

Direct Correlation of the Predictive Value and Analysis of Trans-Cutaneal Arterial Oxygen Pressure (TcPO₂) - Saturation, Compared to Pathologic Syndromes in Primary Health Attendant

Rasheed Abayomi Olusegun Shidi*

Medical Doctor, Pediatrics and Pediatric Surgery, Researcher, Laparoscopy - Minimum Invasive Surgery (UNICETREX), CEO Clinica Medica 2 DE Julho at Rua Dois de Julho 514, Ribeirão Preto-SP, Brazil

***Corresponding Author:** Rasheed Abayomi Olusegun Shidi, Medical Doctor, Pediatrics and Pediatric Surgery, Researcher, Laparoscopy - Minimum Invasive Surgery (UNICETREX), CEO Clinica Medica 2 DE Julho at Rua Dois de Julho 514, Ribeirão Preto-SP, Brazil.

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Abstract

The oxygen saturation (O₂ Sat) or trans-cutaneous oxygen arterial pressure (TcPO₂) indicates the percentage of haemoglobin binding capacity actually combined with oxygen. As perceived in some clinical practice that normal oxygen saturation is 93% or more; oxygen Sat of 90% indicates mild respiratory failure and that oxygen saturation of 84% or less indicates the presence of severe pulmonary disease. This experiment on outpatients seemed to prove otherwise with various physiologic pathology diseases according to the following results. Out of 36 (100%) patients examined during clinical and surgical attendance and treated on various different pathology, only one (01) 2.8% had oxygen saturation - TcPO₂ of 68% below normal value of 93%. Thirty five (35) 97.2% had oxygen saturation above 93%, with various different pathologies (Table 1). The conclusion proved that percentage index of oxygen saturation, otherwise known as trans-cutaneous arterial oxygen pressure - TcPaO₂, is not a specific indicator to only pulmonary pathologic physiology as understood. Normal as 93%, abnormal as 90%, respiratory failure as < 84% severe respiratory failure, because the same occurs in various other acquired and congenital pathologic physiology states or deceases (Table 2).

Keywords: Oxygen Saturation (O₂ Sat); Trans-Cutaneous Oxygen Arterial Pressure (TcPO₂); Pulmonary Disease

Introduction

The oxygen-O₂ saturation otherwise technically known in ventilation as TcPO₂, indicates the percentage of hemoglobin binding capacity actually combined with oxygen. Oxygen - O₂ saturation is affected by the blood pH, red cell 2,3-DPG concentration, in the presence of abnormal hemoglobin molecules, and in the presence of competing substances such as carbon monoxide. Pathologic-physiology, normal oxygen - O₂ Saturation is of 93% or more. Oxygen - O₂ Saturation of 90% indicates mild respiratory failure while O₂ Saturation of 84% or less indicates the presence of severe pulmonary disease. Arterial blood gases are determined to evaluate respiratory gas exchange. PaO₂ arterial partial pressure of oxygen is an indicator of how well oxygen is taken up by the blood in its passage through the lungs, is affected by the FIO₂, right-to-left shunting, and diffusion capacity across the alveolar-capillary membrane. Normally, PaO₂ is 70 mm Hg or greater. A PaO₂ of 60 mm Hg indicates mild respiratory failure; a PaO₂ of 50 mm Hg or less indicates severe pulmonary disease. Oxygen administration should be added only when necessary. Administration of 100% oxygen can promote atelectasis by nitrogen washout effect that may result in oxygen toxicity. Oxygen administration to patients with hypercapnia may depress respiratory drive.

