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A comparative study evaluating the outcome of patients with pneumothorax diagnosed with COVID-19 in Iraq.

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ABSTRACT

Introduction: The Covid-19 pandemic has caused 34,161,721 confirmed cases and more than 1016,986 deaths worldwide so far. However, others can cause serious complications that increase the death rate. Acute respiratory distress syndrome (ARDS) is a complication of this new virus belonging to the family of coronavirus, known as SARS-CoV-2, which is currently the most common complication for patients admitted to an ICU. Another complication, although less common but with a significant impact on the patient's development, is a spontaneous pneumothorax in patients with Covid-19, with a rate of 1-2%. The pathogenesis and pathophysiology of pneumothorax in connection with Covid-19 is still not completely clear, and the possible causes are the formation of bubbles, pneumocele, the inflammatory process itself, and barotrauma. **Objective:** This paper aims to conduct a comparative study evaluating the outcome of patients with pneumothorax diagnosed with COVID-19 in Iraq. **Patients and Methods:** A prospective and archaeological cohort study was conducted evaluating the outcome of patients with pneumothorax diagnosed with COVID-19 in Marjan Medical City/Babylon, Iraq, by adequate sampling from 800 inpatient files admitted from June 2020 through March 2021. A statistical study was conducted for patients using the SPSS program. The study population includes every patient who was admitted and diagnosed with COVID-19 by PCR or chest CT scan. Files lacking the necessary data were excluded from the study. Pneumothorax was defined as any CXR findings according to ATS criteria. **Results and discussions:** The main cause of primary spontaneous pneumothorax in patients with Covid-19 is rupture of subdural bullae or pneumocele with CT findings. The diffuse alveolar damage caused by the excessive inflammatory process caused by the large amount of cytokines released by the COVID-19 virus leads to a weakening of the airway walls, in addition to acute respiratory distress syndrome, which leads to an increase in intra-alveolar pressure that prepares the alveoli to rupture, causing them to rupture. Air leakage into the interstitial space. Follow up to previous studies; previous studies showed that men are more affected than women, as this was confirmed by our study, as it reached 308, or 61.5% of females, while the percentage of males reached 492, or 61.5%. In addition, this study has shown that most patients has gotten the treatment with the exception of two types of treatment where the patients have gotten which are Decadron and enoxaparin.

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Conclusion: Pneumothorax is a primary cause of acute respiratory distress syndrome, which raises the chances of mortality. The problem with pneumothorax in SARS-CoV-2 patients is that despite respiratory therapy and the use of neuromuscular blockers, patients still have a high prevalence of pneumothorax. This increased frequency is due to the fact that individuals infected with SARS-CoV-2 require a larger positive end-expiratory pressure (PEEP). When the cases were combined, it became clear that if a patient had a pneumothorax, the likelihood of mortality rose with time.

Keywords: Pneumothorax; PCR; chest CT; COVID-19; chest CT scan; and Hypertension.

