

## A Review on Gunther's Disease

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### Abstract

Gunther disease, also known as congenital erythropoietic porphyria (CEP), is a congenital form of erythropoietic porphyria. The word porphyria originated from the Greek word porphura. Porphura actually means “purple pigment”. It is a rare, autosomal recessive metabolic disorder affecting blood caused by deficiency of the enzyme uroporphyrinogen cosynthetase. It is extremely rare, with a prevalence estimated at 1 in 1,000,000 or less. In milder cases patients have not presented any symptoms until they have reached adulthood. In Gunther's disease, porphyrins are accumulated in the teeth and bones and an increased amount are seen in the plasma, bone marrow, feces, red blood cells, and urine.

**Keywords:** CEP; Porphyria; Photosensitivity; Splenectomy

### Introduction

CEP is a severe and rare childhood disorder causing lifelong mutilating photosensitivity and hematological disorder. It is an uncommon autosomal passive disorder of the porphyrin metabolism created by the homozygous deformity of uroporphyrinogen III cosynthase [1-5]. High measures of uroporphyrin I aggregate in all cells and tissues, reflected by an expanded erythrocyte porphyrin concentration and discharge of high porphyrin amounts in urine and feces. Dermal stores of uroporphyrin every now and again actuate sensational phototoxic oxygen subordinate skin damage with extensive ulcerations and mutilations. Splenomegaly and hemolytic anemia are internal symptoms. Skeletal changes, for example, osteolysis and calcifications are frequent. Splenectomy, erythrocyte transfusions and bone marrow transplantation have demonstrated some helpful impact. The best treatment is the avoiding of sunlight [6-10].

### Current status of knowledge

The term Porphyria refers to a group of diseases characterised by excessive production and excretion of porphyrins, porphyrin precursor or both. It is classified based on the primary site of expression of the specific enzymatic defect into erythropoietic and hepatic forms and based upon the duration of lasting ,classified into acute and non-acute [11-15]. Acute porphyria acute intermittent porphyria, variegate porphyria, hereditary copro porphyria and ALA dehydratase deficiency or Plumbo porphyria) which present with neurovisceral symptoms. Non acute (CEP and Porphyria cutanea tarda) which present with different type of cutaneous findings including mild to severe photosensitivity, increased skin fragility, vesicles and bullae, burning and stinging, edema, pruritis, hypertrichosis, scarring [16-27]. The diagnosis of different types of porphyrias

requires the analysis and differentiation of porphyrin precursors in blood, urine and stool. The pattern of changes in porphyrin metabolism is of paramount importance in labeling different types of porphyria. This in the presence of a medical history permits an exact diagnosis [28-35].

CEP is an uncommon subtype of porphyria that causes skin to be sensitive to daylight; fundamental deformity is changes of alleles for the gene encoding the enzyme Uroporphyrinogen III synthase that prompts accumulation of porphyrins of type I isomer [36-43]. The C73R mutation is the most frequent in which cysteine is substituted by arginine. The accumulated isomer I porphyrinogens are spontaneously oxidized to their corresponding porphyrins, which are naturally futile yet cause cutaneous photosensitivity described by blisters, erosions and scarring of light exposed skin. These porphyrins are discharged from the developing erythrocytes into the plasma and are excreted through urine, thereby giving a portwine colour. The interaction of abundance porphyrins in the skin and light radiation causes photo-oxidative damage, showing as mechanical delicacy and blistering [44-52].

Photosensitivity happens early in course of infection. Increased delicacy and erosions can add to mutilation, particularly on the face and hands. Hypertrichosis of the face and furthest points is common. The teeth have a reddish colour and fluoresce under Wood' light because of porphyrin deposition in dentin and enamel. Ocular manifestation incorporate blepharitis, cicatricial ectopion and conjunctivitis, subsequent bilateral corneal scarring may happen with possible blindness [53-65]. Porphyrins are also deposited in the bone, resulting in loss of bone, resulting contractures and distortions occurs in grown-ups with CEP. Radiological features incorporate calvarium and meningeal calcifications, augmenting of diploic space in frontal and occipital areas. In more genuine cases, the hemolytic anemia of CEP can bring about hypersplenism. Bright pink fluorescence of urine, teeth and bones under Wood's light enlightenment can help in diagnosis [66-79]. The bright fluorescence of nuclei in erythrocyte antecedent cells is particular for Erythropoietic porphyria. Skin biopsy indicates subepidermal blister with superficial perivascular lymphocyte infiltrate [80-86].

