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CONTENTS OF THE ISSUE

- i. Copyright Notice
- ii. Editorial Board Members
- iii. Chief Author and Dean
- iv. Contents of the Issue
- v. Research and Review Papers
 1. Multi Detector 3D Computed Tomography in the Diagnosis of Paraganglioma: A Case Report. *1-3*
 2. Disseminated Cysticercosis with Tombstones in Portal and Splenic vein Thrombus: An Unusually Novel Location. *5-8*
 3. Presacral Cold Abscess a Rare and Special Case of Skeletal Tuberculosis. *9-11*
 4. Comparison of the Spo₂/Fio₂ Ratio and the Pao₂/Fio₂ Ratio in Patients with Acute Lung Injury or Acute Respiratory Distress Syndrome. *13-17*
- vi. Fellows and Auxiliary Memberships
- vii. Process of Submission of Research Paper
- viii. Preferred Author Guidelines
- ix. Index



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Multi Detector 3D Computed Tomography in the Diagnosis of Paraganglioma: A Case Report

By Elsafi Ahmed Abdalla, Caroline Edward Ayad, Mohammed Abdallwahab
& Monadil Awad
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Abstract- This report describes a case of 45-year-old female with carotid body paraganglioma. This study was conducted in May 2014. CT scanning was performed using high-resolution techniques. The 3D Volume-Rendering reconstructions provided a selective visualization of the anatomic relationships among carotid body tumors, vessels, and surrounding osseous structures with excellent details. Both tumors were suggested to be treated surgically with histological analysis.

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Multi Detector 3D Computed Tomography in the Diagnosis of Paraganglioma: A Case Report

Elsafi Ahmed Abdalla ^α, Caroline Edward Ayad ^ο, Mohammed Abdallwahab ^ρ & Monadil Awad ^ω

Abstract- This report describes a case of 45-year-old female with carotid body paraganglioma. This study was conducted in May 2014. CT scanning was performed using high-resolution techniques .The 3D Volume-Rendering reconstructions provided a selective visualization of the anatomic relationships among carotid body tumors, vessels, and surrounding osseous structures with excellent details. Both tumors were suggested to be treated surgically with histological analysis.

I. INTRODUCTION

Carotid body tumors are rare vascular neoplasms deriving from the paraganglionic cells of the carotid bifurcation. Incidence was reported to be 3.33 per 100,000 patients [Sajid MS, Hamilton G, Baker DM 2007, Plukker JT et al, 2001]. Females appear to be predominate [Rodriguez-Cuevas S 1998, Luna-Ortiz K et al, 2005]. The neoplasm presents as asymptomatic neck mass [Lazar B Davidovic et al, 2005]. Total resection of the carotid body paragangliomas is the best and effective treatment although postoperative bleeding, stroke and injury to cranial nerves may accompany total resection [Young NM et al ,1988].

II. CASE REPORT

A 45 year old female was referred from Eastern Sudan to the CT department with mass in her neck with pain; difficulty in swallowing. Her past medical history reported previous medications of hypertension and no family history of Paraganglioma. Physical examination showed a palpable mass, and no nerve problems were detected. CT with contrast and reconstructed Images were obtained (figure1) and showed hyper vascular mass (45x43x35 mm) which was seen at the bifurcation of left common carotid artery which was displaced laterally in addition to internal and external carotid arteries. Another smaller hyper vascular lesion (28x24x19mm) was seen at bifurcation of right common carotid artery showing similar imaging characteristics. No evident encasement of ICA or ECA.

Bilateral Submandibular enlargement lymph nodes were noted with preserved hilar fat, free nasopharynx, free fossa Rossenmuller, free Valleculae, normal larynx, normal cricoids and thyroid cartilages, and free parapharyngeal fat. Normal parotid glands,

normal thyroid gland, free muscle layers and overlying fascia.

The lesion imaging features were consistent with bilateral carotid body tumors (paragangliomas)

CT scanning was performed using a high-resolution technique, slice thickness 0.5 mm. After acquisition, CT images were transferred to the workstation, oblique Maximum Intensity Projection (MIP) 12.50, WW/WL332/130 and Volume-Rendering images were generated (Vitrea 2, Vital Images). Multi-slice CT angiography demonstrated large and small masses within left carotid bifurcation. The 3D Volume-Rendering reconstructions provided a selective visualization of the anatomic relationships among carotid body tumors, vessels, and surrounding osseous structures with excellent details. Both tumors were suggested to be treated surgically with histological analysis.


III. DISCUSSION

The carotid body was first described in 1743[Milewski C, 1993] .Carotid body tumors are rare vascular neoplasms originating in the paraganglionic cells of the carotid bifurcation. Their incidence ranges between 0.06-3.33 per 100,000 patients [Sajid MS, Hamilton G, Baker DM,2007, Plukker JT et al, 2007].The carotid body paraganglioma is more common in females[Maves MD,1993] like the patient under study.

The paraganglia was the most appropriate nomenclature from an embryologic point of view [Myers EN, Johnson JT, 1993, Kyriakos M: 1987, Maves MD1993].The development of tumors is related to both environmental and genetic risk factors. People who live at higher altitude are considered to have a higher frequency of paragangliomas-[Pacheco-Ojeda L, Durango E, Rodriquez C, et al, 1988]. Our case lives at high altitude area.

Clinical observation combined with radiological imaging is important for early recognition of contralateral tumors [Muhm M, Polterauer P, Gsottner W, Temmel A, Richling B, Undt G,et al,1997] .The carotid angiography is the most useful diagnostic test for paragangliomas. The angiography demonstrates tumor blood supply and widening of the carotid bifurcation by a well-defined tumor blush ("lyre sign"), which is classic patho-gnomonic angiographic finding [Maves MD, 1993, Mayer R, 2000, Defraigne JO, 1997, Laube HR, 1994].

MR and contrast CT are more effective noninvasive imaging modalities comparing with duplex ultrasonography, especially for minute growth

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[Defraigne JO et al, 1997, Devuyever D et al 1993]. Radio immune detection of carotid body paraganglioma was also depicted in the previous studies [Devuyever D, 1993].

