Case report

Severe necrotizing pneumonia associated with Sheisha Smoking in a 14 year old child

Mariam Z Mubarak[1*], Hayfa O M Elhassan[1,] Fatma M A Abonora[2], wifag AE Adam[2], Osama O Elamin[2]

[1]*Khartoum University, Department of Pediatrics.*

[2]*Ahmed Gasim Pediatric Specialised Hospital .*

Introduction: Necrotizing pneumonia is a rare complication of bacterial lung infection .Its cause is due to either a virulence factor of the microorganism or predisposing factor of the host. An association between necrotizing pneumonia and Panton –Valentine Leucocidin (PVL) –secreting S.aureus was first recognized in 1999 (1) .Few years later clinical features of the disease was described by Gillet et al (2) .Risk factors were then well -recognized by 2007 (3) The disease causes a devastating complications such as diffuse pulmonary inflammation ,septic shock and respiratory failure .Staphylococcus aureus strains that produce Panton –Valentine leukocidin have been reported to cause rapidly progressive necrosis of the lung tissue in young immunocompitent patients .Furthermore, recent studies have shown the risk of disease progression is associated with underlying medical conditions (4)

Staphylococcus is related to the Micrococcaceae family , *Staphylococcus*- derived from Greek "staphyle" (bunch of grapes). Virulence factors of *S.* aureus includes enzymes : catalase (counters host defences) ;coagulase ,;hyaluronidase ;lipases; B lactasamase (antibiotic resistance).Toxins **:** enterotoxin, TSST and epidermolytic toxin.The effects of smoking on staphylococcus virulence was studied among cigarette smokers. Methicillin-resistant Staphylococcus aureus (MRSA)colonizes the nasopharynx and is thus exposed to inhalants .MRSA exposed to cigarette smoke extract (CSE-MRSA) was more resistant to macrophage killing (4 fold)It also demonstrated a reduced susceptibility to cell lysis and modification of the surface charge of MRSA and eventually impairing the binding of particles with charge similar to that of AMPs by 90% and increased adherence and invasion of epithelial cells (5) .

***Corresponding author:** Dept. of Pediatrics , Khartoum University, Faculty of Medicine. Email :mariam555za@gmail.com.*

Case Report

An adolescent boy aged 14 years from Algazira Province (Halaween) presented to the ER in Ahmed Gasim Pediatric Specialized Hospital in April 2016 with cough , shortness of breathing ,fever and myalgia for 5 days. Cough was productive of whitish sputum occasionally streaked with blood Two days later he developed frank haemoptysis .The shortness of breathing was severe enough to prevent the child from eating and speech ,associated with paroxysmal nocturnal dyspnea .Fever was high grade accompanied with rigors .The patient's general condition worsened to such an extent that he couldn't perform daily activities and moving on wheelchair to bathroom . Systemic review was unrevealing apart from epigastric pain for the last 2 weeks for which he received full treatment for H.pylori in Algazira without improvement .The family denied any sort of active or passive smoking. However, the patient later informed us that he used to smoke sheisha occasionally with his grandfather for one year and then smoked sheisha for few days secretly during a wedding party in Khartoum . The patient is a member of a big loving extended family and was brought to hospital by his grandfather and

the whole family.

He has been healthy prior to admission and had no notable history of allergy or respiratory disease .No mention of contact with patient of chronic cough .He was fully vaccinated .

Examination showed a well thriving adolescent boy with clear consciousness , good physique. He looked sick, in severe respiratory distress ,on oxygen via nasal prongs .Pulse 132/min ,regular ,BP 105/65, RR 72 ,Temp 38.3 .The conjunctivae were pale , the sclerae showed no signs of jaundice and he was not cyanosed .No cervical lymph nodes were palpable . Trachea has been felt normally deviated to the right side . Normally localized apex beat .Chest moved less on right side and an increased tactile vocal fremitus was evident on right middle zone anteriorly . Percussion note was impaired on the same region. Poor air entry was evident on both sides , bronchial breathing auscultated in right upper and middle zones anteriorly and posteriorly and scattered wheezes and crepitations were heard all over the chest.

