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Incidence of Pulmonary Embolism in CCU at King Faisal Hospital, Taif, Saudi Arabia

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ABSTRACT

Background: Pulmonary embolism (PE) is a frequent cause of death and serious disability with a risk extending far beyond the acute phase of the disease. Despite advances in diagnosis and treatment, high mortality rates are still a common problem. **Aim of the work: was to a**ssess the incidence rate of pulmonary embolism among patients attending CCU of King Faisal hospital in Taif, Saudi Arabia and the most common risk factors of pulmonary embolism in these patients. **Patients and methods:** a cross sectional study for 6 month duration, in the period from June 2016 to December 2016. Patients were chosen from CCU of King Faisal hospital, Taif, Saudi Arabia**.** The study includes 20 patients diagnosed as pulmonary embolism from both sexes (male/female =10/10) with mean age 58.9±19.9 years old and 20 healthy control volunteers (male/female =14/6) with mean age 52.1±19.5 years old were chosen for comparison; incidence rate of pulmonary embolism was calculated and the related risk factors in these patients were evaluated via a questionnaire done to each patient and control. **Results**: 80% and 70% of patients and control lived in Taif, respectively. Incidence rate of pulmonary embolism was 5.5%. 25% of patients were smoker and 15% of control group were smoker. **Conclusion:** the presented study assessed the incidence of pulmonary embolism and its risk factors in King Faial hospital in Taif, Saudi Arabia. All risk factors of pulmonary embolism mentioned in international researches were emphasized in this research particularly travelling history, oral contraceptive therapy and cancer with respect to other risk factors.

Key words: Pulmonary embolism, risk factors, Saudi Arabia and Taif city.

INTRODUCTION

Pulmonary embolism (PE) is a frequent cause of death and serious disability with a risk extending far beyond the acute phase of the disease [(1)]. Despite advances in diagnosis and treatment, high mortality rates are still a common problem [(2).] PE occurs due to pulmonary bed obstruction which is most probably due to blood clot, wedged into one of the arteries of the lungs. Blood clots most commonly come from the deep veins of the legs, a condition termed deep vein thrombosis (DVT). When multiple clots are involved, the portions of lung served by each blocked artery may die due cutting off of blood supply leading to pulmonary infarction, this infarction will decrease oxygen supply to the lung. The incidence of the disease is around 0.5–1 case per 1000. Acute pulmonary embolism may prove fatal if not suspected and subsequently treated; most patients usually die during the first few hours of presentation hence early diagnosis is of importance [(3)].

Acute right ventricular failure is the most common life-threatening complication. Emergency management is usually highly effective and right ventricular failure is potentially reversible.

Patient risk factors include age, personal history of venous thromboembolism and active malignancy, disabling conditions as heart or respiratory failure, congenital or acquired coagulation disorders, hormone replacement therapy and oral contraception. Residence of intensive care units is considered at risk for developing venous thromboembolism. The most common symptoms of a pulmonary embolus are chest pain which is pleuritic in nature, cough with bloody sputum and shortness of breath worsen with effort and may occur at rest [(4)].

In order to diagnose a pulmonary embolism, a review of clinical criteria to determine the need for testing is recommended. D-dimer concentration is an important test performed in patients with suspected thrombotic disorders, used to diagnose thrombosis. A negative result practically rules out thrombosis, a positive result can indicate thrombosis but does not rule out other potential causes [(5).]

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Computed tomography pulmonary angiography is the recommended first line diagnostic imaging test in most people [(6)] Ultrasound of the legs can confirm the presence of a PE but cannot rule it out [(7).] A ventilation/perfusion scan (V/Q scan) shows that some areas of the lung are being ventilated but not perfused with blood due to obstruction by a clot [(8)] .

Initial management is mainly focused on restoring adequate blood flow through the pulmonary bed, preventing the blood clot increasing in size and preventing recurrence. Early management is essential to prevent serious complications or death. Medical treatment includes blood thinner anticoagulants to prevent new clots forming as heparin and oral anticoagulants. Treatment with an anticoagulant is recommended for a minimum of three months. It is recommending continuing anticoagulation indefinitely for people with previous episodes of venous thrombosis or if a permanent risk factor for clotting is present as cancer. Thrombolytic drugs can dissolve clots; they are usually reserved for life-threatening conditions due to multiple side effects. Surgical management may be needed in resistant cases using a catheter to remove clots or preventing clot passage from inferior vena cava to the lungs via a filter [(9)].

AIM OF WORK

This study focused on:

1- The incidence rate of pulmonary embolism among patients attending critical care unit (CCU) of King Faisal hospital in Taif, Saudi Arabia
2- Studying the most common risk factors of pulmonary embolism in these patients.