The surgical removal is the treatment of choice for carotid body paragangliomas [Rush Bf Jr 1962].

Multislice CT angiography can demonstrate a large, carotid body tumor, as well as small, unsuspected mass within the carotid bifurcation. The 3D volume-rendering reconstructions provide a selective visualization of the anatomic relationships among carotid body tumors, vessels, and surrounding osseous structures with excellent detail. The diagnosis of this case was derived from the above mentioned facts.

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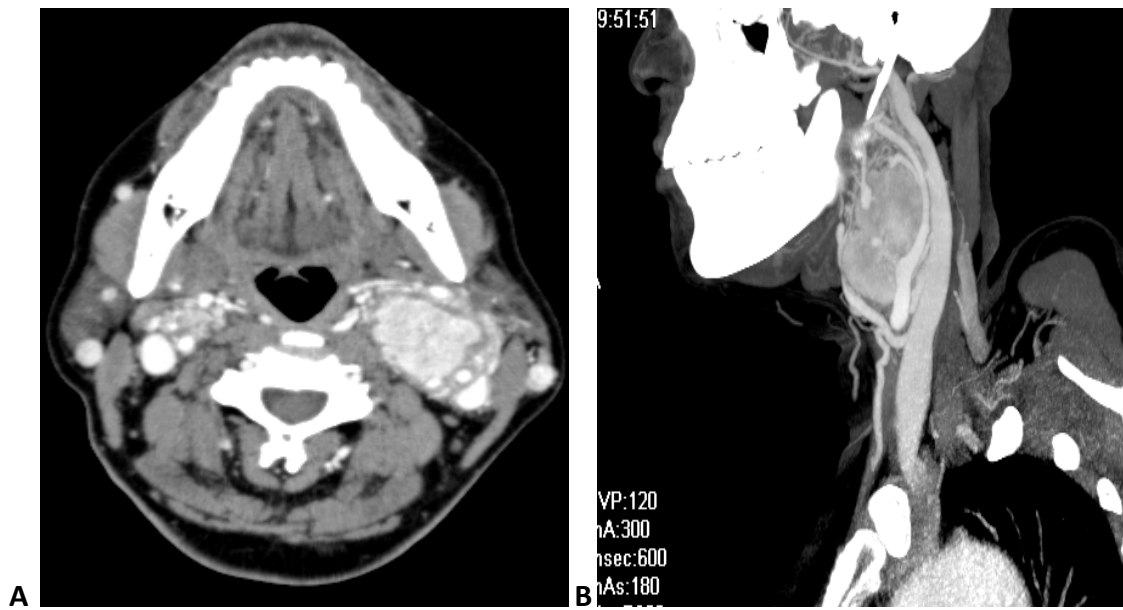


Figure 1 : [A] CT with axial cut with contrast and [B] reconstructed Images. [A] Showed hyper vascular mass (45x43x35 mm) seen at the bifurcation of left common carotid artery (red arrow) which displaced laterally in addition to internal and external carotid arteries. Another smaller hyper vascular lesion (28x24x19mm)(yellow arrow)seen at bifurcation of right common carotid artery showing similar imaging characteristics

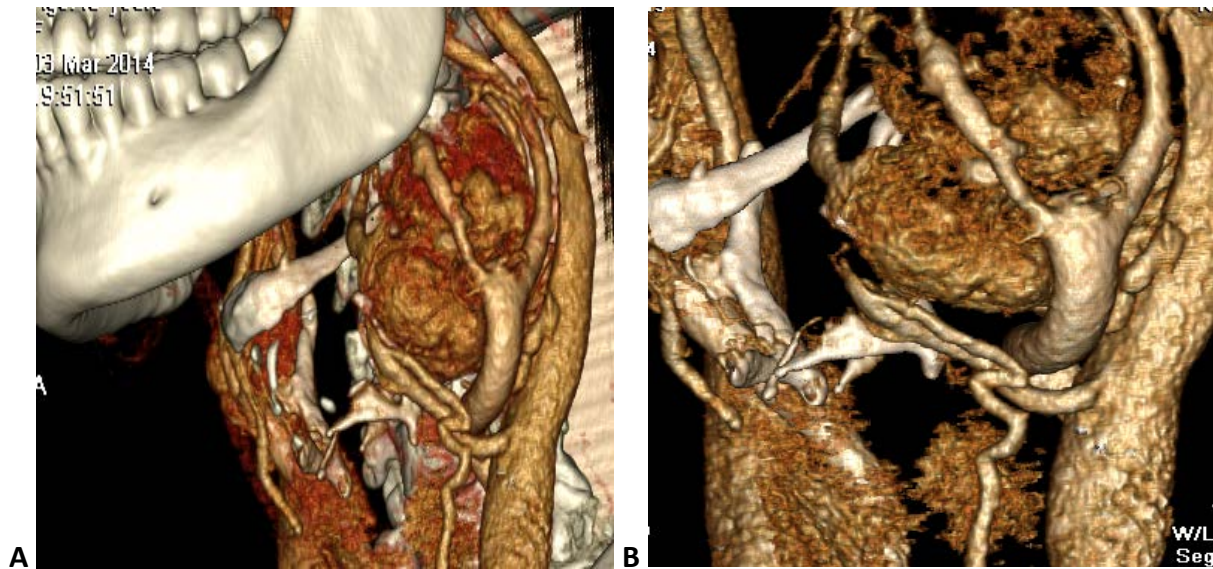


Figure 2 : A,B The 3D Volume-Rendering reconstructions provided a discriminating visualization of the anatomic relationships among carotid body tumors, vessels, and surrounding osseous structures with excellent details. WW/WL63/183(segmented Vessels only)(White arrows)



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Disseminated Cysticercosis with Tombstones in Portal and Splenic vein Thrombus: An Unusually Novel Location

By Shruti Thakur, Vijay Thakur, Neeti Aggarwal, Charu S Thakur & Minhaj Shaikh
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Abstract- Disseminated cysticercosis is a rare complication characterized by extensive dissemination of larvae (*Cysticercus cellulosae*) of *Taenia solium* throughout the human body involving brain, subcutaneous tissue, skeletal muscles and other organs. The symptoms depend upon the parasite burden, its location, stage of cyst evolution and host immunity. We report a case of immunocompetent 47-year-old alcoholic male who presented with symptoms of chronic liver disease. Disseminated cysticercosis was an incidental finding. The emphasis is on the presence of calcified cysticerci in portal and splenic vein thrombus not yet described in literature and this makes our case worth mentioning.