An enlarged, but not tender, liver of 8 cm below costal margin was palpable .Rest of systemic examination was within normal

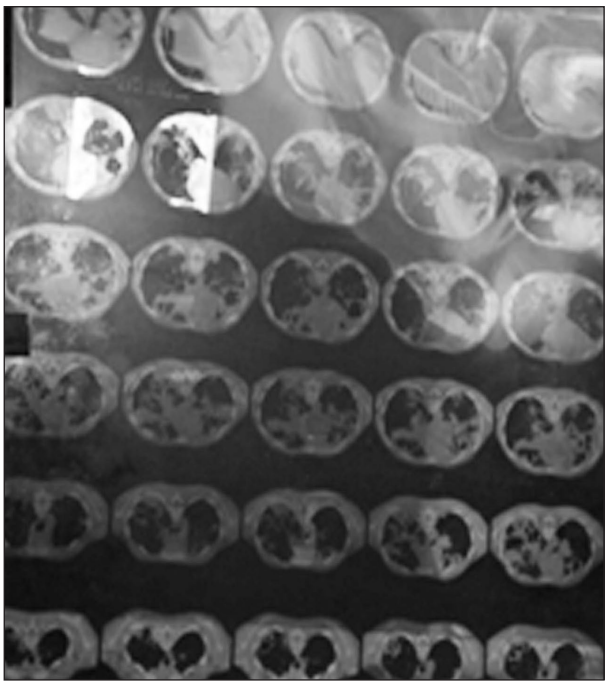
On admission routine blood tests revealed : white blood cells 53.9100/micL ,NEUT% =95.41% ; HGB =12.5g/dL ;HCT =35.5% (44-70)Low ,MCV =86.2fl(102-115)Low MCH=30.3pg (33-39)Low MCHC=35.2g/dl ,PLT=224.000/micL. ESR =70mm/hr .HBG dropped to 8.5 grams after 4 days .Blood biochemical tests showed total protein 8.1g/dL ; albumin , 3.5g/dL ; Globuline 4.6 g/dL ; serum aspartate aminotransferase 17IU/L ; alanine aminotranfserase 11 IU/L ; alkaline phoshpatase 201 IU/L ; C-reactive protein > 24mg/dL; total bilirubin 0.4 mg/dL ; direct bilirubin 0.2 mg/dL blood urea 104mg/dL ; creatinine 1.4 mg/dL ;serum sodium 140 mmol/L and serum potassium 3.9mmol/L .

Sputum for culture and sensitivity revealed Staphylococcus aureus ,sensitive to vancoycin and drugs were selected accordingly. Sputum was negative for ZN stain for 3 consecutive days and serology for HIV was negative .

Figure (1)

Chest x- ray showed cavitations mainly on right side and upper zones with remarkable patchy consolidation on right middle and left lower zones also pleural effusion was noted on right side **(Figure 1).**

Computerized tomography of chest showed multiple bilateral thick wall cavities with multiple pulmonary nodules , areas of consolidations with air bronchogram and minimal bilateral effusions



(Figure 2)

Impression was suppurative lung disease. Abdominal U/S as normal apart from an enlarged liver with no focal lesions.

In ER diagnosis of severe bronchopneumonia was considered and patient was started on Ceftriaxone , Azithromycin and Metronidazole intravenously . Salbutamol and ipratrpium bromide nebulizations were deliverd to the child .

After C/S results ,the patient was started on intravenous Ceftriaxone and vancomycin according to the consultation of the pediatric pulmonologist in Soba Hospital . Intravenous fluids in the form of (D5/0.45 NS)were restricted to 0.6% of the maintenance . Nebulized salbutamol and ipratropium bromide continued as needed .The patient received 2 units of packed RBCs .Antibiotics continued for 3 weeks and the patient showed dramatic improvement in terms of general condition , better appetite , . Follow up chest x–ray clearly showed improved aeration and less cavitations.