PATIENTS AND METHODS

This is a cross sectional study for 6 month duration, in the period from June 2016 to December 2016. Patients were chosen from CCU of King Faisal hospital, Taif- Saudi Arabia. The study was approved by the Ethics Board of King Faisal University. Informed consents were first obtained from all patients and controls to participate in the study. The study includes 20 patients diagnosed as pulmonary embolism from both sexes (male/female =10/10) with mean age 58.9±19.9 years old. 12 patients were diagnosed as pulmonary embolism they were calculated in the incidence rate but we couldn't complete their questionnaire and clinical data. 20 healthy control volunteers (male/female =14/6) with mean age 52.1±19.5 years old were chosen for comparison with patients. Pulmonary embolism was diagnosed by clinical presentation, ECG, chest x-ray, laboratory investigations including; D-dimers and markers of cardiac injury, imaging including; computed tomography, angiography, ventilation-perfusion scan and echocardiography.

Risk factors related to pulmonary embolism in these patients were evaluated via a questionnaire done to each patient and control which was distributed by the researchers using direct contact with them. Data were verified by hand then coded and entered to a personal computer.

The questionnaire covered the following points: Personal information including; age, sex, body mass index (BMI), life style and common risk factors related to pulmonary embolism as smoking, recent travelling for long distances, cancer, operations and others. Body mass index (BMI) was calculated as weight in kilograms (kg) divided by the square of the height in meters (m2) [(10)]

Incidence rate was calculated by dividing the number of new cases of pulmonary embolism during the sixth months of research over the number of patients admitted to CCU of King Faisal hospital at the same period.

Inclusion criteria include pulmonary embolism diagnosed patients while exclusion criteria include patients with other chest diseases as bronchial asthma, tuberculosis or emphysema.

Data were analyzed using statistical Package for Social Sciences (SPSS) software (SPSS) program version 16. Independent samples t-test were used to compare two variables. Chi-square tests of independence were used to analyze individual questions. A P-value of < 0.05 will be considered at the cut-off level for statistical significance. Results were expressed as mean ± SD and percentage.

RESULTS

The results are summarized in the following tables and figures**:**

Demographic data and risk factors of studied patients and control are present in table (1). The study included 20 patients with acute pulmonary embolism and 20 healthy control volunteers their ages and sexes were matched with controls.

Table (1):
Table 1 shows demographic data and risk factors of studied patients and control

	Parameter	Patients N (20) (mean±SD)	Control N (20) (mean±SD)	P value
1	**Age (years)**	58.9±19.9	52.1±19.5	NS
2	**Sex (male/female)**	10/10	14/6	
	BMI (kg/m^2)	29.5±6.42	23.11 ± 1.4	p<0.0001
3	**Blood pressure** (Systol/Diast)	139.1 / 73± 22.9/±9.9	112 / 82.5±6.4±14	p<0.0001
4	**Pulse**	93.7±16.6	78.8±9.2	p<0.001
5	**Respiratory rate**	21.8±3.7	16.1±2.1	p<0.0001
6	**Oxygen saturation (%)**	92.6±5.5	97.4±1.8	p<0.0001
7	**Hemoglobin concentration (g/dl)**	13.1±2.1	11.9±0.7	p<0.05

NS = Non significant, p<0.05= Significant, p<0.001= highly significant, p<0.0001= Very highly significant
There is a non significant difference (NS) between age of patients and control.
Comparison of BMI, blood pressure, respiratory rate and Oxygen concentration in both patients and control show a very highly significant difference (p<0.0001). On comparing pulse of patients and control there is a high significant difference between both groups (p<0.001). Hemoglobin concentration in patients and control show only significant difference (p<0.05).

Figure (1)