Keywords: *cysticerci; disseminated; portal vein; thrombus.*

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Disseminated Cysticercosis with Tombstones in Portal and Splenic vein Thrombus: An Unusually Novel Location

Shruti Thakur ^α, Vijay Thakur ^σ, Neeti Aggarwal ^ρ, Charu S Thakur ^ω & Minhaj Shaikh [¥]

Abstract- Disseminated cysticercosis is a rare complication characterized by extensive dissemination of larvae (*Cysticercus cellulosae*) of *Taenia solium* throughout the human body involving brain, subcutaneous tissue, skeletal muscles and other organs. The symptoms depend upon the parasite burden, its location, stage of cyst evolution and host immunity. We report a case of immunocompetent 47-year-old alcoholic male who presented with symptoms of chronic liver disease. Disseminated cysticercosis was an incidental finding. The emphasis is on the presence of calcified cysticerci in portal and splenic vein thrombus not yet described in literature and this makes our case worth mentioning.

Keywords: *cysticerci*; *disseminated*; *portal vein*; *thrombus*.

I. INTRODUCTION

Cysticercosis is caused by pork tapeworm; *Taenia solium* a common tropical parasite [1]. Disseminated cysticercosis is a rare manifestation that occurs due to widespread dissemination of its larvae throughout human body. We present a case of disseminated cysticercosis with unusual location of cysticerci in portal and splenic vein thrombus not described earlier.

II. CASE REPORT

A 47-year-old immunocompetent alcoholic Indian male presented with symptoms of chronic liver disease. He had a single episode of generalized tonic-clonic seizure 15 years back. His family history was insignificant. The hematologic reports revealed anemia and deranged liver functions. The patient was subjected to contrast enhanced computed tomography (CECT) abdomen. CECT was done on GE light speed Xte 64 slice machine with 100 ml of non-ionic iodinated contrast agent in portal venous phase. The imaging revealed cirrhotic liver, portal and splenic vein thrombosis, multiple collaterals, ascites and massive splenomegaly consistent with the diagnosis of cirrhosis with portal hypertension (Figure 1A, B, 2A). A noteworthy finding was presence of multiple rice grain like specks of calcification in bilateral psoas muscles, gluteal muscles, anterior abdominal muscles, paraspinal muscles and

skeletal muscles of proximal lower limbs. Multiple small calcifications were also seen in spleen. The imaging suggested the diagnosis of disseminated cysticercosis, India being endemic for this disease (Figure 1 A-D, 2 A, B). The very unusual location of these larvae in our case was in portal and splenic vein. The portal and splenic vein were distended with hypodense thrombus; a usual complication of cirrhosis, in which calcified larvae were seen (Figure 1B, 2A). Such a finding has not been described in literature yet. Although the scanned muscles were extensively infested but pseudohypertrophy of these muscles, a diagnostic hallmark of this condition was not seen because of muscular atrophy in this alcoholic male. Subcutaneous nodules another hallmark, were not palpable in our patient as interestingly the larvae were not seen in subcutaneous fat on imaging. The stool examination was done retrospectively for ova of *T. solium* which was negative. CT brain was also done which also showed calcified nodules (Figure 3). High resolution CT chest was done that showed findings of interstitial lung disease, however no nodule was seen. The muscle biopsy was not done as the diagnosis was not questionable. The patient was put on steroids for a week and albendazole was added thereafter. No antiepileptic was given as he had no seizures. Treatment for chronic liver disease and anticoagulant were started. The patient improved and was discharged and is on regular follow up on outpatient basis.

III. DISCUSSION

Human cysticercosis is a common zoonotic infection in tropical regions like South-East Asia, Africa and Latin America [2]. The causative agent is *Cysticercus cellulosae*, the larval form of *Taenia solium*; a pork tapeworm [3]. The infestation is seen in underprivileged society having poor sanitation [4]. The life cycle consists of a definite host (man; harboring adult tape worm in small intestine) and an intermediate host (pig; harboring larval form). Two distinct types of infection are seen in man; intestinal taeniasis and tissue cysticercosis. In 'intestinal taeniasis' man acts as a definite host and gets infected by eating undercooked pork infested by living cysticerci larvae. These larvae develop into adult tapeworm in human small intestine and the eggs are released in faeces. In 'tissue

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cysticercosis', man is an accidental intermediate host and procures infection by eating viable eggs from ingestion of faecally contaminated water or food or by autoinfection. These eggs develop into hexacanth embryos in small intestine. The embryos enter the systemic circulation from intestine through hepatoportal route and get disseminated in various tissues and organs where they develop into larval cysts [5]. In most instances, these larvae are destroyed by host's immunity except where body organs are devoid of immune response like nervous system [4]. The most common location is brain parenchyma where the infection is referred to as neurocysticercosis. In addition, the larval stage may infest any tissue or organ of body like eye, subcutaneous fat, skeletal muscles, diaphragm, heart, pleura, lungs, liver and peritoneum [4, 6]. The organs reported to be rarely involved are pancreas and spleen [3]. The constellation of symptoms depends upon the parasite burden, its stage of evolution, the site of lodgment and host immunity [5, 6]. The syndrome of disseminated cysticercosis is defined by pseudomuscular hypertrophy, palpable subcutaneous nodules, seizures, abnormal mentation, and relative absence of focal neurological deficit or obviously raised intracranial pressure, atleast until late in the disease [6]. The muscle involvement can be of three types- myalgic, nodular and pseudohypertrophy. The latter presentation is rarest of the three and gives a 'Herculean appearance' to the patient [3]. It signifies heavy parasite burden in muscles [6]. The exact pathogenesis of such a presentation is unclear but thought to be either an allergenic response or inflammatory response to irritant effect of dead larvae in muscles [6]. The muscle involvement is characterized by painless or painful diffuse involvement of muscles along with weakness and easy fatigability [7]. CECT is the imaging modality of choice for disseminated cysticercosis while magnetic resonance imaging (MRI) is appropriate for brain, intraocular and spinal cysticercosis that better delineates various stages of larval development. The treatment is albendazole or praziquantel both of which are cysticidal drugs. The advantage of albendazole is its better penetration into CSF for treating neurocysticercosis. Steroids are added beforehand as these cidal drugs may cite severe inflammatory response [2].