Firgure(3)

Patient and family were counseled for the issue of smoking and the patient was followed for 3 month in the outpatient clinic .

Discussion

The presentation of this adolescent boy mainly favors an aggressive form of bronchopneumonia characterized by severe disease , hypoxia and persistent systemic manifestations that cannot be explained in a well thriving ,previously healthy child .

Clinical findings supported the diagnosis of severe lung injury . Cavitations and necrotic changes were quite evident on both chest –X-ray and CT chest .Moreover , the significant anemia and hypoalbuminemia are characteristic features of necrotizing pneumonia .

Sheisha smokers are at the same risk of diseases cigarette smokers face including lung and stomach cancer ,reduced lung function

Staphylococcus aureus is estimated to cause 1-10% of community- acquired pneumonias (CAP)and 20-50 % of nosocomial pneumonias with high morbidity and mortality . Underlying risk factors and co- morbidities were evident in nearly half of the patients [6,7,8].Panton –Valentine Leucocidin is known to play an important role in the pathogenesis of necrotizing pneumonia .It forms pores in the cell and mitochondrial membrane of neutrophils and macrophages provoking cell lysis ,apoptosis and subsequent liberation of inflammatory mediators[9,10,11] .

Treatment is mainly by antibiotics based on cultures and sensitivity .Patients who fail to respond may need lung resection as an alternative treatment option .Disease outcome is governed by degree of disease progression and co-morbidities[12].

Morbidity and mortality of necrotizing pneumonia caused by Staph .aureus is based on series and case reports .Typically ,the patient will present with an influenza- like prodrome which progresses to septic shock and respiratory failure .In the context of multiloblar consolidation ,pleural effusion and airway hemorrhage ,pleural effusions are considered predictive of fatal outcome [3].Published mortality rates vary between 40% and 60%.

Sheishas are water pipes used to smoke specially made tobacco that is usually flavored .They are also called a number of different names including narjiles ,shisha goza & hooka . Smoking is typically practised in groups , with the same mouth piece passed from mouth to mouth which was thought to increase both the risk of infection and the virulence of the organism .Similar to cigarettes, sheisha smoking delivers the addictive drug nicotine and it is at least as toxic as cigarette smoking .While many sheisha smokers may consider this practice less harmful than smoking cigarettes, Sheisha smoking carries many of the health risks as cigarettes[12].

Though some people believe the myth that because sheisha employs a water bowl ,it makes it safer by

drawing the smoke through the water , a new study unveils some shocking facts about how harmful sheisha smoking is. It stated that one sheisha session delivers 125 times the smoke , 10 times the carbon monoxide ,25 times the tar and 2.5 times the nicotine of a single cigarette and reduced fertility [13]. Another study investigated 21 people using sheisha for less than 5 year .Investigators took samples from the airways of the study group using a fine brush through a lung tube to gather the cells. Changes were noted in the epithelium of lung tissue .The study also reported higher carbon monoxide levels in sheisha smokers and they concluded that sheisha pipe seemed to expose the user to 7-11 times more carbon monoxide compared to one cigarette [13,14].

Sheisha users reported more coughing ,bringing-up sputum and lower scores on lung function tests[14].

Smoking can induce acute oesinophilic pneumonia causing acute respiratory distress syndrome- like illness . The current diagnostic criteria are as follows : fever ,acute respiratory symptoms ,severe hypoxia and bilateral infiltrates on chest x –ray[15,16].

Recommendations

Sheisha **is** similar to cigarettes. Besides delivering the addictive drug nicotine, it carries the same health risks as cigarettes .In recent years ,there has been an increase in sheisha use around the world, most notably among youth and students with higher rates among boys than girls .Important policies to be adopted by health authorities include : education of health professionals , regulators and the public about the risks of sheisha smoking including high potential levels of second hand exposure among children .Also false claims of harm reduction and safety should be prohibited . Sheishas should be prohibited in places consistent with bans on cigarette and other forms of tobacco smoking .

