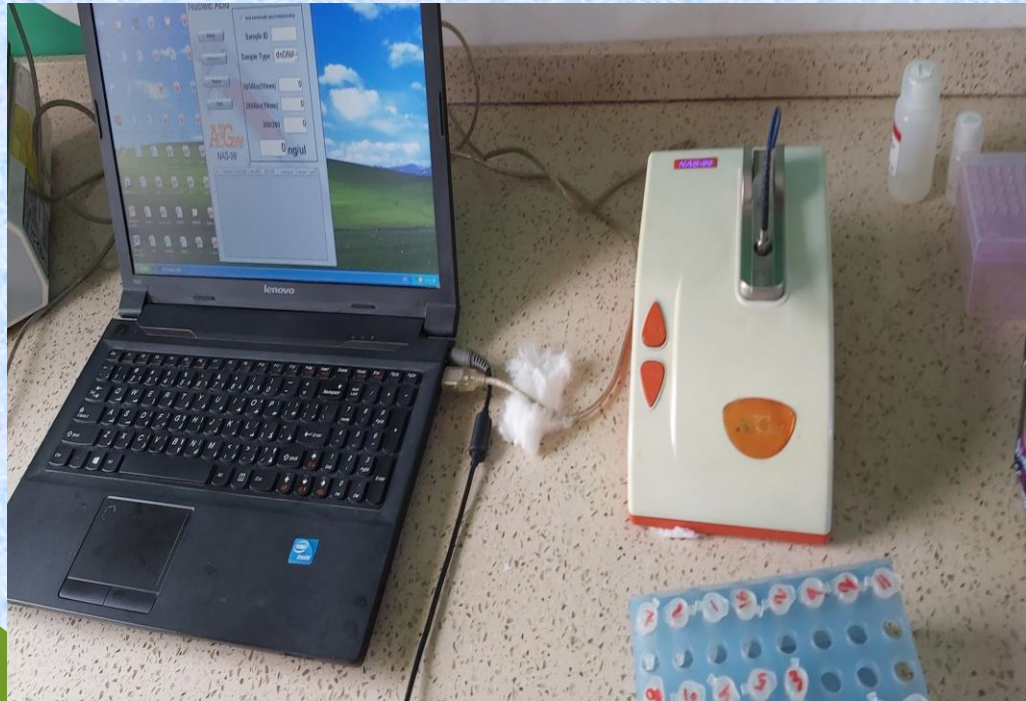
NO	Mix infection	Frequency
1	<i>Staphylococcus aureus</i> + <i>Staphylococcus epidermidis</i>	1
2	<i>Mycoplasma pneumoniae</i> + <i>Streptococcus pneumoniae</i> + <i>Candida albicans</i>	2
3	<i>Mycoplasma pneumoniae</i> + <i>Streptococcus pneumoniae</i>	2
4	<i>Mycoplasma pneumoniae</i> + <i>Candida albicans</i>	1
	<i>Mycoplasma pneumoniae</i> + <i>staphylococcus aureus</i>	2
	<i>Mycoplasma pneumoniae</i> + <i>staphylococcus aureus</i> + <i>Candida albicans</i>	1
5	<i>Staphylococcus aureus</i> + <i>klebsiella pneumoniae</i>	4
6	<i>Staphylococcus aureus</i> + <i>Candida albicans</i>	2
7	<i>Streptococcus pneumoniae</i> + <i>klebsiella pneumoniae</i>	1
8	<i>streptococcus gordonii</i> + <i>streptococcus sanguinis</i>	1
9	<i>streptococcus salivarius</i> + <i>kocuria kristinae</i>	1
	<i>Total</i>	18

