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RESEARCH ARTICLE

THE RELIABILITY OF CLINICAL PROBABILITY SCORE IN (WELLS SCORE) THE DIAGNOSIS OF PULMONARY EMBOLISM (PE) IN COVID-19 PATIENTS

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Abstract

Background: The risk of developing pulmonary embolism (PE) is high in patients infected with COVID-19, and its diagnosis is a severe challenge for healthcare professionals duringthe COVID-19 pandemic. Physicians are frequently usingcomputed tomography pulmonary angiography(CTPA), d-dimer, and well score for the diagnosis of PE.
Methods: A retrospective study was used in which we investigated the reliability of clinical well scores by collecting data, such as medical records in registered form (serum D-dimer level and Wells scores) of every patient for whom physicians have requested whose CTPA with suspicion of PE at King Faisal Medical Center (KFMC) from the period from 1st of April to the 1st of October. **Results**: The study results showed significantly higher values of d-dimer in patients with positive PEcompared to those with negative values. In addition wells score is not a reliable preclinical score in diagnosis PE in COVID 19 patient.
Conclusions: As per the results of the well score, there is no significant difference between vulnerable people with PE +ve and -ve.

Introduction:-

The COVID-19 outbreak is a global clinical pandemic, as its fast spread and high mortality rate have instigated severe damage. COVID-19 patients may experience severe symptoms of pneumonia, acute respiratory distress syndrome (ARDS), and a couple of organs failure (Yang *et al.*, 2020). Consequently, it is reflected as a burden on the healthcare system, government, and society. Furthermore, the mortality rate of COVID-19 has been progressing between COVID-19 patients becauseCOVID-19 most commonly infects the lungs and respiratory system (Kordzadeh-Kermani*et al.*, 2020). In addition,COVID-19 is related to respiratory deterioration as the incidence of venous thromboembolism and coagulopathy is surprisingly high (Ibaet al., 2020).

Many studies supported the fact that COVID-19 pneumonia is growing the risk of prethrombotic conditions and ultimately increasing the patients' risk with pulmonary embolism (PE) (Whyte *et al*., 2020; Grillet*et al*., 2020). Because pulmonary embolism (PE) is a fatal disease, a high grade of clinical care and quick diagnosis are required. Therefore, doctors use scores, which help in narrowing the differential diagnosis besides using the D-dimer and computed tomography pulmonary angiography (CTPA) to confirm the diagnosis (Gervaise*et al*., 2020; Whyte *et al*., 2020). This has led to the increasing demand of CTPA and D-dimer testing as tools to conduct the PE diagnosis (Alonso-Fernández*et al*., 2020; Léonard-Lorant*et al.*, 2020). The high value of d-dimer may be associated with the

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enhanced blood coagulation activation in patients infected with COVID 19, which is secondary tothe direct result of SARS-CoV-2 itself or systemic inflammatory response syndrome(Van Dam *et al.*, 2020).

The clinical probability score, i.e., modified well score, is a score that contains diverse variables. Through well score, patients are divided into high-probability and low-probability risks of VTE (Wells*et al.*, 2001; Ooi et al., 2020). The overarching aim of this research was to establish the reliability of the wells score in the diagnosis of PE in COVID-19 patients and to establish the relation of D-dimer score with the result of CTPA.

Methodology:-

Study Design

The researcher retrospectively examined the data (serum D-dimer level and Well Scores)from April 2020 to October 2020 of every patient whose CPTA was demanded by the physician with suspected PE. The research was conducted at King Faisal Medical Center (KFMC), Taif city, Saudi Arabia.

Study Population

The result of the patient that underwent CTPA was retrieved from the picture archives in the radiology department (PACs) in KFMC from 1 April to 1 October.

The data of CTPA was evaluated as the patient is either positive or negative for PE. In addition, two different radiologists interpreted the result blindly to avoid bias and ensure accurate results. The patient medical record was examined; searching for the entities and variables of wells score and the data was collected and grouped in data collecting sheets. Patient age, gender, CTPA results, D-dimer level, and the score of wells criteria of each patient were entered in google form to create a database. Finally, we investigated a possible Correlation between Di-dimer and well score values and CTPA for PE and concluded that to which extent these clinical probability scores are reliable for the PE diagnosis in COVID-19 patients.