For management of such patients, absolute avoidance of Sun exposure is crucial and Sunscreen containing Zinc oxide is preferable. Oral photo protectants (beta carotene) may prevent tissue damage due to light exposure possibly by forming an internal light screen [87-95]. Splenectomy might be shown for unmanageable hemolytic anemia. Transfusion of erythrocytes; intravenous hematin, oral activated charcoal, bone marrow transplant and gene therapy are different choices [96-104].

## **Conclusion**

It should never be forgotten that most people found to have porphyria are able to lead a normal healthy life. All that is required is to take the couple of basic measures to diminish the danger of sickness that is portrayed here. Indeed, even the few who do turn out to be sick as a rule make an entire recuperation and have close to maybe a couple intense attacks in early grown-up life. As one becomes older, the danger of an intense attack reduces, especially after the age of forty, however it never vanishes totally.

## **REFERENCE**

1. Divya R, Max R O'Donnell, Allan MW-F, et al. Discordance between tuberculin skin test and interferon gamma release assay is associated with previous latent tuberculosis infection treatment. *Mycobact Dis.* 2016; 6:227.
2. Avilez C, Verdugo Martinez O, Encina C, et al. Effectiveness of clinoptilolite zeolite for mycobacterium avium subsp. paratuberculosis (map) control in dairy slurry. *Mycobact Dis.* 2016; 6:226.
3. Kalyan Kumar PV, Ramakrishna G, Ramakrishna R. Prospective study of moxifloxacin prophylaxis in patients suffering with hiv having contact history of multidrug resistant tuberculosis (MDR-TB). *J Pulm Respir Med.* 2016; 6:377.