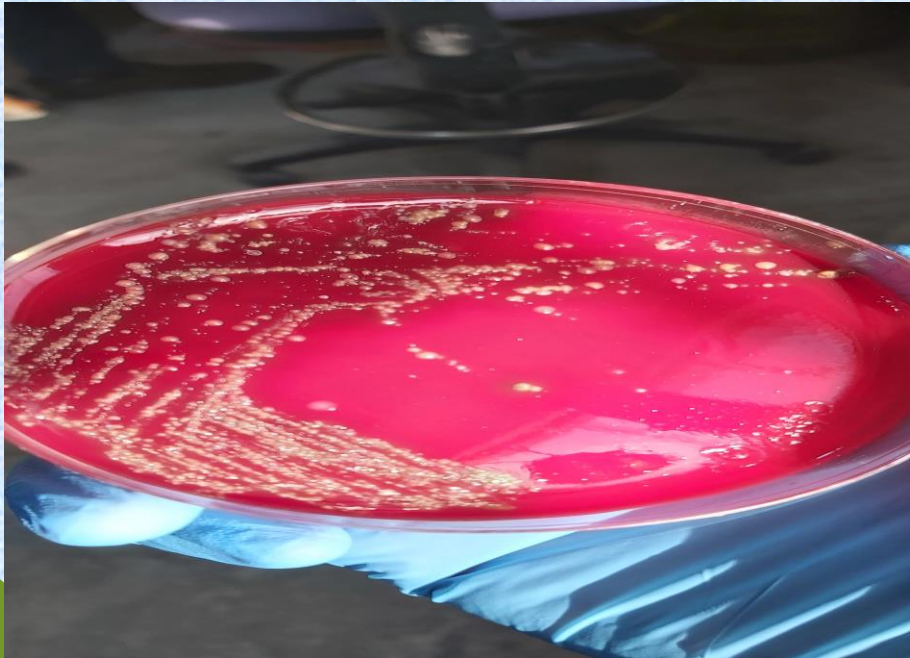
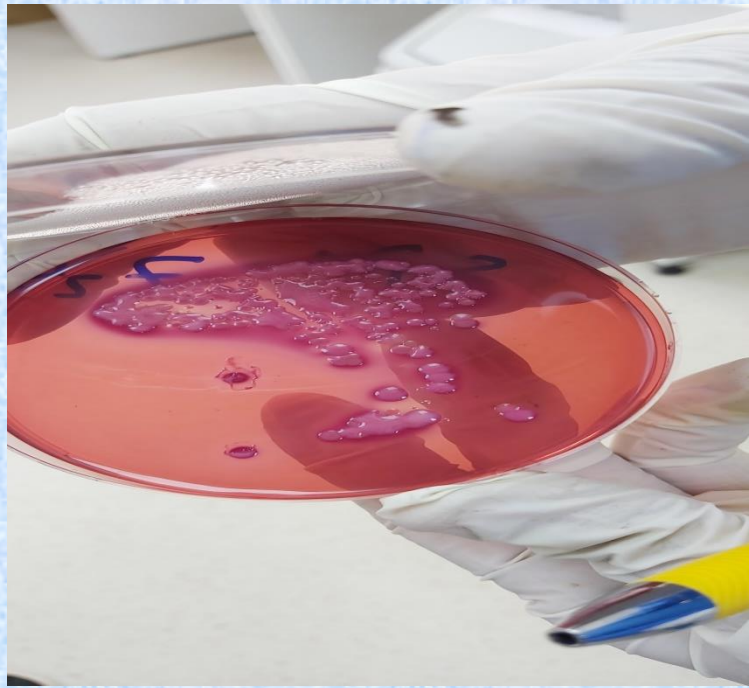
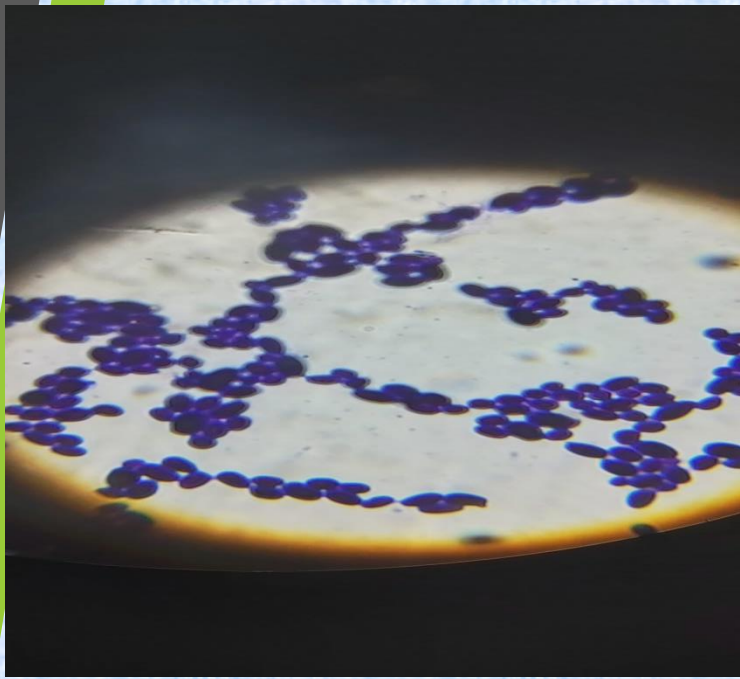
The correlations between LYM-NUT