INTRODUCTION

The Covid-19 pandemic has resulted in 34,161,721 confirmed cases and over 1016,986 fatalities globally. Others, on the other hand, can result in major problems that raise the fatality rate. Acute respiratory distress syndrome (ARDS) is a consequence of this new virus, known as SARS-CoV-2, that belongs to the coronavirus family and is now the most prevalent complication for patients admitted to an ICU. A spontaneous pneumothorax in Covid-19 patients occurs at a rate of 1-2%, which is less common but has a substantial influence on the patient's development. **[1,2]**. The origin and pathophysiology of pneumothorax in relation to Covid-19 are yet unknown, and plausible reasons include bubble formation, pneumocele, the inflammatory process itself, and barotrauma. **[3].** The frequency of barotrauma increases by up to 15% and has a clear link to underlying lung disorders such as chronic obstructive pulmonary disease (COPD), duration of acute respiratory distress syndrome, peak respiratory pressure of more than 40 to 50 cm H, and high positivity. High tide volumes and pressure near the periphery of tides **[4,5]**. Currently, the incidence of pneumothorax as a complication in COVID-19 patients is of major concern due to its elevated incidence and death rate (33%), particularly in cases of barotrauma secondary to mechanical ventilation. Therefore, quick identification and treatment are critical **[6].** To recap, pneumothorax is defined as the presence of free air in the pleural space between the parietal pleura and the visceral pleura, which covers the lung. It is divided into two categories: primary and secondary. A primary pneumothorax develops when there is no underlying lung illness present, with smoking as a risk factor and the rupture of the subdural bullae as the major cause **[7].** An underlying lung illness, such as emphysema, cystic fibrosis, necrotizing pneumonia, severe asthma, cancer, trauma, or artificial ventilation, causes secondary pneumothorax. **[8].** Pneumothorax can develop as a complication in Covid-19 patients at various phases of the illness and can be caused by underlying lung disease, barotrauma from mechanical ventilation, or disease severity **[9].** According to previous research, the current Covid-19 pandemic has resulted in a few cases of spontaneous pneumothorax, the pathophysiology, aetiology, occurrence, or predictive value of which is unknown, prompting us to investigate the history of previous coronaviruses in which pneumothorax is also mentioned **[10], a**s an added difficulty. Coronaviruses are a broad family of single-stranded RNA viruses that infect people, according to Harvard University research. Human coronaviruses are classified into six types: alpha-COV (HCOV-NL 63, HCoV-229E), beta-CoV (HCoV-OC43, HCoV-HKU1), those causing acute respiratory distress syndrome (SARS-CoV), and those from the Middle East (MERS-CoV) **[11].** The first occurrence of SARS-CoV was in 2002, with 8098 confirmed cases and 774 fatalities, with a mortality rate of 5-10%, including a few cases of spontaneous pneumothorax in hospitalized patients, with an incidence of 1.7%. The first case of severe pneumonia was reported in Saudi Arabia in 2012, and it spread throughout Europe, Asia, Africa, and the northern United States; presentation of cases in 2494 subjects and 858 deaths, with a high ICU admission rate of 40-50% and a mortality rate of 75%, with a high incidence of pneumothorax of 20-34% secondary to barotrauma, is considered a poor prognostic sign **[12].** As a consequence, spontaneous pneumothorax occurs in 1% of hospitalized patients and 2% of ICU patients with Covid-19, with a mean time to progression of 24.3 days after hospitalization. **[13,14,15].** In contrast, documented pneumothorax due to barotrauma had a 15% incidence and a 33% fatality rate, with a mean time to progression of 4-5 days after intubation for a patient on Covid-19. **[16].**

Secondary pneumothorax in patients with Covid-19 presents a higher risk of morbidity and mortality than spontaneous primary pneumothorax **[17,18]**. This paper aims to conduct A comparative study evaluating the outcome of patients with pneumothorax diagnosed with COVID-19 in Iraq.

PATIENTS AND METHOD

A prospective and archaeological cohort research was undertaken at Marjan Medical City/Babylon, Iraq, to evaluate the outcome of patients with pneumothorax diagnosed with COVID-19 using a suitable sample from 800 inpatient files admitted from June 2020 to March 2021. SPSS version 25 was used for statistical analysis. Frequencies and percentages were used to represent categorical variables. (Means SD) was used to represent continuous variables. To compare the means of the two groups, the student t-test was utilized. To determine the relationship between categorical variables, Pearson's chi-square and Fisher's exact test were utilized. A p-value of 0.05 was deemed significant. Every patient who was hospitalized and diagnosed with COVID-19 through PCR or chest CT scan is included in the study cohort. A prospective and archaeological cohort research was undertaken at Marjan Medical City/Babylon, Iraq, to evaluate the outcome of patients with pneumothorax diagnosed with COVID-19 using a suitable sample from 800 inpatient files admitted from June 2020 to March 2021. SPSS version 25 was used for statistical analysis. Frequencies and percentages were used to represent categorical variables. (Means SD) was used to represent continuous variables. To compare the means of the two groups, the student t-test was utilized. To determine the relationship between categorical variables, Pearson's chi-square and Fisher's exact test were utilized. A p-value of 0.05 was deemed significant. Every patient who was hospitalized and diagnosed with COVID-19 through PCR or chest CT scan is included in the study cohort. The study rejected files that lacked relevant data. According to ATS criteria, pneumothorax was classified as any CXR results. Age, gender, smoking status, presence of pneumothorax, presence of comorbidities (diabetes mellitus, chronic kidney disease, heart disease, hypertension, gastric or duodenal ulcers, and multiple comorbidities), presence of symptoms (chest pain, SOB, and DLOC), need for chest tube insertion or other intervention, SPO2 at admission and the lowest level of SPO2 reached during a hospital stay.