In our case, portal and splenic vein were distended and filled with thrombus; predisposing the lodgment of cysticercal larvae in this unusual location. Our case presents the extensive sites of lodgment of cysticercal larvae. The portal and splenic vein involvement is not described in literature to the best of our knowledge.

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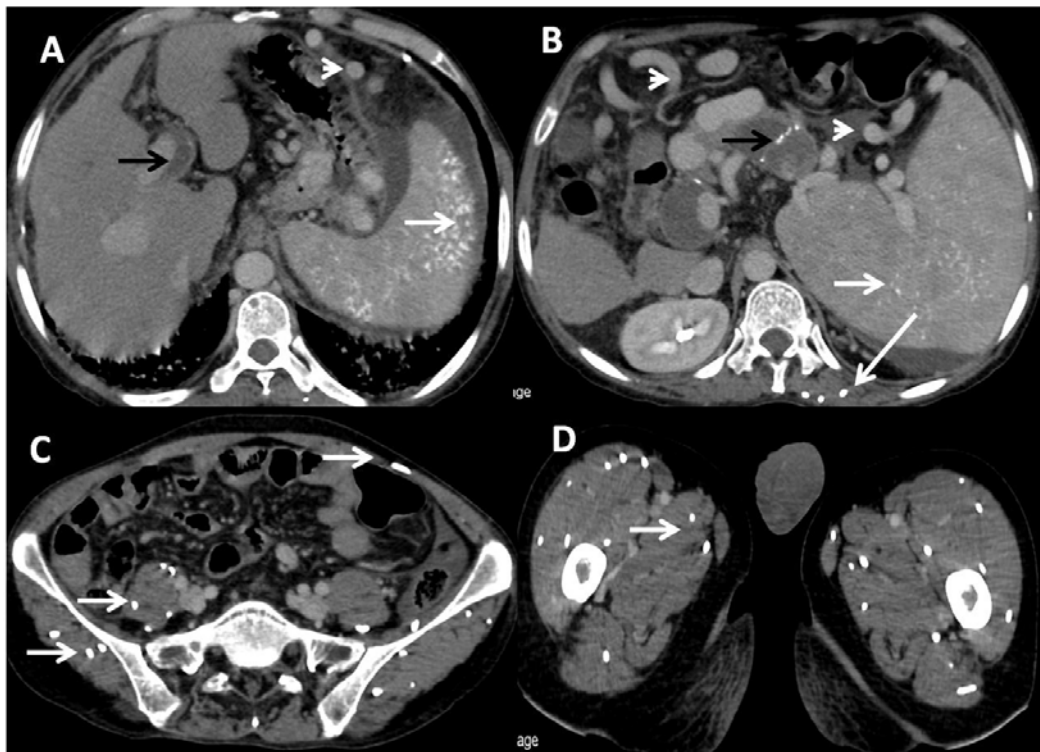


Figure 1 : Contrast enhanced computed tomography (CECT) axial images show (**Figure 1 A, B**) shrunken liver with widened ligament falciparum fissure. The spleen is massively enlarged and shows multiple small specks of calcification (white arrows). The portal vein and splenic vein are distended with thrombus in which foci of calcification are evident (black arrows). Multiple collateral vessels are also seen (white arrow head). (**Figure 1 C, D**) - Rice grain like calcifications are seen in bilateral psoas, gluteal muscles, paraspinal muscles and thigh muscles



Figure 2 : Contrast enhanced computed tomography (CECT) coronal images show (**Figure 2A**) cirrhotic liver, thrombosed portal and splenic vein with calcified cysticercal larvae within it (black arrows), splenic enlargement with multiple calcifications (white arrows). **Figure 2B** shows calcified larvae in paraspinal muscles and gluteal muscles