Figure 1 shows demographic data and risk factors of studied patients and control

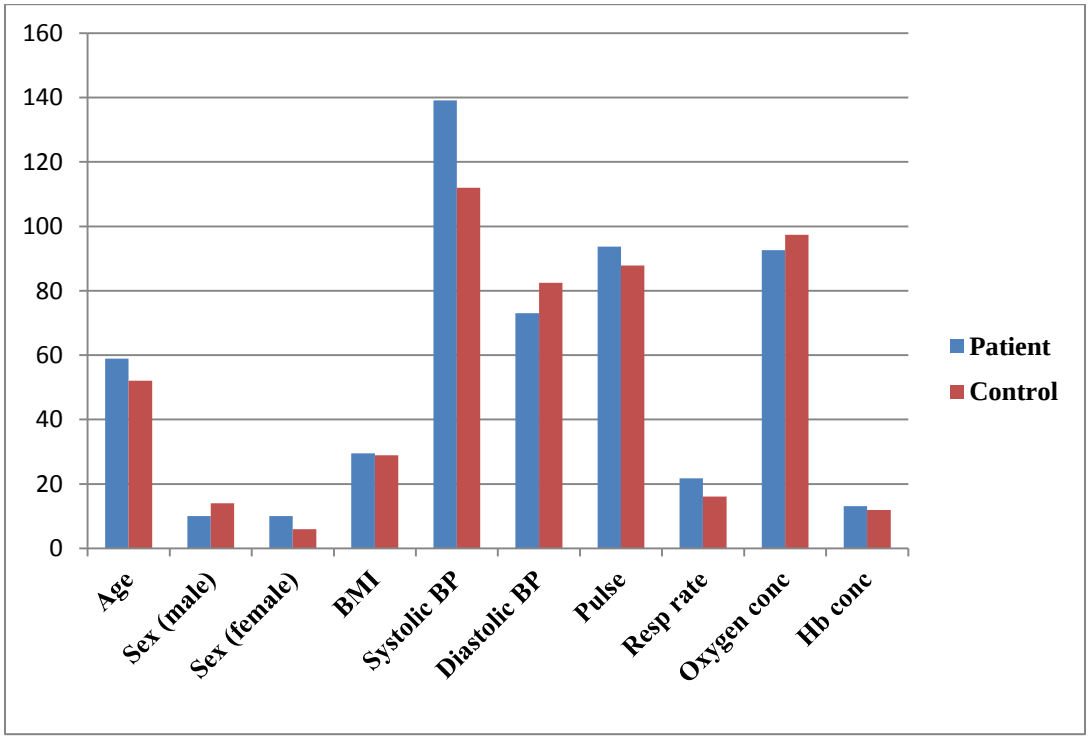


Table (2): shows other risk factors of pulmonary embolism in both patients and control
Table 2 shows the following results:

	Parameter	Patients (N=20)	Control (N=20)
1	**Residence of Taif / Residence of other cities**	80% / 20%	70% / 25%
2	**Smoker / non smoker**	25% / 75%	15% / 85%
	Smoker>20 y / <20 y	10% / 20%	15% / 0
3	**Consumption of alcohol / no consumption of alcohol**	0/20	0/20
4	**Regular exercise / irregular exercise**	30% / 70&	30% / 70%
5	**Recent travel / no Recent travel**	60% / 40%	45% / 55%
6	**Travelling<4 hours / Travelling>4 hours**	25% / 75%	25% / 75%
7	**Sitting on computer <4hours / Sitting on computer 4-6 hours**	10% / 90%	60% / 40%
8	**Surgical procedure**	25%	20%
9	**Pelvic fracture**	15%	0/20
10	**Recent accident**	5%	10%
11	**Increase in red blood cells**	0/20	0/20
12	**DVT**	25%	0/20
13	**Increase in blood clotting**	5%	0/20
14	**Hypertension**	30%	0/20
15	**DM**	0.05%	0.05%
16	**DM & BP**	20%	0/20
17	**Hyperlipidemia**	0/20	15%
18	**History of cancer**	35%	10%
19	**Family history of PE**	20%	0.05%
20	**Pregnancy & lactation**	0/20	0/20
21	**Oral contraceptive**	50%	20%

-80% of patients live in Taif while 20% live outside Taif City. 70% of control live in Taif, 25% live outside Taif City.

25% of patients were smoker with10% smoked more than 20 years and 20% smoked less than 20 years, 75% of patients were non smoker, as regard the control group 15% were smoker 15% of them smoked more than 20 years and 85% were non smoker

-No body in the patient or control group consume alcohol

-30% of both groups had regular exercise

- 60% of patients had a recent travelling history 25% of them travelled less than 4 hours and 75% travelled more than 4 hours. 45% of the control group had a recent travelling history 25% travelled less than 4 hours and 75% travelled more than 4 hours

-10% of patients keep sitting in front of the computer less than 4 hours and 90% sit in front of the computer from 4-6 hours, while 60% of control group sit in front of the computer less than 4 hours and 40 % keep sitting in front of the computer from 4-6 hours

-25% of patient group had a recent surgical procedure while 20% of control had a recent surgical procedure

-15% of patients had a recent pelvic fracture; no one from the control group had a recent pelvic fracture

-5% of patients had a recent accident while 10% of control had a recent accident

-Regarding increase in red blood cells (RBCs) both groups didn't show any increase in RBCs

-25% of the patient group had a recent DVT and nobody had DVT from the control group

-5% of patients had increase in blood clotting but no one from the control had increase in blood clotting

-30% of patients had hypertension and no one from control had

-0.05% of both patients and control group had diabetes mellitus while 20% of patients had both diabetes and hypertension

-No patients had hyperlipidaemia while 15% had hyperlipidaemia from the control group

-35% of patients had a history of cancer while only 10% of control had a history of cancer

-20% of patients had a positive family history of pulmonary embolism and 0.05% of control had

-No pregnancy and lactation in both groups of patient and control, 50% of patients received contraceptive pills while 20% of control did.