- There is a significant negative correlation at a level less than (0.01) between NUT and LYM, while the other variables CRP/D-Dimer /PCT did not show a significant correlation between them at a level less than (0.01)









Discussion

- **1-**The findings of this study revealed that higher infection (39,52.7%) was found among patients within age group (46-70) years old, my explanation to this result is might be due to the higher exposure of individuals within this age group to infection was accelerated by other predisposing diseases like *Diabetes mellitus* ,hypertension ,liver or kidney functions impairment in such age group patients.
- **2-***Staphylococcus aureus* high rate of isolation in this study can be explained by pathogenicity factors owned by this organism like Protein A and coagulase enzyme in addition to the resistance factors to antibiotics in some strains particularly resistance to beta lactams and Methicillin in MRSA group of *Staphylococcus aureus* .

- **3-** This study revealed the mixed bacterial infections in patients with COVID19, two or more microorganisms were isolated as mixed infection from specimens of 74 patients (18- 24%) . We can explain that by the viral infection causes damage to the lung tissue and facilitates secondary infection like opportunistic bacteria cause lung infection , immune-compromised status of patient and other causes facilitating infection during the course of COVID-19 infection .
- **4-** procalcitonin level at the time of admission to the hospital in patients with COVID-19 being investigated for suspected bacterial co-infection showed that procalcitonin was not a reliable marker for positive bacterial infection. Overall, procalcitonin may be affected by other markers like IL-6 so it may be not a reliable indicator of bacterial infection in severe viral diseases . Microbiological investigation remains critical to identify co-infections and inform antimicrobial decision-making .

Conclusions:

- 1- Staphylococcus took the first rank of isolation (30) isolates out of 52% isolates. Twenty four 24 of them were *Staphylococcus aureus* and one isolate from each of *Staphylococcus epidermidis* and *Staphylococcus lentus* . While the most common Gram negative was *Klebsiella pneumonia* (14) out of (23%) Gram-negative isolates.
- 2- Other bacterial isolates became next within lower rate of isolation like *E. coli*
- 3- Eight (8) isolates of *Mycoplasma pneumonia* were isolated from the sputum of patients and all Mycoplasma infections were accompanied with secondary Gram-positive and fungal infections.
- 4- The isolation rate of *Candida albicans* was (16 %) as a mycotic agent isolated from the sputum of studied COVID-19 patients.
- 5- All included patients had significant lymphopenia in spite of significant COVID-19 management and all got a secondary pyogenic or fungal infection which mean the prediction of secondary pyogenic or fungal infection in this pertain criteria.
- 6- In this study, it was found there was leukocytosis and neutrophilia with elevated CRP titer and PCT in Gram positive and Gram negative but there was a non-significant difference regarding parameters with the type of bacteria wither is it Gram-negative or Gram-positive.
- 7- Procalcitonin may be associated with cytokine storm in COVID-19 as the results revealed PCT was elevated in in 50% of patients.
- 8- Results showed mixed infection in 24% of our patients.
- 9- There is a significant negative correlation between neutrophils and lymphocytes during secondary bacterial infection, this is an indication of acute bacterial pyogenic infection.

Recommendations:

- 1- We recommend further study of other types of bacterial pathogens like *Chlamydia pneumonia* and other anaerobic bacteria in COVID- 19 infections.
- 2- Study of other inflammatory markers in COVID-19 patients like apoptotic factors.
- 3- Study of pathological pathways accompanied with bacterial infections in COVID19 patients.
- 4- We recommend bacterial vaccines for the risky group (Diabetic, HIV, Cortisone Dependent patients) to prevent their infection with the COVID-19 virus.
- 5- Study of Th2 mediators in patients with COVID-19 patients.
- 6- Accentuation hospital-acquired pneumonia prevention protocol
- 7- Focus on laboratory diagnosis of *Mycoplasma pneumonia* in patients.
- 8- Sputum culture and sensitivity test before use of antibiotic.
- 9- Further study of PCT elevation in non-bacterial infections like cytokine storm and other conditions associated with COVID-19 cases.

A watercolor illustration of a jungle scene. The background is a light, pale green. In the foreground, there are several green vines and leaves. The vines are thick and wavy, with some showing small green leaves. The leaves are various shapes, including some with prominent veins and others that are more rounded. The overall style is soft and artistic, typical of watercolor painting.

Thanks for listening