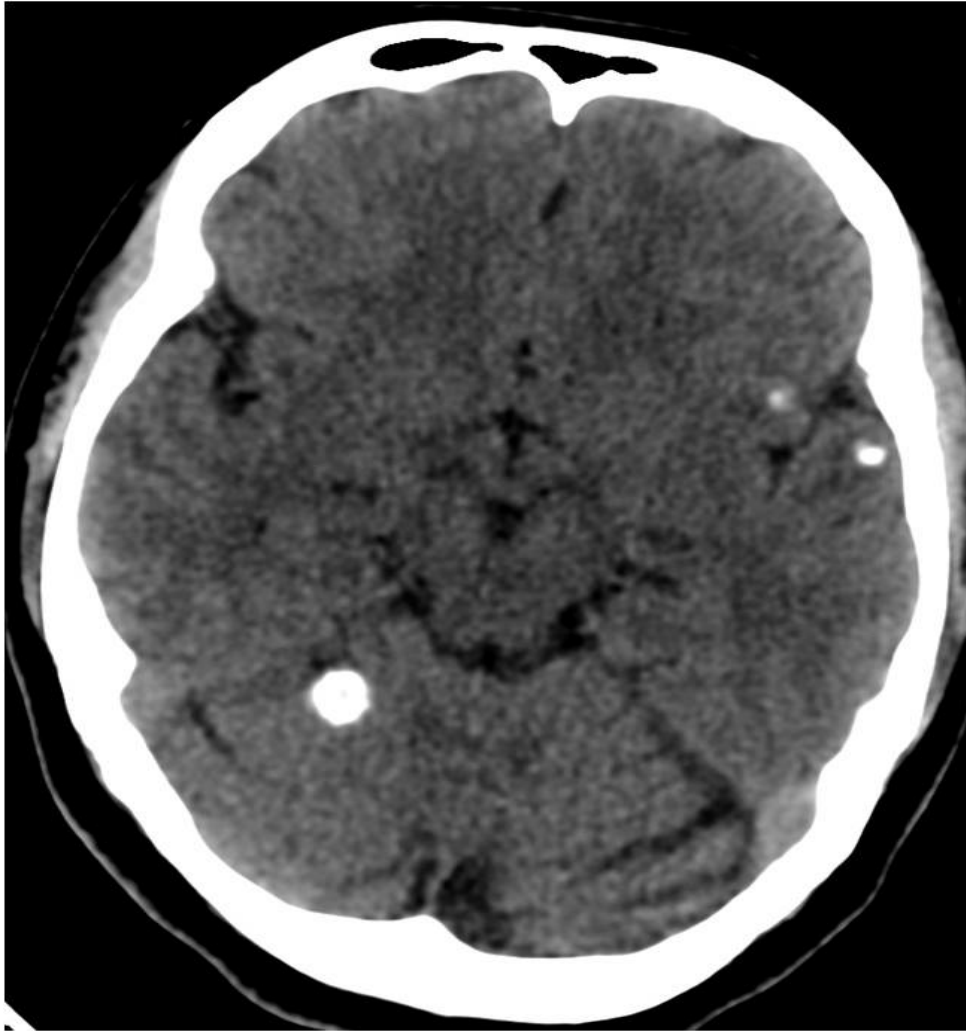


Figure 3 : Plain CT brain axial image show calcified nodules in right cerebellar hemisphere and left frontal and temporal lobes





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Presacral Cold Abscess a Rare and Special Case of Skeletal Tuberculosis

By Dr. Ashfaq Ul Hassan, Dr. Rohul Afza Kaloo, Dr. Zahida Rasool & Dr. Obaid
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Abstract- Skeletal Tuberculosis is a not that common nowadays due to effective antitubercular chemotherapy available along with the fact that most cases of primary tuberculosis are diagnosed quite ealy. Furthermore Presacral tubercular abscesses are a rare entity. Lumbosacral region is the least effected. We report a case of a patient with presacral abscess in a patient without any source of tuberculosis elsewhere. We present a rare case of large presacral abscess simulating a big tumor and MRI Done showed a large presacral abscess. It was managed by drainage through a trans pedicular route.

Keywords: presacral, vertebrae, joint, abscess, therapy, histiocyte, granuloma.

GJMR-D Classification : NLMC Code: WF 600



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Presacral Cold Abscess a Rare and Special Case of Skeletal Tuberculosis

Dr. Ashfaq Ul Hassan ^α, Dr. Rohul Afza Kaloo ^σ, Dr. Zahida Rasool ^ρ & Dr. Obaid ^ω

Abstract- Skeletal Tuberculosis is a not that common nowadays due to effective antitubercular chemotherapy available along with the fact that most cases of primary tuberculosis are diagnosed quite early. Furthermore Presacral tubercular abscesses are a rare entity. Lumbosacral region is the least effected. We report a case of a patient with presacral abscess in a patient without any source of tuberculosis elsewhere. We present a rare case of large presacral abscess simulating a big tumor and MRI Done showed a large presacral abscess. It was managed by drainage through a trans pedicular route.

Keywords: presacral, vertebrae, joint, abscess, therapy, histiocyte, granuloma.

I. INTRODUCTION

The known fact that the incidence of tuberculosis had decreased significantly due to significant development of effective ant tubercular therapy coupled with the fact that tuberculosis is diagnosed at earlier stages have contributed to the reduction of pulmonary tuberculosis. However In recent years, there has been an increase in the incidence of tuberculosis associated with HIV infections.

Tuberculosis is one disease which can effect virtually any body system. When bones are effected in case of Skeletal tuberculosis, it is invariably as a result of hematogenous seeding of tubercle bacilli from a pre-existing lung lesion or gastrointestinal focus. The tubercle bacilli frequently infect the joints and intervertebral discs initially followed by the infection of the long bones. It has been seen that the intervertebral discs of the lower thoracic and upper lumbar spine account for 25- 30% of all cases of skeletal tuberculosis. The present article describes the clinical rarity associated with tuberculosis which presented like a tumor mass in the patient. On further evaluation of the mass it was found to be tubercular in origin.

II. TEXT

The patient had hip pain as well as lower back for last six months with slight painful movements of the

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hips. There was no past history of tuberculosis or immunosuppression.

- Laboratory examination revealed a elevated white cell count, an elevated erythrocyte sedimentation rate.
- The tuberculin skin test was positive.
- The white cell count was elevated, with an increased number of mononuclear cells.
- Lab Investigations of Patient

- Temp: 98.70F
- BP: 126/78
- RR: 12/Min
- Pulse 82 bpm
- HB: 13.7 gm/dl
- WBC : 11,200 / microlitre
- Platelets : 2,30,000/microlitre (n 150000-400,000)
- Sodium: 144meq/L (n 135-145)
- Potassium : 4 meq/L(n 3.5-5)
- ESR Significantly raised : 56
- CXR: Normal
- USG Abdomen: Normal
- CT scan /MRI Pelvis: Large Presacral mass

III. DISCUSSION

Presacral tubercular abscesses are a rare entity.¹ Buyukbebeci reported one case of presacral abscess.² Following hematogenous inoculation, tubercle bacilli can lodge at multiple sites in the subchondral bone of the epiphysis, in the joint capsule, or in the synovial membrane. The initial host response is an infiltration of lymphocytes, plasma cells, and histocytes. The multifocality of tuberculosis is a well established fact.³ However the present patient had no evidence of Pulmonary Tuberculosis as evidenced by a normal chest radiograph and sputum culture.