4. Araya M, Seleshe N, Tadesse G, et al. Magnitude of presumptive tuberculosis cases, in the rural communities of north western and north eastern parts of amhara regional state, Ethiopia. *Clin Microbiol.* 2016; 5:261.
5. Aweke K, Gashaw G. Prevalence of avian tuberculosis in domestic chickens in selected sites of Ethiopia. *J Vet Sci Technol.* 2016; 7:377.
6. Joshi SD, Aminabhavi TM. Pyrrole analogs as novel organic molecules to combat tuberculosis. *J Pharma Care Health Sys.* 2016; 3:e143.
7. Hirama T, Minezaki S, Kanazawa M, et al. The quantiferon®-tb gold in-tube assay detects interferon- $\gamma$  release responses to *Mycobacterium tuberculosis* antigens for extended periods of time. *J Mycobac Dis.* 2016; 6:225.
8. Radzikowska E, Błasińska-Przerwa K, Skrońska P, et al. Lymphangioma in patients with pulmonary lymphangioliomyomatosis: results of sirolimus treatment. *J Cancer Sci Ther.* 2016; 8: 233-239.
9. Ahmad V, Sidiq Z, Vashishtha H, et al. Additional resistance to moxifloxacin and levofloxacin among mdr-tb patients with base line resistance to ofloxacin at a reference laboratory. *J Biotechnol Biomater.* 2016; 6:239.
10. McGee WT, Singh M. *Mycobacterium tuberculosis* presenting as septic shock with ARDS: multiculturalism promotes early therapy. *Lung Dis Treat.* 2016; 2:115.
11. Nohaji W, Sokhela N, Nonkelela N. Directly observed treatment strategy still a challenge in tuberculosis control: The South African plight. *J Comm Pub Health Nurs.* 2016; 2:136.
12. Gupta RK, Srivastava S, Srivastava BS, et al. Defining new drug targets through protein-protein interaction: interaction of resuscitation promoting factors with suca of tca cycle in *M. tuberculosis* H37Rv. *J Pulm Respir Med.* 2016; 6:363.
13. Ferdaous Y, Maher A. Spinal tuberculosis. *Mycobact Dis.* 2016; 6:221.
14. Albana R, Purba JA, Manihuruk H, et al. Cemented total hip arthroplasty for neglected tuberculosis of the hip in endemic area (Papua, Indonesia): A Case Report. *J Clin Case Rep.* 2016; 6:835.
15. Patil J. Use of biomarkers in tuberculosis treatment: a challenging approach. *J Pharmacovigil.* 2016; 4:e162.
16. Wang T, Zhang N, Liu J, et al. Tuberculous pseudoaneurysm of descending abdominal aorta in association with tuberculosis of spine: a rare complication. *J Vasc Med Surg.* 2016; 4:279.
17. Mehta PK. Immuno-PCR: It's role in serodiagnosis of tuberculosis. *Mycobact Dis.* 2016; 6: 219.
18. Worku A, Abreham S, Hailu M, et al. Cross-Sectional study and comparison of different diagnostic methods of bovine tuberculosis in Gondar Elfora Abattoir, Ethiopia. *Mycobact Dis.* 2016; 6:218.
19. Issarow CM, Wood R, Mulder N. Seminal *Mycobacterium tuberculosis* in vivo transmission studies: reanalysis using probabilistic modelling. *Mycobact Dis.* 2016; 6:217.
20. Akhtar K, Ahmad M, Waris A, et al. Primary conjunctival tuberculosis-a rare presentation. *J Med Surg Pathol.* 2016; 1: 124.
21. Germanovna DE (2016) Treatment of tuberculosis by preparation sangviritrins without resistance occurrence mycobacterium. *Transl Med.* 2016; 6: 174.
22. Elhag NI, Eltahir EAG, Elhassan AM, et al. Drug resistant *Mycobacterium tuberculosis* complex isolates among patients with tuberculous lymphadenitis. *J Infect Dis Preve Med.* 2016; 4:130.
23. Ba ID, Thiongane A, Ba A, et al. Immune reconstitution inflammatory syndrome (iris) in a child with disseminated tuberculosis. *Interdiscip J Microinflammation.* 2015; 3:134.