Figure (2): It shows percentage of other risk factors of pulmonary embolism in both patients and control group

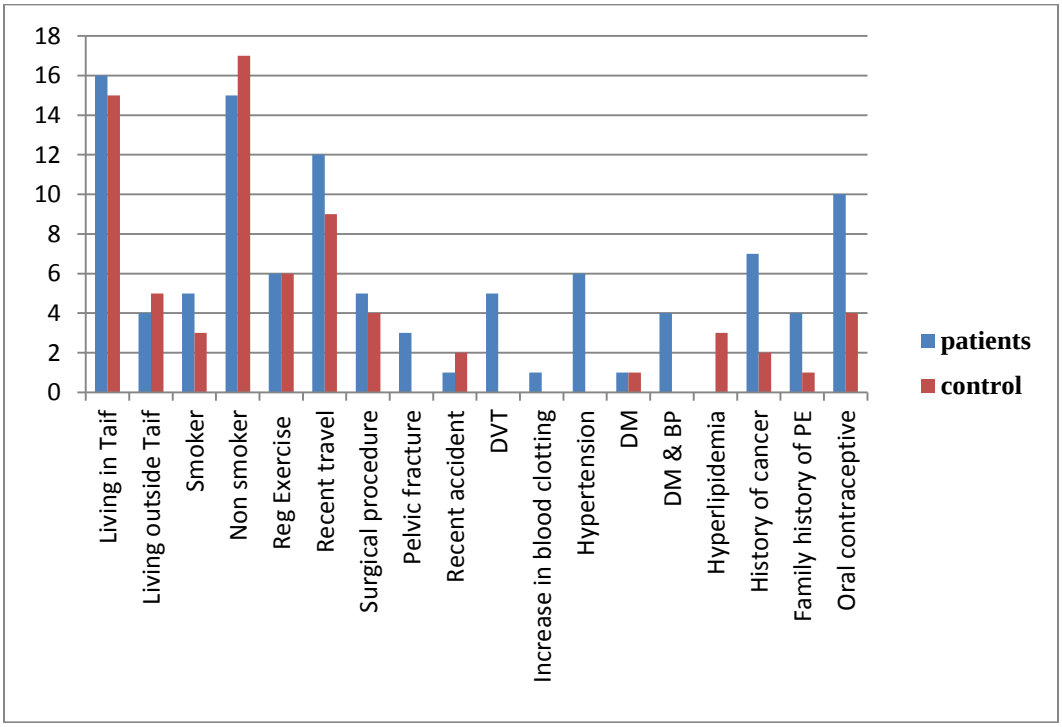
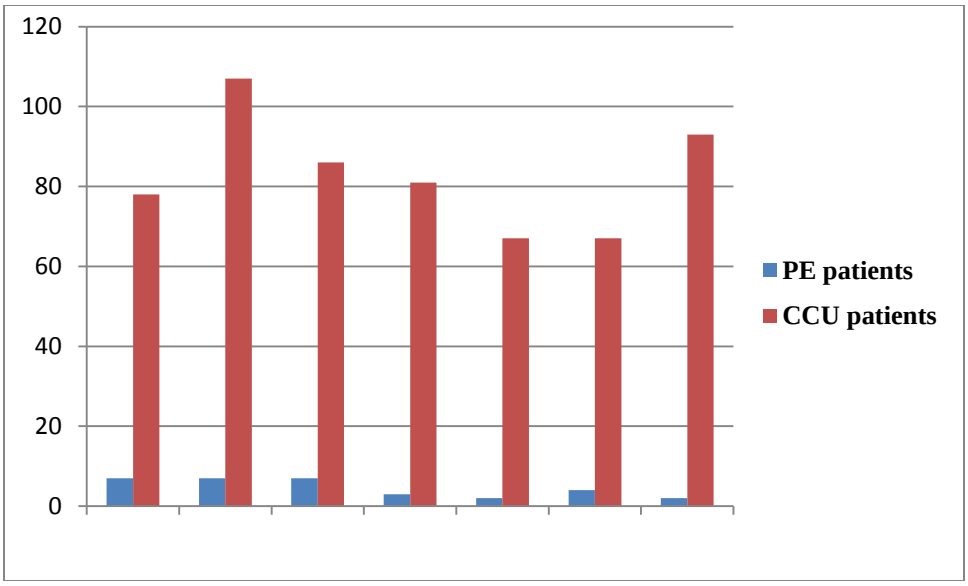


Table (3): it shows the number of pulmonary embolism patients in each month and the total number of patients admitted to critical care unit (CCU) in King Faisal hospital from June to December 2016

Month	# of PE cases	# of all cases in CCU
JUN	**7**	**78**
JUL	**7**	**107**
AUG	**7**	**86**
SEP	**3**	**81**
OCT	**2**	**67**
NOV	**4**	**67**
DEC	**2**	**93**
Total	**32**	**579**