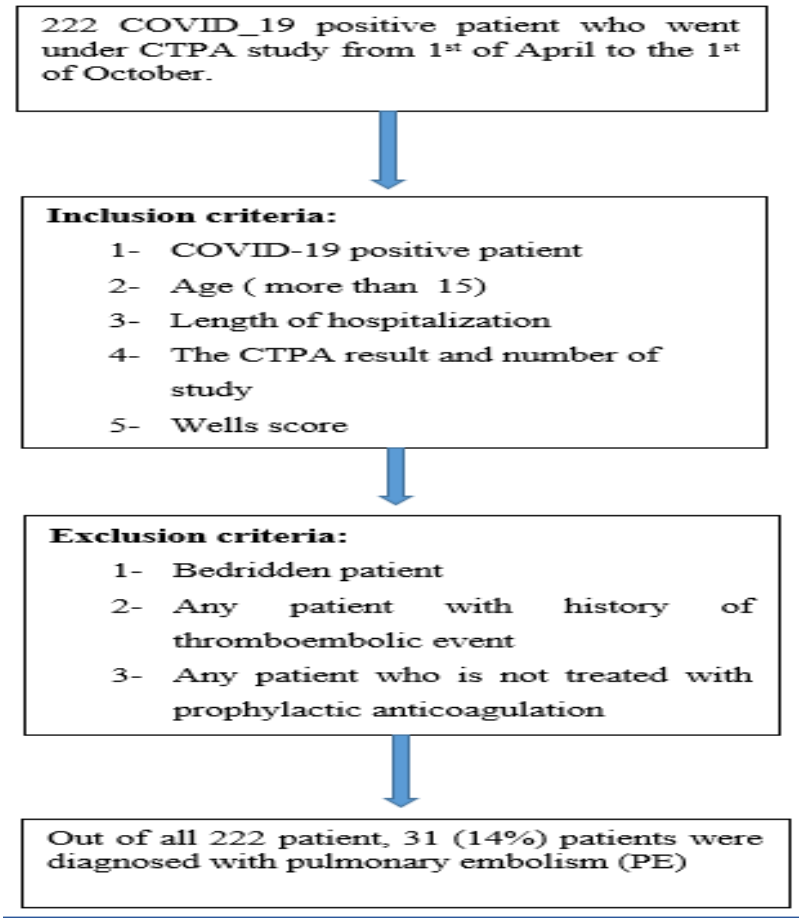

Figure 1:- Graph representing the patient inclusion and exclusion process for our study.

Ethical Approval and Confidentiality
The approval for the study was obtained by the Ethical Committee of King Faisal Medical Center (KFMC), Taif, Saudi Arabia, and the IRB. The patient list was identified by a number corresponding to the Medical record number and name to keep the confidentiality.

Statistical Analysis
To assess any significant correlation between the variables, we performed statistical analysis with a P-value ≤of 0.05 deemed statistical significance between different variables (i.e., D-dimer with PE in COVID19 patient. Additionally, a P-value > 0.05 in other variables that deemed a statistical insignificant (i.e., wells score and PE in COVID-19 patient).

Results:-

All 31 COVID-19 and PE positive patients diagnosed by CTPA were included for further diagnosis by D-dimer score, Well score, and baseline platelet count to check the reliability of these tests for PE diagnosis in COVID-19 patients. Out of 13 patients (age <55) who underwent CTPA, 41.9% were diagnosed with PE, and out of 18 patients (age >56) who underwent CTPA, 58.1% were PE positive. Patients aged> 56 had greater chances to be diagnosed with PE than patients with age <55.

Gender was also considered while observing the reliability of all the diagnostic tests and scores. Out of 21 males, 67.7% were diagnosed with PE. On the other hand, out of 10 females, 32.3% were PE positive. More male patients were found to be in PE positive group than females.

The platelet count of all the 31 PE-positive patients diagnosed through CTPA was evaluated. Patients with platelet count <150, resembling 16.1% were diagnosed with PE. Similarly, out of 23 patients whose platelet count was evaluated (with the value ranging from 150-450), 74.2% patients were PE positive while 78.6% were PE negative, while a platelet count >450 in 3 patients demonstrated 9.7% PE positive cases. No significant disparity was found in baseline platelet count between groups with PE positive and PE negative.

Out of 31 patients, 24 were further diagnosed for PE using D-dimer serum analysis. For the D-dimer analysis, a value >1 was considered positive for PE, while below values were negative. Twenty-two patients demonstrated a score >1 being positive, while two patients were negative. A significantly higher D-dimer score was found in patients with PE positive than patients with PE negative, with 91.7%.

A modified well score was also evaluated for all 31 patients who previously found PE positive via CTPA. Patients were categorized based on the high clinical probability, i.e., a score >4 (likely) and low clinical prob. i.e., score ≤ 4 (unlikely). Out of 31 patients, only 1 patient demonstrated a score of >4, another 3 patients demonstrated a score of 2-4 and the rest of 27 patientsestablished a value <2. No significant difference was found witha well score concerning PE positive or negative status of patients.