Misleading labeling ,such as (contains 0 MG tar) , which may imply safety , should be prohibited.

References

1-Lina G, Peimont Y ,Godail-Gamot F, et al . Involvement of Panton –Valentine Leucocidin producing Staphylococcus aureus in Primary Skin Infections and Pneumonia .*Clin Inect Dis* 1999; 29 : 1128-1132.

2-Gillet Y ,Issartel B,Vanhems P, et al . Association between Staphylococcus aureus strains carrying gene for Panton –Valentine Leucocidin and highly lethal necrotizing pneumonia in young immunocompetent patients .*Lancet* 2002 ;359:753-759 .

3- Gillet Y , Vanhems P , Lina G , et al . Factors predicting mortality in necrotizing community-acquired Pneumonia caused by Staphylococcus aureus containing Panton –Valentine Leucocidin .*Clin Infect Dis* 2007 ;45:315 -321.

4-Tsai YF ,K uYH . Necrotizing Pneumonia : a rare complication of pneumonia requiring special considerations .*Curr Opin Pulm Med* 2012 ;18 :246-52 .

5-Don Rauf : Even light hookah use may cause airway problems , American Journal of Respiratory and Critical Care Medicine .Updated April 14 .2016 11:36 PM AST./U.S Centers for Disease Control and Prevention .

6 -Howards LS ,Sillis M ,Pasteur MC ,Kamath AV ,Harrison BD . Microbiological Profile of community acquired pneumonia in adults over the last 20 years .*J Infect* 2005 ; 107 :1013-1016 .

7 -Chichering HT ,Park JH, Jr: Staphylococcus aureus Pneumonia .*JAA* 1919; 72:617-626.

8- Kallen AJ ,Bruncard J ,Moore Z et al . Staphylococcus aureus community acquired Pneumonia during the 2006-2007 influenza season . *JA nnEmergMmed.2008* ; 365:101-116.

9-Miles G , Movileanu L ,Bayley H : Subunit composition of a bicomponent toxin : Staphylococcal Leucocidin form an octameric

transembrane pore Protein . *Sci* 2002 ; 11:894-902.

10 –Bubeck w J , Palazzolo –Ballance AM, Otto m, Sckneewind O ,DeLeo FR , : Panton –Valentine Leucocidin is not a virulence determinant in murine models of community associated methicillin resistant staphylococcus -aureus disease .*J Infect Dis*2008 ; 198:1166-1170.

11 – Olsen RJ , Kobayashi SD , Ayeras AA et al : Lack of a major role of staphylococcus –aureus Panton –Valentine Leucocidin in lower respiratory tract infection in nonhuman primates .*Am J Path* 2010 ; 176:1346-1353.

12 -Lukas K , Emmanuel C ,Phillips E :Community –acquired necrotizing pneumonia due to methicillin sensitive staphylococcus aureus secreting Panton –Valentine Leucocidin : a review of case reports .*Annu Intens car* 2011 ;1:52.

13- Centers for Disease Control and Prevention(CDC): Dangers of Hookah Smoking ,2012 (http:// www.cdc.gov/pcd/ issues/2012/120082htm) : Page last reviewed : November 9,2015.Page last updated November 9 ,2015.

14- Marie Ellis : One hookah session delivers 125 times the smoke of one cigarette. Published : 2016 .http:// www.medicalnewstoday.co/ articles/305137.php.

15- Ji -Seok Youn, Ji-won Kwon,Byoung –Ju Kwimand Soo –Jong Hong : Smoke- Induced Acute Oesinophilic Pneumonia in a 15 year old girl : A case report .*Allergy Asthma Immunol Res* 2010 ; 2:144-148.

16-McEachem EK, Huang JH ,Sladewski KM .DP: Analysis o the Effect of Cigarette smoke on staphylococcal virulence phenotypes .*Infect Immun*2015 ; 83: 2443-52.