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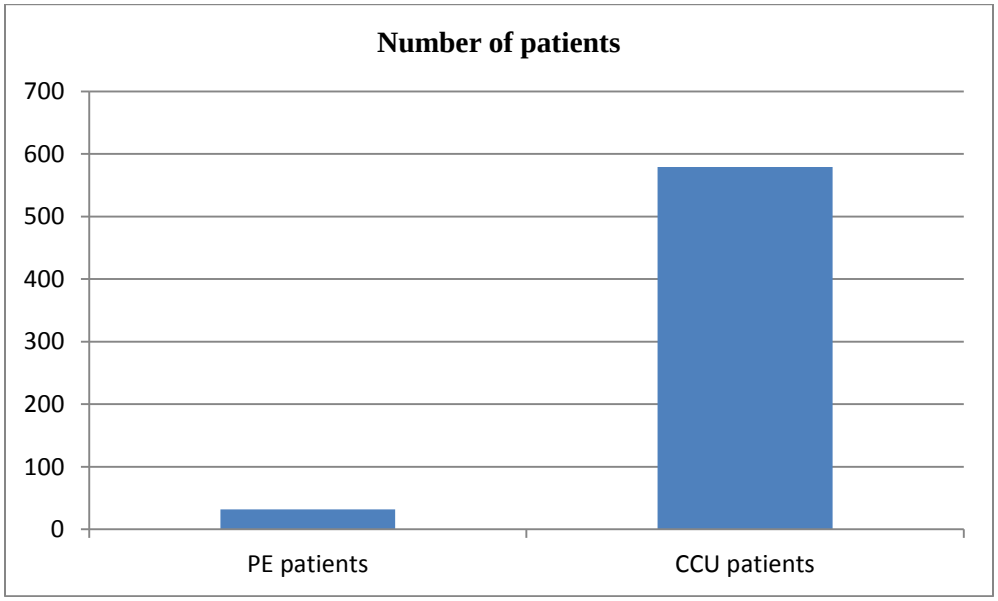

Figure (4): It shows the total number of pulmonary embolism patients and the total number of patients admitted to the critical care unit of Faisal hospital in the 6 months duration of the study from June to December 2016 with incidence rate **5.5%**

DISCUSSION

Pulmonary embolism as a sequence of deep venous thromboembolism is a common and potentially lethal disorder affecting hospitalized and non-hospitalized patients. It leads to long-term complications. PE is considered the third most common cause of hospital death and the most common preventable one [(4)].

Pulmonary embolism occurs when a blood clot or thrombus dislodges from a vein, travelling through the veins of the body, and become impacted in the lung. Thrombi mainly came from one of the deep veins of the legs, thighs, or pelvis; a condition known as deep vein thrombosis (DVT). Clots interrupt blood flow to

parts of the lung, and interfere with oxygen delivery to the brain and the rest of the body. Pulmonary embolism is uncommon, but can be fatal if not identified and treated early. Recognizing and treating the disease as early as possible can reduce the risk of fatal complications and death [11]. In this research we used a systematic workup for incidence and the most common risk factors for pulmonary embolism in patients who were admitted to CCU in King Faisl hospital in Taifin 6 months duration from June to December 2016 and found numerous risk factors. As regard age and sex we found no differences in age and gender distribution between pulmonary embolism cases and controls.

In comparison to **Paul *et al.*** [12] who studied the prevalence of pulmonary embolism among patients hospitalized for syncope and mentioned that the prevalence of pulmonary embolism was 17.3% in his study and the results of Algahtani ***et al.*** [13] on studying the clinical characteristics and risk factors of pulmonary embolism data from a Saudi tertiary-care center, he studied 341 suspected cases of pulmonary embolism patients referred to King Khalid University hospital in Riyadh and found that 68 patients diagnosed as pulmonary embolism with incidence rate 19.9%, we found that the incidence rate was 5.5% in all CCU admitted patients in our research. The difference in incidence rate in our study might be due to several limitations as the relative small sample size based on single center and the retrospective data collection.

The Peak incidence of the disease was in summer (June, July and August), 7 patients had pulmonary embolism in each month, this incidence differs from that of **Olié andBonaldi** [14], they studied the influence of seasonal effect and age on pulmonary embolism hospitalization and mortality from the French hospitalization activity database and concluded that there is a peak of hospitalization and mortality during winter and higher intensity among elderly, **Olié and Bonaldi** [14] explained their results by the effect of cold temperature which induce hyper coagulable state due to several factors as decreased physical activity in winter, peripheral vasoconstriction due to cold weather, frequent respiratory tract infections which may impair the coagulation cascade and increases inflammation which is involved in the pathogenesis of pulmonary embolism, they also mentioned some arterial risk factors presenting a clear seasonal pattern, as dyslipidemia together with hypertension both can play a role in the occurrence of hyper coagulablity state. In contrast **Marti *et al.*** [15] searched for Seasonal variation of overall cardiovascular mortality in 19 countries from different geographic locations; he failed to show any seasonal variations in mortality rates from pulmonary embolism. Our results may be explained by the fact that Taif city is a summer resort and many people from different cities in Saudi Arabia visit it leading to increase in the rate of admission to CCU which may explain the increased number of cases in summer months in our research.