24. Waghmare P, Wankhade G, Jena L, et al. Excretory secretory proteins released during growth of mycobacterium tuberculosis (h37ra), with diagnostic potential in pulmonary and extra pulmonary tuberculosis. *Mycobact Dis.* 2016; 6:215.
25. Parandhaman DK, Hassan S, Narayanan S. Multifaced pkne: apoptosis inhibition, hiv co-infection, host signaling cross-talk and in orchestrating the physiology of Mycobacterium tuberculosis. *J Microb Biochem Technol.* 2016; 8:231-235.
26. Talwar H, Talreja J, Samavati L. T7 phage display library a promising strategy to detect tuberculosis specific biomarkers. *Mycobact Dis.* 2016; 6:214.
27. Khan FY, Dosa K, Fuad A, et al. Disseminated tuberculosis among adult patients admitted to hamad general hospital, qatar: a five year hospital based study . *Mycobact Dis.* 2016; 6:212.
28. Gupta K, Nair D, Sharma P, et al. Changing trends in the susceptibility pattern of Mycobacterium tuberculosis over a decade from a tertiary care dots centre delhi. *Mycobact Dis.* 2016; 6:211
29. Sarkar S, Ganguly A, Sunwoo HH. Current overview of anti-tuberculosis drugs: metabolism and toxicities. *Mycobact Dis.* 2016; 6:209.
30. López MES, Huesca-Gómez C, del Mar De la Cruz M, et al. Association of the presence of the is6110 gene and the polymorphisms of the receptor of the bactericide p2x7 (a1513c and -762 c/t) in mexican patients with takayasu's arteritis and tuberculosis. is the vasculitis a manifestation of extrapulmonary tuberculosis? *J Vasc.* 2016; 2:109.
31. Maes R. A critical appraisal of the ban on serological tests for tuberculosis usefulness of serological monitoring of tuberculosis antibodies during the treatment of tb patients. *Clin Microbiol.* 2016; 5:254.
32. Tilahun A, Geleta DA, Abeshu MA, et al. Assessment of integrated pharmaceutical logistic system for the management hiv/aids and tuberculosis laboratory diagnostic commodities in public health facilities in Addis Ababa, Ethiopia. *J Pharma Care Health Sys.* 2016; 3:158
33. Da Silva GAV, Barletta-Naveca RH, Carvalho BKS, et al. Haplotype of the promoter region of tnf gene may mark resistance to tuberculosis in the Amazonas State, Brazil. *J Clin Cell Immunol.* 2016; 7:430.
34. Titanji VPK, Assam JPA. Drug sensitivity and molecular diversity of m. tuberculosis in cameroon: a meta-analysis. *J Vasc Med Surg.* 2016; 2016; 4: 266.
35. Karanja JK, Kiboi NG, Nebere SN, et al. Highly active antiretroviral therapy and anti-tuberculosis drug interactions with associated clinical implications: a review. *J Drug Metab Toxicol.* 2016; 7:207.
36. Jhamb R, Madhu SV, Juneja A. Non hodgkins lymphoma masquerading as tuberculosis. *J Blood Disord Transfus.* 2016; 7:349.
37. Nyatichi FO, Amimo FA, Nabie B, et al. Factors contributing to delay in seeking treatment among pulmonary tuberculosis patients in suneka sub-county, Kenya. *J Health Edu Res Dev.* 2016; 4:170.
38. Al-Sulami AA, Al-Tae A, Hasan ZA. Frequency of rapid growing mycobacteria among tuberculosis suspected patients in Basra- Iraq. *Biol Med.* 2016; (Aligarh) 8: 297.
39. Christianah I, Rodrigues A, Ijeoma O, et al. Rifampicin-loaded silver-starch nanocomposite for the treatment of multi-resistant tuberculosis. *J Nanomed Nanotechnol.* 2016; 7:374.
40. Mawatari T, Yoshida E, Higuchi N, et al. A combination polymorphism of the glutathione synthesis genes can be a predictive biomarker for anti-tuberculosis drug-induced hepatotoxicity in japanese patients with pulmonary tuberculosis. *Lung Dis Treat.* 2016; 2:105.