IV. PATHOLOGY

The histologic appearance of the tuberculous lesion in bone resembles that observed in visceral tuberculosis.⁴ Histiocytes, Langhans giant cells, and fibroblastic proliferation⁵ are all present. Caseous necrosis is less frequently seen in joint lesions than in pulmonary lesions.⁶ Within the joint, invasion of bone tends to occur at the margins where synovium is attached to bone, producing a characteristic marginal defect.⁷ The weight-bearing areas of the joint tend to be spared in the early phase of the disease, and there is

preservation of joint width on early radiographs. As destruction proceeds, the joint becomes filled with necrotic products and fragments of articular cartilage, material called rice bodies because of its resemblance to grains of rice. In some instances, joint or disc space infection burrows into adjacent soft tissues, extends along fascial planes, and may eventually penetrate the skin, producing a draining sinus tract.

The destruction of bone and articular cartilage by tuberculous infection is a slow process, and symptoms are correspondingly insidious in their development. The patient usually complains of a dull ache in the area of the affected joint. A history of weight loss and easy fatigability may be obtained. There may be a history of close contact with a family member or friend with known tuberculosis.

Spinal involvement with tuberculosis produces diminished motion at the thoracolumbar level.⁸ Protective paraspinal muscle spasm holds the back hyperextended.⁹ If the tuberculous process has escaped the confines of the disc space and adjacent vertebrae¹⁰, a large paraspinal abscess may result. As the spine becomes weakened, collapse of the vertebral column may occur, forcing caseous necrotic debris into the spinal canal and producing neurologic symptoms ranging from paresis to complete paraplegia. The paraspinal abscess developing around a focus of tuberculous infection may extend some distance beneath the paraspinal muscle and present as a mass above the posterosuperior iliac crest, or it may extend down the psoas muscle and present as a mass in the medial thigh. On incision, these masses produce caseous necrotic material but characteristically do not have any associated erythema or increased heat. This clinical presentation is known as a cold abscess. The first radiographic change in tuberculous spondylitis is narrowing of the disc at the affected level. The outlines of the adjacent vertebral end plates become indistinct in appearance. As the disease progresses, the combination of interspace narrowing and vertebral collapse may produce a kyphotic deformity. If a paraspinal abscess is present, it usually produces a soft tissue shadow on plain radiographs. Calcification is occasionally observed within the abscess. The patient had ignored the symptoms for a long period of time and ultimately presented at a late stage when the tubercular disease had progressed and a big abscess had already been formed.

Radiographs of tuberculous joints demonstrate generalized osteoporosis, with preservation of the joint width and distention of the joint capsule. The earliest bony changes consist of erosion of the joint margins at the point of synovial attachment to bone. Similar defects may occur within the epiphysis, and infection may cross the epiphyseal plate into the adjacent metaphysis. When the hip joint in children is involved, progressive capsular distention may interrupt the blood supply to the capital

femoral epiphysis. This patient had already developed a large abscess in front of the sacrum. MRI/CT Scan diagnosed the same. After diagnosis, the patient was surgically managed and the abscess was managed by drainage through a trans pedicular route. Six months after the treatment patient was followed up and had absolute recovery.

V. CONCLUSION

Tuberculosis can effect any site in the body and its manifestations as regards skeletal tuberculosis can also be varied. Early recognition of tubercular abscesses and drainage is of utmost importance. Late presentation can lead to complications and increase in morbidity. Presacral region is a difficult region for drainage and an anterior approach is the most preferred.

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Fig. 1: CT Scan demonstrating Presacral abscess depicted by arrow



Fig. 2: MRI Scan demonstrating Presacral abscess denoted by arrow





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Comparison of the SpO_2/FiO_2 Ratio and the Pao_2/FiO_2 Ratio in Patients with Acute Lung Injury or Acute Respiratory Distress Syndrome

By Nemat Bilan, Azar Dastranji & Afshin Ghalehgholabbehbahani

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Abstract- Background: Diagnostic criteria for acute lung injury (ALI) and ARDS requiring acute onset of disease, chest radiograph demonstrating bilateral pulmonary infiltrates, lack of significant left ventricular dysfunction and $\frac{Pao_2}{FiO_2}$ (PF) ratio ≤ 300 for ALI or ≤ 200 for ARDS. recent criteria is requiring invasive arterial sampling.

The pulse oximetric saturation SpO_2/FiO_2 (SF) ratio may be a reliable non invasive alternative to the PF ratio.

Methods: In this cross sectional study, Enrolled 70 patient ALI or ARDS that Admitted in Tabriz children's hospital PICU. Included in the analysis were corresponding measurement of SpO_2 , FiO_2 , Pao_2 , charted within 5 min of each other And computed SF and PF to determine the relationship between SF and PF ratio.

Keywords: ARDS, A ALI, $\frac{paO_2}{FiO_2}$, pulse oximetry.

GJMR-D Classification : NLMC Code: WS 280, WF 651



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Results: The relationship between SF and PF ratio was described by the following regression equation $SF=57+0/61PF$ ($P<0/001$). SF ratios of 181 and 235 corresponded of PF ratio 300 and 200. The ALI SF cutoff of 235 had 57% sensitivity and 100% specificity, and ARDS, SF cutoff of 181 had 71% sensitivity and 82% specificity.

Conclusion: SF ratio is a reliable noninvasive marker for PF ratio to identify children with ALI or ARDS and can be replaced pulse oximetry by arterial blood sampling.

Keywords: ARDS, ALI, $\frac{pao_2}{Fio_2}$, pulse oximetry.

Abbreviations: Pao_2 : Arterial partial pressure of oxygen , SpO_2 : pulse Oximetric oxygen saturation, **ARDS:** Acute Respiratory Distress syndrome, **ALI:** Acute lung injury,

FiO_2 : Fraction of inspiratory oxygen, $SF = \frac{spO_2}{Fio_2}$ ratio ,

$PF = \frac{Pao_2}{Fio_2}$ ratio , **ABG=** Arterial blood gas analysis,

PICU= Pediatric Intensive Care unit, **Paco₂** Arterial partial pressure of carbon dioxid, **Sao₂=** Arterial oxygen saturation.