On comparing the BMI of patients and control group there was a very highly significant difference between them ($p<0.0001$). Our results were similar to the results of **Philip *et al.*** [16] on searching a prospective study of BMI and the risk of pulmonary embolism in women and concluded that there was a strong positive association between BMI and the risk of idiopathic pulmonary embolism, moreover he mentioned that BMI has a strong linear association with the development of pulmonary embolism in women, the risk increased nearly six times among subjects with BMI >or=35 $kg/m^{(2)}$, and he advised clinicians to consider BMI when assessing the risk of pulmonary embolism in their patients. On comparing risk factors for the competing risks of coronary, heart disease, stroke and venous thromboembolism. **Robert and Bernard** [17] concluded that higher body mass index was more strongly associated with risk of venous thromboembolism than of either coronary heart disease or stroke. **Ogren *et al.*** [18] explained the underlying mechanisms by the concept that visceral obesity suppresses endogenous fibrinolysis and concluded that BMI and subcutaneous fat thickness were both markers of disease progression to pulmonary embolism and he reported that subcutaneous obesity may be of greater importance in venous thromboembolism when compared with cardiovascular diseases related to abdominal obesity with glucose metabolic disturbances and lipid.

There is a high significant difference between patient and control groups as regard pulse rate

(p<0.001) and a very high significant difference (p<0.0001) in respiratory rate in this research. Tachypnea and Tachycardia are both nonspecific but occur in almost all cases of pulmonary embolism, pulmonary embolism is infrequently diagnosed in absence of tachypnea, pleuritic pain or signs of deep venous thrombosis [19]. Similar to our results Kearon *et al.* [20] reported tachypnea with respiratory rate >16/min (96%) and tachycardia with heart rate >100/min (44%) of pulmonary embolism patients in his study of antithrombotic therapy for venous pulmonary embolism disease. **Jan *et al.*** [21] studied the epidemiology, risk factors and risk stratification, pathophysiology, clinical presentation, diagnosis and non-thrombotic pulmonary embolism and mentioned that acute massive pulmonary embolism is characterized by hemodynamic instability with persistent hypotension and cardiogenic shock, defining hypotension as a sudden fall in systolic blood pressure to less than 90 mmHg or more, or by dropping of blood pressure 40 mmHg from baseline, he also mentioned the division of pulmonary embolism into acute massive, acute sub massive, acute small, sub-acute massive pulmonary embolism and chronic thromboembolic pulmonary embolism. On the contrary our patients were hypertensive with a very high significant difference (p<0.0001) in blood pressure compared to control group, as they were hemodynamically stable with tachycardia and tachypnea we may categorize them as sub acute massive pulmonary embolism according to **Jan *et al.*** [21]. On the other side **Walter *et al.*** [22] reported that patients with hypertension had a slightly higher risk of venous thromboembolism in accordance to our results.

Oxygen is essential for life; none of the human being can survive without oxygen even for few minutes. A balance between oxygen demand and delivery is essential to maintain homeostasis in human body. The two main systems responsible for oxygen delivery in the body and maintaining homeostasis are respiratory and cardiovascular system. Any abnormality in both of them will lead to the development of hypoxemia and its serious consequences. Among various mechanisms of hypoxemia ventilation/perfusion mismatch is the most common underlying mechanism [23]. There is a very high significant difference (p<0.0001) between patients and control groups as regard Oxygen concentration in our research. Similar results were obtained by **Konstantinides *et al.*** [24] in searching for ESC Guidelines on the diagnosis and management of acute pulmonary embolism; he found that arterial oxyhemoglobin saturation was less than 90% in his pulmonary embolism patients. **Tapson** [25] explained that a clot impacted in pulmonary vessels can redistribute blood flow to areas of the lung with already high perfusion relative to ventilation causing more blood to pass through the lung without being fully oxygenated. This is probably the main cause of hypoxemia in pulmonary embolism which increases alveolar-arterial oxygen difference. Pulmonary embolism causes redistribution of blood so the left lung got 80% of the cardiac output instead of 50% and the ventilation will not be sufficient to oxygenate the blood.

A significant difference (p<0.05) was found between hemoglobin concentration in patients and control in our study. In accordance with these results **Sigrid *et al.*** [26] found that patients with higher hemoglobin concentration had a 1.5-fold increased risk of total venous thromboembolism, he suggested that hematocrit and related hematologic variables such as hemoglobin and red blood cell count were risk factors for venous thromboembolism in a general population. **Can and Hakan** [27] disagree with our results, he investigates the relationship between blood hemoglobin level and acute pulmonary embolism in emergency setting and found that the mean blood hemoglobin level was 11.6 Â± 2.0 g /dl in pulmonary embolism group and 13.0 Â± 1.7 g in control group and showed a relationship between coagulation, blood viscosity, hematocrit and hemoglobin, he suggested that decrease in blood viscosity due to low hemoglobin level lead to decrease secretion of anti-thrombotic mediators from endothelial cells, which might result in thrombosis and concluded that low serum hemoglobin levels could be related to pulmonary embolism.