41. Hama M, Yamazaki Y, Kosaka M, et al. Fulminant pulmonary tuberculosis by infliximab in patient with rheumatoid arthritis. *Mycobact Dis.* 2016; 6:206.
42. Hama M, Yamazaki Y, Kosaka M, et al. Fulminant pulmonary tuberculosis by infliximab in patient with rheumatoid arthritis. *Mycobact Dis.* 2016; 6:206.
43. Ayele B. The yield of first spot double slide smears for the diagnosis of pulmonary tuberculosis. *Mycobact Dis.* 2016; 6:205.
44. Saravanan P, Patra S. Rv3802c in tuberculosis therapeutics. *Mycobact Dis.* 2016; 6:204.
45. Shingdang J, Bot Y, Ojo O, et al. Serum albumin/globulin ratio in tuberculosis and hiv patients any relationship?. *Mycobact Dis.* 2016; 6:199.
46. Rennou M, Maes MC, Maes HH, et al. Antibodies against BCG and *M. tuberculosis* H37Ra do not consistently recognize pathogenic *M. tuberculosis* whole cells but recognize their cytoplasmic constituents. Implications for the variability and protective efficacy of the vaccine. *Clin Microbiol.* 2016; 5: 246.
47. Gumbo FZ, Kembo C. Mother to child transmission of tuberculosis, a problem in resource limited settings under reported or undiagnosed - a case report. *J Preg Child Health.* 2016; 3:241.
48. Rehman F, Rao AS, Hasan A, et al. An assessment of patient's perception on tuberculosis, prevention and control in a teaching hospital. *Adv Pharmacoepidemiol Drug Saf.* 2016; 5:201.
49. Wei T, Huang Q, Li F, et al. Macrophage models for tuberculosis studies. *Air Water Borne Dis.* 2016; 5:124.
50. Silva LS, de Sousa JGD, de Paiva LO, et al. Knowledge about tuberculosis among Brazilians. *J Clin Respir Dis Care.* 2016; 2:106.
51. Kiboi NG, Nebere SN, Karanja JK. Immunological interactions of tuberculosis with drugs and substance use: a systematic review and update. *J Pulm Respir Med.* 2016; 6:326.
52. Latief M. Scleral and body hyperpigmentation in disseminated tuberculosis with adrenal insufficiency (addison's disease). *J Gen Practice.* 2016; 4:i002.
53. Maulida HN, Hikmawati D, Budiadin AS. Injectable bone substitute paste based on hydroxyapatite, gelatin and streptomycin for spinal tuberculosis. *J Spine.* 2016; 4:266.
54. Moon M, Moon H, Kim S. Tubercle bacilli in spinal tuberculosis - morphology, cell wall features, behaviour and drugs. *J Spine.* 2015; 4:265.
55. Tousif S, Ahmad S, Bhalla K, et al. Challenges of tuberculosis treatment with DOTS: an immune impairment perspective. *J Cell Sci Ther.* 2015; 6:223.
56. Sanitize E, Shengelia R. First partnerships to fight tuberculosis. *J Clin Res Bioeth.* 2015; 6:241.
57. Ayele B, Nenko G. Treatment outcome of tuberculosis in selected health facilities of Gedeo Zone, Southern Ethiopia: a retrospective study. *Mycobact Dis.* 2015; 5:194.
58. Larcombe LA, Mookherjee N, Lodge AM, et al. Frequency of NRAMP1 gene polymorphisms among canadian first nations peoples experiencing endemic tuberculosis. *Mycobact Dis.* 2015; 5:193.
59. Alireza A, Bijan DS. A space-time permutation scans statistic and its application on early detection of tuberculosis outbreaks in Iran (2006-2011). *J Biom Biostat.* 2016; 6:249.
60. Bhattacharya PK, Roy A, Jamil Md, et al. Lupus pneumonitis masquerading as pulmonary tuberculosis – a case study. *J Arthritis.* 2015; 4:171.