RESULTS

TABLE 1: The Distribution of patients according to socio-demographic characteristics (N=800)

Study variables		
Age (years)	(54.40 ± 15.02)	(16.0 - 96.0)
Gender		
Male	492	61.5%
Female	308	38.5%
Total	800	100.0%
Smoking		
Smoker	58	7.3%
Non-smoker	742	92.8%
Total	800	100.0%

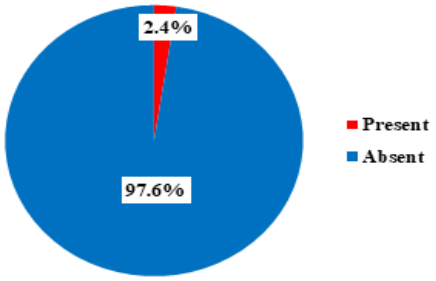

FIGURE 1: depicts the distribution of patients according on pneumothorax, including (present and absent). Only 19 individuals suffer pneumothorax, accounting for (2.4%) of all patients.

TABLE 2: The Distribution of patients according to according to comorbidities (N=800)

Study variables	**Number**	**%**
Comorbidities		
Present	370	46.2%
Absent	430	53.8%
Total	800	100.0%
Type of comorbidities		
Diabetes mellitus	99	26.8%
Chronic kidney disease	2	0.5%
Heart disease	9	2.4%
Hypertension	102	27.6%
Gastric or duodenal ulcer	3	0.8%
Multiple comorbidities	155	41.9%
Total	370	100.0%

TABLE 3: The Distribution of patients with pneumothorax according to intervention need and associated symptoms (N=19)

Study variables	Number	%
Intervention		
Chest tube	19	100.0%
Total	19	100.0%
Associated symptoms		
Chest pain, SOB, DLOC	2	10.5%
No symptoms	17	89.5%
Total	19	100.0%

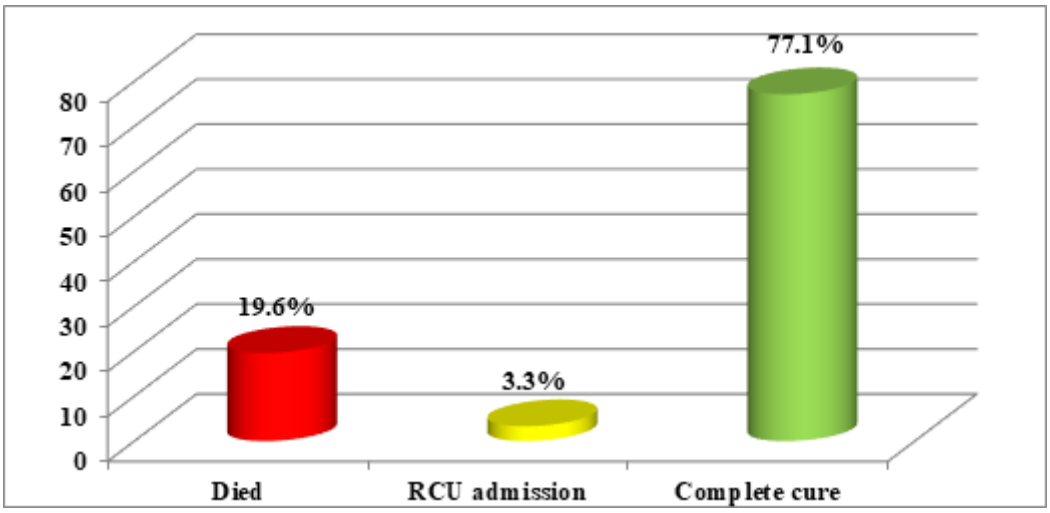

FIGURE 2: Distribution of patients with COVID-19 according to fate (N=800)

TABLE 4: The mean differences of study variables according to pneumothorax

Study variables	Pneumothorax	N	Mean	SD	t-test	P-value
Age (years)	Present	19	51.52	15.30	-0.846	0.398
	Absent	781	54.47	15.01		
SPO2 on admission (%)	Present	19	0.86	0.07	-1.534	0.125
	Absent	779	0.89	0.09		
Lowest SPO2 (%)	Present	19	0.72	0.08	**-3.628**	**<0.001***
	Absent	778	0.83	0.13		
CT involvement (%)	Present	19	0.72	0.12	**8.875**	**<0.001***
	Absent	752	0.46	0.22		