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But oxygen toxicity occurs in two forms in infants. First, retrolental fibroplasia or cataract is a hazard in premature infants who have been given high concentrations of oxygen. Permanent eye damage has occurred when arterial PO₂ has exceeded 110 mm Hg for longer than one or two hours. Second, bronchopulmonary dysplasia occurs when ventilation with an oxygen concentration of more than 70% percent is carried out for longer than four or five days. Oxygen - O₂ at 100% can provoke lesion of alveolar macrophage, reduction of pulmonary surfactant and stimulates alveolar fibrosis. Therefore, levels of arterial blood gas must be monitored closely and the inspired oxygen concentration reduced as much as a possible in infants, especially if they are premature. It is evident that patients receiving respiratory assistance tend to accumulate interstitial water in the lungs, which leads to decreased compliance and poor oxygenation. Possible causative factors are increased water permeability of damaged capillaries, decreased surfactant, diminished plasma oncotic pressure, increased secretion of antidiuretic hormone, the poorly understood effects of homologous blood transfusion, and left atrial hypertension. Increased interstitial water in the lungs may be reflected as an increased alveolar - atrial oxygen gradient (a-ADO₂) and decreased compliance. Vigorous diuresis often results in dramatic improvement in PO₂ and is one of the mainstays of postoperative respiratory care. With brisk diuresis, the blood volume may decrease, and infusion of salt-poor albumin, plasma, or packed cells may be required to maintain the intravascular space while the extravascular space is dried out [1]. Mature cells of the red cell series (primitive stem cells, erythroblasts, normoblasts, reticulocytes) and adult red cells constitute an organ which is termed the erythron. The primary purpose of the erythron is the exchange of oxygen and carbon-dioxide between tissue and environment. This exchange is carried out most efficiently when the ratio of red cells to plasma in the peripheral blood is of the order of 45:55. Lower concentration of red cells lead to a reduction in oxygen tension in the tissues due to inadequate oxygen carrying capacity and concentrations higher than this also lead to a reduced oxygen tension due to reduction in blood flow as a result of increased viscosity [1,2]. The discovery that congenital deficiencies of some of these enzymes can occur and give rise to haemolytic anaemia is of fairly recent origin. It was noticed in the decade 1920-30 that the antimalarial drugs, aminoquinolines, produced a haemolytic anaemia in certain individuals but it was not until the work of Beutler and others [3] that this was found to be a haemolytic anaemia due to a congenital deficiency of glucose-6-phosphate dehydrogenase.

Objective of the Study

Arterial blood gases are determined to evaluate respiratory gas exchange. The value of arterial partial pressure of oxygen - PaO₂, is an indicator of how well oxygen is taken up by the blood in its passage through the lung, PaO₂ is affected by the FIO₂, right-to-left shunting, and diffusion capacity across the alveolar-capillary membrane. The objective of this research is to prove if the measurement and percentage of oxygen saturation also known as trans-cutaneous oxygen arterial pressure - TcPO₂, is basically an indicator to only pulmonary failure as it seemed to be perceived and admitted during out-patience exams at emergency units.

Results

Out of 36 (100%) patients examined during clinical and surgical attendance and treated on various different pathology (Table 1), only one (01) (2.8%) had oxygen saturation - TcPO₂ (68%) below (93%). Thirty five (35) 97.2% had oxygen saturation above 93% with various different pathologies (Table 2).

Total numbers of patients	Numbers below 93% TcPO ₂ or SAT.O ₂	Numbers above93% TcPO ₂ or SAT.O ₂	% Total
36	01 (2.8%)	35 (97.2%)	100%
Pathology	URTI, PBSG, Anemia		

Table 1: Results in numbers and percentage of patients examined by TcPO₂ or oxygen saturation device - TcPO₂ finger pulse oximeter.