61. Jamaluddin NN, Weiss GA, Ho W. Asymptomatic colonic tuberculosis in an immunocompetent patient. *J Gastrointest Dig Syst.* 2015; S13:010.
62. Chukwunke JL, Achebe CH, Omenyi SN. Surface thermodynamics approach to *Mycobacterium tuberculosis* (M-TB)–human sputum interactions. *J Bioengineer & Biomedical Sci.* 2015; 5:167.
63. Sánchez YP, Rodríguez DR. Tuberculosis meningitis, still misunderstood. *J Neuroinfect Dis.* 2015; S2:005.
64. Khaliq A, Khan IH, Akhtar MW, et al. Environmental risk factors and social determinants of pulmonary tuberculosis in Pakistan. *Epidemiology.* 2015; 5:201.
65. Maroudam V, Mohana Subramanian B, Praveen Kumar P, et al. Paratuberculosis: diagnostic methods and their constraints. *J Veterinar Sci Technol.* 2015; 6:259.
66. Sidiq Z, Hanif M, Chopra KK, et al. Reporting the unreported- a case of neglected errors of supervisors in random blinded rechecking of afb smears. *J Biotechnol Biomater.* 2015; 5:197.
67. Adriani M, Dewi YIK, Faiza EI, et al. Level of zinc, retinol, blood macrophages, t- lymphocytes and immunoglobulin g in children with tuberculosis and non-tuberculosis. *J Nutr Disorders Ther.* 2015; S1:003.
68. Malede A, Shibabaw A, Hailemeskel A, et al. Treatment outcome of tuberculosis patients and associated risk factors at dessie and woldiya town health institutions, Northeast Ethiopia: a retrospective cross sectional study. *J Bacteriol Parasitol.* 2015;6:240.
69. Cheng Y, Huang C, Tsai HJ. Relationship of bovine SLC11A1 (Formerly NRAMP1) polymorphisms to the risk of bovine tuberculosis in holstein cattle. *J Veterinar Sci Technol.* 2015; 6:247.
70. Fernandes GFS, Chin CM, Santos JL. Screening and identification of new potential targets against *Mycobacterium tuberculosis*. *Biochem Pharmacol.* 2015; 4:e178.
71. Ismawati R, Wirdjatmadi B, Yoes Priyatna D, et al. The effect of zinc, lysine, and vitamin a supplementation to increase cellular immune response of pulmonary tuberculosis patients. *Biochem Physiol.* 2015; S5:006.
72. Yan L, Gao L, Cui Z, et al. Investigation of cross- resistance between rifampin and rifabutin in multi-drug resistant *Mycobacterium tuberculosis*. *Med chem.* 2015; 5:412-414.
73. Patil JS. Current treatment of tuberculosis. *J Pharmacovigil.* 2015; 3:e143.
74. Abin VT, Arjun P, Ameer KA, et al. Coexistent pulmonary tuberculosis and carcinoma lung diagnosed from the same clinical specimen - a case report. *J Pulm Respir Med.* 2015; 5:274.
75. Kuzhko MM, Butov DO, Hulchuk NM, et al. Clinical case of using intravenous forms of anti-tuberculosis drugs to improve the treatment efficiency of tuberculosis in patients with malabsorption syndrome. *J Pulm Respir Med.* 2015; 5:269.
76. Gulich GA, Tulu KT, Worku A, et al. Molecular characterization of *Mycobacterium tuberculosis* complex in Gambella region, south west Ethiopia. *J Med Diagn Meth.* 2015; 4:175
77. Accinelli RA. Duration of isoniazid prophylaxis in HIV-infected individuals living In endemic areas of tuberculosis. *J AIDS Clin Res.* 2015; 6:456.
78. Woldeyohannes SM, Abera SY. Worldwide spatial and temporal distribution of tuberculosis (TB). *J AIDS Clin Res.* 2015; 6:452.
79. Bhat S, Kangoo KA, Zahoor A, et al. Concomitant pyogenic spondylodiscitis with large psoas abscess in known case of tuberculosis spine; presenting as refractory tuberculosis. *J Spine.* 2015;4:212.