TABLE 5: Association between study variables and pneumothorax (N=800)

Study variables	Pneumothorax		Total	X^2	P-value
	Present	Absent			
Gender				**4.239**	**0.039***
Male	16 (84.2)	476 (60.9)	492 (61.5)		
Female	3 (15.8)	305 (39.1)	308 (38.5)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Smoking					0.388 f
Smoker	0 (0.0)	58 (7.4)	58 (7.3)		
Non-smoker	19 (100.0)	723 (92.6)	742 (92.7)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Comorbidities				1.062	0.303
Present	11 (57.9)	359 (46.0)	370 (46.2)		
Absent	8 (42.1)	422 (54.0)	430 (58.8)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
C-reactive protein				0.512	0.474
Positive	14 (73.7)	514 (65.8)	528 (66.0)		
negative	5 (26.3)	267 (34.2)	272 (34.0)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Associated symptoms.					1.000 f
Yes	2 (10.5)	85 (10.9)	87 (10.9)		
No	17 (89.5)	696 (89.1)	713 (89.1)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Respiratory rate				4.354	0.113
12-18	0 (0.0)	22 (18.0)	22 (15.6)		
18-30	11 (57.9)	64 (52.5)	75 (53.2)		
>30	8 (42.1)	36 (29.5)	44 (31.2)		
Total	19 (100.0)	122 (100.0)	141 (100.0)		
Interventions					**<0.001* f**
Yes	19 (100.0)	71 (9.1)	90 (11.3)		
No	0 (0.0)	710 (90.9)	710 (88.7)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		

TABLE 6: The mean differences of study variables according to pneumothorax.

Study variables	Pneumothorax	N	Mean	SD	t-test	P-value
PCV (HCT)	Present	19	41.26	3.44	1.769	0.078
	Absent	207	38.64	6.36		
Platelet's count	Present	19	361.15	178.63	**3.135**	**0.005***
	Absent	200	230.57	105.56		

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TABLE 7: Association between type of treatment and pneumothorax (N=800)

Type of treatment	Pneumothorax		Total	X^2	P-value
	Present	Absent			
Anti-platelet use					**<0.001*** f
Yes	9 (47.4)	42 (5.4)	51 (6.4)		
No	10 (52.6)	739 (94.6)	749 (93.6)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Plasma					0.276 f
Yes	4 (21.1)	94 (12.0)	98 (12.3)		
No	15 (78.9)	687 (88.0)	702 (87.7)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Favipiravir					**0.011* f**
Yes	0 (0.0)	178 (22.8)	178 (22.3)		
No	19 (100.0)	603 (77.2)	622 (77.7)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Remidisvir					**<0.001* f**
Yes	19 (100.0)	172 (22.0)	191 (23.9)		
No	0 (0.0)	609 (78.0)	609 (76.1)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Solomedrol					0.146 f
Yes	1 (5.3)	158 (20.2)	159 (19.9)		
No	18 (94.7)	623 (79.8)	641 (80.1)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Decadron					1.000 f
Yes	18 (94.7)	706 (90.4)	724 (90.5)		
No	1 (5.3)	75 (9.6)	76 (9.5)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Heparin				3.055	0.081
Yes	4 (21.1)	320 (41.0)	324 (40.5)		
No	15 (78.9)	461 (59.0)	476 (59.5)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		
Enoxaparin				2.033	0.154
Yes	15 (78.9)	492 (63.0)	507 (63.4)		
No	4 (21.1)	289 (37.0)	293 (36.6)		
Total	19 (100.0)	781 (100.0)	800 (100.0)		