Regarding smoking 25% of our patients was smoker with10% of them smoked more than 20 years, while only 15% of the control group was smoker all of them smoked more than 20 years. These results were in accordance to those of **Cheng *et al.*** [28] on studying a systematic review

and meta-analysis on current and former smoking and risk for venous thromboembolism, he deduced a causal relationship between venous thromboembolism and smoking mediated by several mechanisms including prothrombin mutation, moreover he found that the risk of developing venous thromboembolism was greater for current smokers than for former smokers, and there was a dose-response relationship for daily smoking and pack-years smoked. He suggested that a pro-coagulant state, induced by smoking reducing fibrinolysis, increasing blood viscosity and inducing inflammation which may underlie the association between smoking and venous thromboembolism risk, he also mentioned that smoking is associated with a higher level of plasma fibrinogen which increase factor VIII which may be related to venous thromboembolism. **Enga *et al.*** [29] disagree with our results in his research of cigarette smoking and risk of venous thromboembolism and found that smoking was not associated with a risk of venous thromboembolism in subjects who did not experience a myocardial infarction event or cancer. **Robert and Bernard** [17] opinion was similar to **Enga *et al.*** [29], they concluded that hypertension, elevated cholesterol, diabetes, and smoking were associated with increased rates of coronary, heart disease and stroke, with comparable magnitudes, but had no association with venous thromboembolism in comparing risk factors for the competing risks of coronary, heart disease, stroke and venous thromboembolism.

According to **Pahor *et al.*** [30] low to moderate alcohol consumption is associated with a decreased risk of deep venous thrombosis and pulmonary embolism in older persons. No one consumes alcohol in our patient or control group due to religious and traditional social habits.

In this study no difference was found between patients and control group regarding regular exercise as 30% of both groups had regular exercise. **Van *et al.*** [31] searched if regular sports activities decrease the risk of venous thrombosis and deduced that exercising on a regular basis decreases the risk of venous thrombosis by 30-50% compared with not exercising. On the contrary **Van *et al.*** [32] found that physical activity is associated with an increased risk of venous thromboembolism in researching for Strenuous sport activities involving the upper extremities and the increased risk of venous thrombosis of the arm. [33] explained that there is a difference between short term exercise, which might increase the risk of thrombosis by increasing inflammation and injuries to extremities, and regular exercise, which might decrease the risk of thrombosis by improving blood flow. **Christopher *et al.*** [33] explanation was in accordance to our results as 30% of both groups do regular exercise, and 70% had irregular exercise

To the opposite of regular exercise, other risk factors related to prolonged immobility as travelling for long distances, sitting in front of computer and immobility for long periods at work, we found that 60% of our patients had a recent travelling history 25% of them travelled less than 4 hours and 75% travelled more than 4 hours, while 45% of the control group had a recent travelling history, 25% of them travelled less than 4 hours and 75% travelled more than 4 hours. In the same subject, 10% of patients keep sitting in front of the computer less than 4 hours and 90% sit in front of computer from 4-6 hours, while 60% of control group sit in front of the computer less than 4 hours and 40 % keep sitting in front of the computer from 4-6 hours. Similar results were obtained by **Christopher *et al.*** [33] on making a prospective study of physical inactivity and idiopathic pulmonary embolism in women concluding that physical inactivity is associated with incident pulmonary embolism in women, he suggested that interventions decreasing time sitting would lower the risk of pulmonary embolism. Explanation of this matter was conducted by **Harvey *et al.*** [34] on studying air travel related deep vein thrombosis and pulmonary embolism; he mentioned that any situation makes the leg bent at the knee for prolonged periods without much active motion may lead to a reduction of blood flow and increasing the risk of blood clots. Regarding prolonged sitting in front of computers. **Bridget *et al.*** [35] searched for the link between prolonged work and computer related seated immobility and the risk of venous thromboembolism, he proposed the term seated immobility thromboembolism syndrome for people having prolonged seated immobility at work, situations

of long distance air, car and train travel, certain lifestyles as those attending the theatre and recreational computer use, he linked between all these risk factors and the risk of thromboembolism and suggested a strategy to increase awareness of the role of prolonged work-related seated immobility and the occurrence of venous thromboembolism.

Another category of risk factors as surgical procedures, pelvic fracture or recent accident were studied in this research; we found that 25% of patient group had a recent surgical procedure while 20% of control had, also 15% of patients had a recent pelvic fracture but no one from the control group had a recent pelvic fracture, regarding recent accidents 5% and 10% of patients and control had a recent accident respectively. In accordance to these results **Lassen *et al.*** [36] on his working of patients with pelvic fractures concluded that patients with pelvic fractures had the highest risk for pulmonary emboli than any other trauma patients. Similarly, **Henry *et al.*** [37] worked on pelvic fracture in geriatric patients; his results showed that the incidence of proximal deep vein thrombosis with pelvic fractures was 25-35%.and the incidence of symptomatic pulmonary embolism was 2-10% deducing that thromboembolism was the most common complication following pelvic fractures. In the same context **Lewis *et al.*** [38] explained that trauma can produce a hypercoagulable state immediately after a traumatic event resulting in a pulmonary embolism on his work on the same subject. On the contrary . **Paul *et al.*** [12] disagree with our results he mentioned that the incidence of deep venous thromboembolism was low in his cohort study of risk factors for deep venous thrombosis following orthopedic trauma surgery after analyzing 56,000 patients.