80. Soussi Tanani D, Serragui S, Cherrah Y, et al. Signal management of disproportionate reporting in moroccan pharmacovigilance: the lower limb edema induced by anti-tuberculosis drugs. *J Pharmacovigilance*. 2015; 3:161.
81. Trabulo D, Teixeira C, Ribeiro S, et al. Sweet syndrome and pulmonary tuberculosis in a crohn's disease patient treated with anti-TNF $\alpha$ . *J Gastrointest Dig Syst*. 2015; 5:262.
82. Ejeta E, Chala M, Arega G, et al. Treatment outcome of tuberculosis patients under directly observed treatment of short course in Nekemte town, western Ethiopia: retrospective cohort study. *Gen Med (Los Angel)*. 2015; 3:1000176.
83. Razvodovsky YE. Fraction of tuberculosis mortality attributable to alcohol in Russia. *J Alcohol Drug Depend*. 2015; 3:195.
84. Fiseha T, Gebru T, Gutema H, et al. Tuberculosis treatment outcome among hiv co-infected patients at Mizan-Aman general hospital, southwest Ethiopia: a retrospective study. *J Bioengineer & Biomedical Sci*. 2015; 5:139.
85. Fiseha T, Gebru T, Gutema H, et al. Trends of tuberculosis and treatment outcomes at mizan aman general hospital, southwest Ethiopia: a four year retrospective study. *J Bioengineer & Biomedical Sci*. 2015; 5:138.
86. Shu L, Muhammad H, Han L, et al. The role of flexible bronchoscope in the diagnosis of the pulmonary tracheobronchial tuberculosis in children-report of four cases and review of literature. *J Bacteriol Parasitol*. 2015;6:223.
87. Klautau GB, Bammann RH, Ferreira NVS, et al. (2014) QuantiFERON $^{\circledR}$ -TB gold in-tube is not Useful for Diagnosing Active Tuberculosis in HIV/AIDS Patients with Severe Immunodeficiency: Results from Brazil. *J Trop Dis* 2:150.
88. Lenjisa JL, Tolosa BB, Woldu MA, et al. Assessment of tuberculosis retreatment case rate and its treatment outcomes at adama hospital medical college, East Showa, Ethiopia. *J Steroids Hormon Sci*. 2015; 6:153.
89. Santosh T, Patro MK, Bal AK, et al. Tuberculosis of breast masquerading as malignancy. *J Clin Case Rep*. 2015; 5:492.
90. Padayatchi N, Naidu N. Novel and adjunct treatment for drug resistant tuberculosis: a public health imperative. *J Mycobact Dis*. 2014; 4:165.
91. Ocejo-Vinyals JG, Escobio A, Irure-Ventura J, et al. No evidence for association between the functional rs1862513 polymorphism in the promoter region of the resistin gene (RETN) and pulmonary tuberculosis in northern Spain. *Mycobact Dis*. 2015; 5:178.
92. Das S. Changing trend of surgery in pulmonary tuberculosis. *J Pulm Respir Med*. 2015; 5:225.
93. Amaral L. The world must seriously consider with urgency the use of thioridazine in combination with conventional antibiotics for therapy of extensively drug resistant pulmonary tuberculosis: therapy proven effective in Argentina. *Mycobact Dis*. 2014; 4:e130.
94. Gupta AK, Singh A, Singh S. Glycogenomics of Mycobacterium tuberculosis. *Mycobact Dis*. 2014; 4:175. 151. Dantie D, Woldeyohannes D, Mathewos B. Review on molecular mechanism of first line antibiotic resistance in Mycobacterium tuberculosis. *Mycobact Dis*. 2014; 4:174.
95. Fujiwara H, Nishimura T, Iketani O, et al. Discordance between two interferon-gamma release assays in the diagnosis of latent tuberculosis infection in healthcare workers. *J Infect Dis Ther*. 2014;2:171.
96. Amaral L, Soolingen D. Advances in personalised treatment of multi-drug resistant tuberculosis. *Biochem Pharmacol (Los Angel)*. 2014; 3:148.
97. Veras AAO, Sá PHCG, Pinheiro KC, et al. Efficiency of corynebacterium pseudotuberculosis 31 genome assembly with the Hi-Q enzyme on an ion torrent PGM sequencing platform. *J Proteomics Bioinform*. 2014; 7:374-378.
98. Dan X, Feng L, Wang W, et al. Abdominal tuberculosis leading to prehepatic portal hypertension: a case report. *J Cytol Histol*. 2014; 5:278.

99. Schweinfurth D, Baier RD, Richter S. Abdominal tuberculosis: a benign differential diagnosis for peritoneal carcinosis: report of a case. *Mycobact Dis.* 2014; 4:173.
100. Isaiah IN. Immunoinflammation and elevated serum procalcitonin in patients with resistant strain *Mycobacterium tuberculosis* in benin metropolis. *J Med Microb Diagn.* 2014; 3:154.
101. Therese KL. A pilot study on the detection of multidrug resistant tuberculosis in hospital based population of Chennai, India. *J Med Microb Diagn.* 2014; 3:153.
102. Ekpe EE, Obot V. Indications and outcome of surgery in pleuropulmonary tuberculosis. *Trop Med Surg.* 2014; 2:174.
103. Patil JS. New theoretical background for tuberculosis treatment. *J Pharmacovigil.* 2014; 2:e123.
104. Chakrabarti K. Tuberculosis in children. *J Preg Child Health.* 2014; 1:e102.