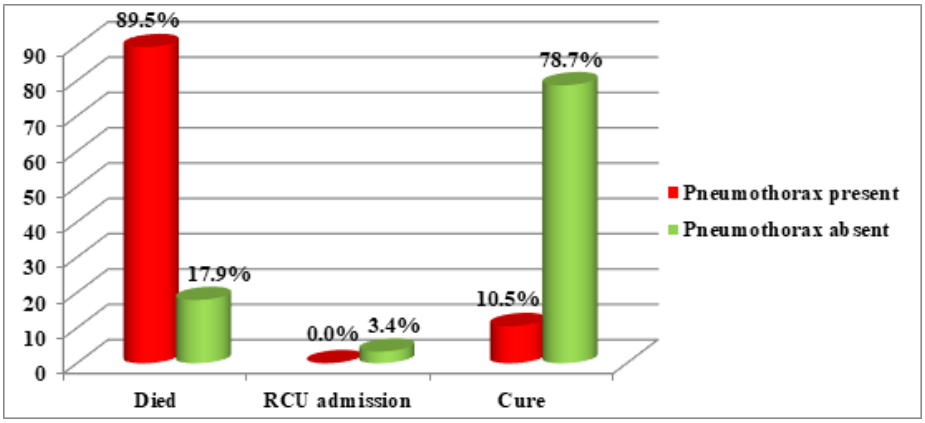

FIGURE 3: The association between the fate of patients and pneumothorax (N=800)

DISCUSSION

The rupture of subdural bullae or pneumocele with CT abnormalities is the most common cause of primary spontaneous pneumothorax in Covid-19 patients **[19].** The diffuse alveolar damage caused by the excessive inflammatory process caused by the large amount of cytokines released by the COVID-19 virus leads to a weakening of the airway walls, as well as acute respiratory distress syndrome, which causes an increase in intra-alveolar pressure, causing the alveoli to rupture. Leakage of air into the interstitial area. **[20,21,22]**

In this study, the percentages placed in the demographic table appear, as it was found that the percentage of affected females appears more than males, reaching 308 with 61.5%, while the percentage of males reached 492 with 61.5%.

This study, on the other hand, revealed that the majority of patients suffering from pneumothorax do not smoke, as the proportion of smokers seemed to be 58 (7.3%), whereas 742 (92.8%) out of a total of 800 patients. In this study, patients were categorized into absent and present, with present accounting for 97.6% and absent accounting for 2.4%. **[23]**

Besides comorbidities, this study evaluated patients according to comorbidities, where Present 370 (46.2%) and Absent 430 (53.8%), where the most common comorbidities affecting patients were Multiple comorbidities, which were 155 (41.9%), and Hypertension 102 (27.6%).

In addition, a meta-analysis was performed in which only (N = 157, 19.6%) patients died, and (N = 26, 3.3%) patients were admitted to RCU, and most patients (N = 617, 77.1%) got a complete cure. As for symptoms, associated symptoms (N=19) showed that Chest pain, SOB, and DLOC were 2 (10.5%), while no symptoms were 17 (89.5%). As a result, this study presented study variables according to pneumothorax, whereas the German studies **[24,25]** showed that in the normal situation, it is 47% in men and 42% in women, and in children, it is about 36% to 44% of what was distributed in this study Present 19 and Absent with P- value 0.078, while Platelets count found Present 19 and Absent 200 with a P-value of 0.005.

In comparison to the kind of therapy reported in this study, the Association between forms of treatment (antiplatelet, Plasma, Favipiravir, Remdesivir, Solumedrol, Decadron, Heparin, and Enoxaparin) and pneumothorax, including (present and absent). There was a significant association between anti-platelet use, Favipiravir, and Remdesivir, and pneumothorax, where it was discovered that most patients did not receive all of these treatments, where, for example, in treatment, anti-platelet use reached 749 (93.6), while patients who received it reached 51 (6.4) with a P value 0.001, except for two types of treatment, Decadron and Enoxaparin, which showed that Decadron the majority of patients who re (37.0). According to studies of people infected with COVID-19, pneumothorax can develop in 1% of those who need hospitalization, 2% of those who need intensive care unit (ICU), and 1% of those who die from the infection. **[26]**

CONCLUSION

Pneumothorax is a major cause of acute respiratory distress syndrome, which increases the risk of death. The issue with pneumothorax in SARS-CoV-2 patients is that it persists after respiratory treatment and the use of neuromuscular blockers. This greater frequency is attributable to the fact that SARS-CoV-2 infected patients require a higher positive end-expiratory pressure (PEEP). When the cases were analyzed together, it became evident that if a patient had a pneumothorax, the chance of death increased with time.

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