In this study 25% of the patient group had a recent DVT and nobody had DVT from the control group. Regarding increase in red blood cells (RBCs) both groups didn't show any increase in RBCs. **Jason and brian** [39] stated that deep venous thrombosis and pulmonary embolism are the most two important manifestations of venous thromboembolism, he added that they are the third most common life threatening cardiovascular disease, after myocardial infarction and stroke, in accordance to our study, more over **Liberman *et al.*** [40] stated that the risk of pulmonary embolism after cerebral venous thromboembolism is lower than after deep venous thromboembolism, according to a study presented at the 2017 international stroke conference in Houston, Texas and simultaneously published in Stroke.

Samuel *et al.* [41] broaden the term venous thromboembolism stating that it refers to deep venous thrombosis, pulmonary embolism, or combination of both conditions. **Roy *et al.*** [42] stated that an increased level of one or more factors involved in blood clotting, such as factor VIII, increases the risk of a blood clot; his results were matching to our results which showed that 5% of patients had increase in blood clotting while no one had increase in blood clotting from control.

Other common category of risk factors for pulmonary embolism including various diseases as hypertension, Diabetes and hyperlipidaemia were studied in this research, we found that 0.05% of both patients and control group had diabetes mellitus while 20% of patients had both diabetes and hypertension. No patients had hyperlipidaemia while 15% had hyperlipidaemia from the control group, these results fulfill the conclusion of **Anders *et al.*** [43] who searched for risk factors of venous thromboembolism and concluded that both smoking and obesity were important risk factors for venous thromboembolism but total high density lipoprotein / low density lipoprotein cholesterol levels, triglyceride levels, and diabetes mellitus were not. **Walter *et al.*** [22] also reported that the mean levels of total cholesterol were not significantly related to venous thromboembolism on studying cardiovascular risk factors and venous thromboembolism similar to our results, he also mentioned that patients with venous thromboembolism had higher triglyceride levels than controls.

In accordance to **Frederick *et al.*** [44] who worked on risk factors and venous thromboembolism and mentioned that advanced cancers were associated with a high incidence of venous thromboembolism, especially cancers of the breast, lung, brain, pelvis, rectum, pancreas, and gastrointestinal tract, we found that 35% of patients had a history of cancer while only 10% of control had a history of cancer in our work**.**

Frederick *et al.* [44] added that administration of chemotherapy increases the risks of venous thromboembolism. In the same context [45] stated that venous thromboembolism is a significant health problem in the general population especially in cancer patients on studying burden, mechanisms, and management of cancer-associated venous thromboembolism. **Raja *et al.*** [5] explained that cancer increases secretion of pro-coagulants contributing to venous thromboembolism.

The results of **Guyatt *et al.*** [46] were matching to our results on studying antithrombotic therapy and prevention of thrombosis deducing that family history of close relatives including sibling, who has had deep vein thrombosis or pulmonary embolism are a major risk factor for pulmonary embolism. In our study we found 20% of patients had a positive family history of pulmonary embolism and only 0.05% of control had. **Zöller *et al.*** [47] explained the familial risk in multiplex sibling families and suggested the existence of strong genetic risk factors for pulmonary embolism; he concluded that familial factors and possibly genetic factors are important risk factors for primary fatal pulmonary embolism.

Specific risk factors for females are pregnancy; lactation and the use of contraceptive pills were also studied in this research. Unfortunately no pregnant or lactating women were present in both groups of patient and control in this work even though they are very important risk factors for pulmonary embolism but with respect to contraceptives, 50% of patients received contraceptive pills while 20% of control did in our study. Similar results were obtained by **Abramowicz *et al.*** [48] he stated that estrogen in combination hormonal birth control methods increases the risk of blood clot in both legs and lung, he also suggested that women should expect the possibility of thromboembolic disorder irrespective of the type of oral combined contraceptive pills prescribed. **Kiran *et al.*** [49] had an explanation for the previous statements; he said that Estrogen containing oral contraceptives increase the plasma concentration of clotting factors II, VII, X, XII, VIII, fibrinogen, Estrogen like other lipophilic hormones, affects the gene transcription of various proteins increasing plasma concentrations of these clotting factors by increasing gene transcription deducing that higher doses of estrogen confers a greater risk of venous thrombus formation which can be explained by a greater degree of nuclear receptor binding and overall activation of gene transcription for these clotting factors.

From the previous results we found that recent travelling, the use of contraceptive pills and cancer were the most common risk factors for pulmonary embolism in Taif followed by other risk factors.

CONCLUSION

In summary, the presented study assessed the incidence of pulmonary embolism and its risk factors in King Faial hospital in Taif, Saudi Arabia. All risk factors of pulmonary embolism mentioned in international researches were emphasized in this research particularly travelling history, oral contraceptive therapy and cancer with respect to other risk factors.

RECOMMENDATIONS

We recommend more studies on pulmonary embolism with larger number of patients and more prolonged duration in all centers and hospitals to assess the accurate incidence and risk factors of the disease in Taif .

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