Discussion:-

COVID-19 has variousclinical forms, from asymptomatic patients' cases to severe cases of COVID-19 pneumonia that may cause death (Chen *et al*., 2020). In addition, the correlation between PE and COVID-19 pneumonia has been studied in severe to critically ill hospitalized patients (Tirumani*et al*., 2021; Alonso-Fernández *et al.*, 2020). The purpose of our study was to assess the reliability of the modified well score for the diagnosis of PE in COVID-19 patients because it is found that PE is more common in COVID-19 patients, thus increasing the burden of differential diagnosis to include or exclude PE in a short period to save the patient's life. In this study, 31 patients were PE-positive through CTPA, most of whom were over 55 years old, and there were more men than women.

D-Dimer Score and PE COVIDPatients
The D-dimer level appears to be a significant parameter in the COVID-19 patient's management and hence assists in evaluating the disease severity and in suspecting PE (Gervaise*et al.*, 2020). Based on this, the elevation in D-dimer levels may be associated with COVID-19; In caseof a cut-off D-dimer level that can be recommended for CTPA for PE diagnosis in COVID-19 patients, it will be exciting to assess it on the ground of large-scale research works (Tirumani*et al.*, 2021). In their research work, Zhou et al. also demonstrated that D-dimer levels > 1 μg/ml were accompanied by fatal outcomes of the COVID-19 (Zhou *et al*., 2020). Therefore, before waiting for supplementary

data on D-dimer levels, we consider that all the patients with COVID-19 pneumonia and elevated D-dimer levels is advised to be studied with CTPA as soon as possible to exclude PE.

Well Score and PEin Patients with COVID 19

The Wells criterion is a clinical probability score to determine the PE likelihood, dividing patients into high-risk and low-risk patients. Using the wells scoring system to decide the clinical probability of PE is the first step in diagnosing PE. Following that, CTPA should be employed for the final diagnosis of PE (Monfardini*et al.,* 2020). There was no significant difference between well score probability in positive as well as negative PE patients. Well score did not differentiate well between favorable and unfavorable PE patients. These results are linked with past research (Molaee*et al.,* 2015; Grillet*et al*., 2020). More patients (29) fall in the low clinical probability score, i.e., <2 (low PE risk), with only one patient from 31 patients showed the higher clinical probability of wells score, i.e., >4. Hence, we can conclude that a well score of <2 may be seen in patient diagnosed with PE in our study, while most studies showed a higher well score associated with PE diagnosis (Kirsch *et al*., 2021). Furthermore, our results demonstrated that a well score is not a reliable clinical probability tool to be employed by the physicians for the evaluation of a patient's probability of being PE positive or negative because of its low sensitivity of 9.7% for PE diagnosis. Consequently, it cannot be suggested to the physicians as a reliable tool to decide the CTPA requirement for COVID-19 patients.

Platelet Count and the Diagnosis of PE in COVID 19 Patient

Patients with PE exhibit a lower platelet count than their levels before developing thrombosis (Thachil and Srivastava 2020). Our study did not find any significant baseline platelet count between negative and positive PE groups. Most patients have a moderate platelet count (150-450), so a lung scan can be suggested for PE diagnosis. Previous studies indicated that elevated d-dimer levels and low to moderate platelet levels were associated with PE diagnosed in COVID-19 patients (Zhou et al., 2020). Hence we can conclude that in patients with higher platelet count, the probability of PE diagnosis is low.

Table 1:- The patients' Clinical and Demographic Characteristics based on CTPA diagnosis.

	Diagnose with PE
Age	
<55	41.9%
>56	58.1%
Sex	
Male	67.7%
Female	32.3%
D-dimer	
POSITIVE >1	91.7%
NEGATIVE	8.3%
Well Score	
<2	87.1%
>4	3.2%
2-4	9.6%
Baseline Platelet Count	
<150	16.1%
150-450	74.2%
>450	9.7%

Conclusion:-

As mentioned earlier in the discussion part, wells score is not a reliable tool to be used by physician in determine the risk of PE among patient with COVID 19. However we recommend to include COVID 19 infection as a positive criterionin the score of wells criteria as a risk factor of PE. Nonetheless, d-dimer and platelet count were critical measures used in PE diagnosis in COVID-19 patients. The statistical analysis shows a strong correlation between d-dimer and positive PE when $P < 0.05$. Consequently, physicians should capitalize on the CTPA, d-dimer analysis, and platelet count in facilitating PE diagnosis for COVID-19 patients.

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