I. INTRODUCTION

Acute lung injury and ARDS are terrible syndromes with high mortality and morbidity¹⁻². It is estimated that 30 to 60% of all PICU admitted patient require

mechanical ventilation and of these patient up to 25% may have ALI and 5 to 10% may have ARDS. With the implementation of lung-protective ventilation strategies overall morbidity and mortality have improved significantly for both adult and children with ALI and ARDS³⁻⁴. Based on American European consensus conference (AECC) in 1994: Diagnostic criteria for acute lung injury (ALI) and ARDS requiring acute onset of disease, chest radiograph demonstrating bilateral pulmonary infiltrates, lack of significant left ventricular dysfunction

and $\frac{Pao_2}{Fio_2}$ (PF) ratio ≤ 300 for ALI or ≤ 200 for ARDS⁵.

The first three components can be established with clinical history or noninvasively tools such as chest radiograph or echocardiography. However PF criteria require arterial blood sampling⁶⁻⁷. Concerns about anemia following blood sampling and a movement to minimally invasive approaches have led to reduction blood gas measurements in critically ill patient⁸⁻⁹. however studies in ARDS and ALI patient are lacking. Furthermore SF threshold values could be used for diagnosing ARDS and ALI⁶⁻¹⁰.

Pulse oximetry is the most commonly utilized technique to monitor Oxygenation. Noninvasive and safe. It indirectly measures arterial hemoglobin O₂ Saturation by differentiating oxy hemoglobin from deoxygenated hemoglobin using their respective light absorption at wave lengths of 660 nm (red) and 940 nm (infra red)¹¹⁻¹². Pulse oximetry is used: 1-detection of hypoxia. 2-prevention of hyperoxia. 3-for weaning from mechanical ventilation 4-titration of FiO_2 ⁹⁻¹³.

In most PICU daily arterial blood sampling to calculate the PF ratio often impossible, then calculate the SF ratio and replacement by PF ratio for diagnose ARDS or ALI is non invasive and affordable¹⁴. Using SF ratio determine the degree of hypoxemia non invasively without the need for arterial blood sampling⁷.

In this study we computed the relationship between SF and PF ratio in critically ill patient with ALI and ARDS. We hypothesize that the continuously available and noninvasively SF ratio can be used instead the PF ratio in diagnosis of ALI and ARDS.

II. METHODS

In this cross sectional study 70 children with ARDS or ALI that admitted in Tabriz children's hospital

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PICU, Iran between 2012 and 2013 were studied. In Patient with ARDS or ALI under Mechanical ventilation with same Fio₂, Pao₂ measured with Arterial blood sampling and Spo₂ measured with pulse oximetry and charted with in 5 min of each other. Computed SF and PF ratio.

Inclusion criteria were children with ARDS or ALI and acute onset of disease and chest radiograph demonstrating bilateral pulmonary infiltrates, consistent with pulmonary edema.

Exclusion criteria were children with pulmonary edema due to heart failure and congenital heart disease and Anatomic anomalies of lung or air ways.

III. STATISTICAL ANALYSIS

Statistical analyses were performed using the Statistical Package for Social Sciences, version 17.0 (SPSS, Chicago, Illinois). Quantitative data were presented as mean ± standard deviation (SD), while qualitative data were demonstrated as frequency and percent (%). The categorical parameters were compared by (χ²) tests, and the continuous variables were compared by independent t test. A p value of <0.05 was considered statistically significant. Relationship between SF and PF, described by linear regression equation. ROC curves were plotted to determine the sensitivity and Specificity of the SF threshold values correlating with PF of 200 (ARDS) and 300 (ALI).

IV. RESULTS

Of 70 children enrolled in this study, included 38 patient female (54.3%) and 32 patient male (45.7%) with a mean age of 32± 5 months (minimum 2 and maximum 144 months).

A total of 70 data pairs 56 (80%) met the PF ratio criteria for RADS and 14(20%) met the PF criteria for ALI. The median time difference between charted values of Spo₂ and Pao₂ pairs was 5 min . Table (1) demonstrates baseline findings of the patients enrolled in the study.

Age was no significantly relationship with SF ratio. Pvalue = 0.81 and was no significantly relationship with PF ratio Pvalue=0.99.

Sex was no significantly relationship with SF ratio Pvalue = 0.77 and was no significantly relationship with PF ratio Pvalue =0.06.

In general , SF ratio could be predicted well from PF ratio, described by the linear regression equation SF =57+0.61 PF. Based on this equation a PF ratio of 300 corresponds to an SF ratio of 235 and PF ratio of 200 to an SF ratio of 181. Pvalue <0.001[Fig1] The ALI SF cut off of 235 had 57% sensitivity and 100% specificity and ARDS cut off of 181 had 71% sensitivity and 82% specificity.

In general, the SF ratio had excellent discrimination ability for ARDS(AUC=0.86) [Fig2] and good discrimination ability for ALI and ARDS (AUC=0.89) [Fig3].

Table 1 : demonstrates base line findings of the patients

	MAX-MIN	MNAE
Pao ₂ / Fio ₂	298-46	155±61
Spo ₂ /Fio ₂	248-77	152±47
Spo ₂	99-71	94±4
Fio ₂	100-40	67±18
Pao ₂	176-41	96±25
age	144-2	32±5