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Patients	General clinical state/diagnosis	Age	TCPO₂% (SPO₂)	FC/MINU
01)	Good		98%	86/m
02)	Good		98%	80/m
03) Rg = 360-Ped.	Good (newborn-phimosis)		97%	120/m
04) Rg = 369-CL.	Good (Intestinal obstipation)		96%	68/m
05) Rg = 370-CL.	Good (low back pain)		95%	68/m
06) Rg = 371-Ped.	Good (health certificate)		98%	72/m
07) Rg = 372-CL.	Good (Systemic hypertension)		97%	80/m
08) Rg = 373-CL.	Good (Protein caloric malnutrition)		97%	64/m
09) Rg = 374-CL.	Good (obesity)		99%	80/m
10) Rg = 376-Ped.	URTI, ponderable below score gain - PBSG, anemia	7 yr + 2m.	68%	88/m
11) Rg = 375-CL.	Good (Cardiac congestive failure + Systemic hypertension)	68 yr + 5m.	98%	76/m
12) Rg = 357-CL.	Good (obesity)	69 yr. + 11m.	98%	80/m
13) Rg = 377-Ped.	Good (ponderable below score gain, URTI)	11m. + 3w.	97%	71/m
14) Rg = 336-CL.	Good (systemic hypertension,cardiac congestive failure, obesity)	51yr. + 11m.	97%	85/m
15) Rg = 336-CL.	Good (systemic hypertension, obesity)	51 yr. + 11m.	97%	100/m
16) Rg = 350-CL.	Good (phimosis/Postectomy)	63 yr. + 1m.	96%	76/m
17) Rg = 350-CL.	Good (Postectomy/post-operation)	63 yr. + 1m.	96%	82/m
18) Rg = 350-CL.	Good (Postectomy post-operation)	63 a. + 1m.	97%	77/m
19) Rg = 378-CL.	Good (Protein caloric malnutrition)	84 a. + 1m.	96%	64/m
20) Rg = 378-CL.	Good (Protein caloric malnutrition systemic hypertension, cardiac congestive failure)	84 a. + 4m.	97%	64/m
21) Rg = 378-CL.	Good (Protein caloric malnutrition, systemic hypertension, cardiac congestive failure)	84 a. + 4m.	96%	51/m
22) Rg = 379-CL.	Good (Fore arm abscess)	51 a. + 11m.	98%	60/m
23) Rg = 378-CL.	DPC+ICC+HAS (Bem)	84 a. + 5m.	97%	65/m
24) Rg = 380-CL.	Dor de membro inferior +Hepato-Splenomegaly	48 a. + 7m.	98%	68/m
25) Rg = 381-CL.	Constipation + Hepatomegaly	33 a. + 17d.	98%	68/m
26) Rg = 382-CL.	Obesity (HAS)	79 a. + 5m.	97%	68/m
27) Rg = 350-CL.	Hepato+Splenomegaly+Sinusitis	64 a. + 1m.	97%	88/m
28) Rg = 350 CL.	ICC+Hepatomegaly+ Dermatitis of Contact	64a. + 1m.	97%	72/m
29) Rg = 382 CL.	HAS+Hepatomegaly	79a.+8m.	98%	57/m
30) Rg = 383 Ped.	IVAS+ Abdominal Colic	5a+6m.	99%	93/m
31) Rg = 350 CL.	Constipation Intestinal	64a+2m.	98%	81/m
32) Rg = 382 CL.	ICC+hepatomegaly	79a+8m.	96%	78/m
33) Rg = 383 Ped.	Eutrophic	5a+6m.	98%	88/m
34) Rg = 384 CL.	DPC+ICC+splenohepatomegaly	68a+6m.	98%	91/m
35) Rg = 384 CL.	HAS+ICC+Hepato+splenomegaly	68a+7m.	97%	88/m
36) Rg = 350 CL.	Constipation + mild hepatomegaly	64a+3m.	96%	101/m

Table 2: Results and registry of patients clinic states and diagnosis, ages, exams; cardiac beats or pulse and TCPO₂/SPO₂.

Discussion

Factors that increases requirements for oxygen consume, such as fever and sepsis should be taken into considerations if patient presents low cutaneous saturation or TcPO₂. Oxygen delivery should always be doubtful in the presence of hypotension, shock, anemia and metabolic alkalosis. The justification and evidence of the fact is proved by pathologic - physiology state of the only patient below normal TcPO₂ of 68% based on the circumstance of; Upper respiratory tract infection -URTI, accompanied with a predisposition for underweight ponderable below score gain - PBSG and Anemia based on malnutrition.

Conclusion

The percentage index of oxygen saturation - O₂ Sat, otherwise known as trans-cutaneous arterial oxygen pressure - TcPaO₂, is not a specific indicator focused to only pulmonary pathologic physiology as stated; normal 93%, partially abnormal 90%, respiratory failure < 84% or severe respiratory failure, because the same could occur in various other acquired and congenital deceases. Out of 36 (100%) patients examined during clinical and surgical attendance and treated on various pathology, only one (2.8%) had oxygen saturation - TcPO₂ (68%) below (93%), being a Pediatric patient with URTI - upper respiratory tract infection, accompanied with ponderable below score gain - PBSG and an anemia based on malnutrition. Thirty five 35 (97.2%) had oxygen saturation above normal of 93% with different pathologies in adults and children varying from obesity, systemic hypertension, congestive heart failure, intestinal constipation, protein caloric malnutrition, synovitis and others.

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