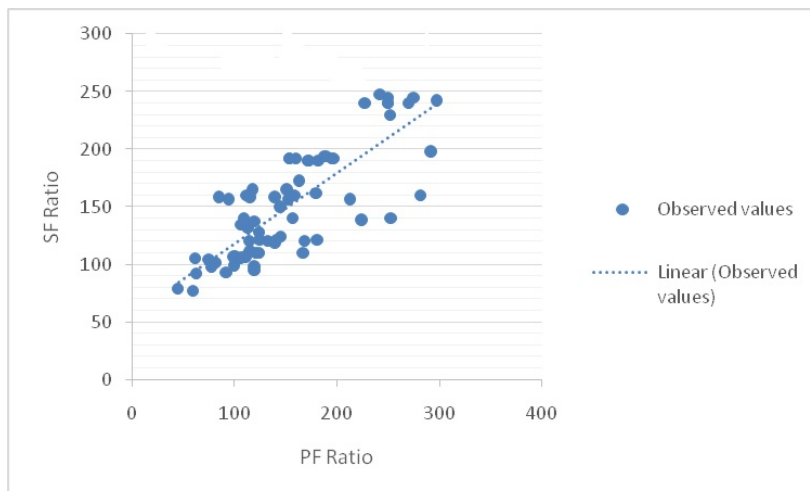


Figure 1 : S/F ratio vs P/F ratio scatterplot for the derivation data set. The line represents the best fit linear relationship $SF=57+0/61PF$ ($P<0/001$)

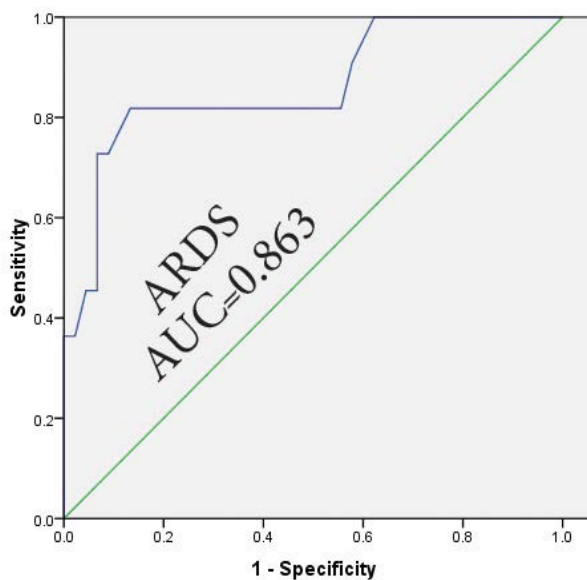


Figure 2 : ROC curves for S/F vs P/F ratios of ≤ 200 (ARDS)



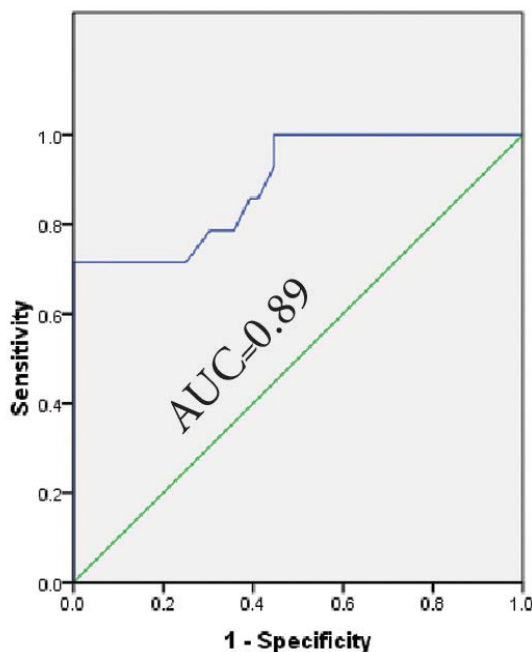


Figure 2 : ROC curves for S/F vs P/F ratios of ≤ 200 (ARDS) and S/F vs P/F ratios of ≤ 300 (ALI) for the derivation data set

V. DISCUSSION

Acute lung injury (ALI) and ARDS significant causes of morbidity and mortality for patients admitted to PICU¹⁵. The routine use of pulse oximetry and capnography has led to reduce ABG measurements. In most PICU¹⁶, Pulse oximetry is now available in most children's hospital and used routinely and shows oxygenation status, easier and continuously than Arterial blood sampling¹⁷⁻¹⁸. Pulse oximetry prevents Arterial blood sampling and cost for ABG analysis¹⁹. Using SF ratio for diagnose of ALI and ARDS lead to identification of undiagnosed cases of these syndromes²⁰.

SF ratio may be useful in many organ failure scores, such as lung injury scores²¹, multi organ dysfunction score²², sequential organ failure assessment²³, instead PF ratio to estimate the degree of hypoxemia.

In this study Included 70 patient with ALI or ARDS Pao₂ and Spo₂ measured with the same Fio₂ computed SF and PF ratio. We seen the relationship between SF and PF ratio was described following equation $SF = 57 + 0.61 PF$ and SF ratio threshold value for ALI was 235 and for ARDS was 181 corresponded of PF ratio 300 and 200.

In the similar study khemani et al who used pediatric data. They found than an SF cutoff of 201 could predict PF criteria for ARDS with 84% sensitivity and 78% specificity and an SF of 263 could predict ALI with 93% sensitivity and 43% specificity²⁴.

In adult patients, the one study by Rice et al They found than an SF cut off of 235 could predict for ARDS with 85% sensitivity and 85% specificity and SF

cut off of 315 could predict for ALI with 91% sensitivity and 56 % specificity²⁵. In this study, we assessed relationship between age and sex with PF and SF ratio. we measured Pao₂ and Spo₂ in maximum 5 min. The SF ratio thresholds determined in this study were based on PF ratio proposed by the AECC.

There are certainly limitation to the this study:

First, ABG and pulse oximetry measurements were close in time to each other (median 5min). Given that changes in Spo₂ and Pao₂ may happen quickly. Second, we did not control for PH, Hemoglobin, Paco₂, temperature, that maybe influenced by the relationship between Spo₂ and Pao₂.

However non invasively SF ratio can be used for Diagnosis of ALI or ARDS.

VI. CONCLUSION

According to this study SF ratio is a reliable non invasive and continuously available marker for PF ratio for diagnose children with ALI or ARDS. Then can be replaced pulse oximetry by Arterial blood sampling. According to complication of Arterial blood sampling such as Anemia, Bleeding, in critical illness, Pulse oximetry can be used instead Arterial blood sampling.

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