ISSN: 2349-9141

Available online at http://www.ijirr.com

International Journal of Information Research and Review
Vol. 2, Issue, 06, pp. 765-768, June, 2015

OPEN ACCESS JOURNAL

Full Length Research Paper

SEROPREVALENCE OF HEPATITIS B (HBS AG) AND HEPATITIS C (ANTI-HCV) VIRUSES AMONG SUDANESE PATIENTS WITH HIV/TB CO-INFECTION

[1]Khalid, H. Idris and [2, 3*]Bahaeldin, K. Elamin

[1]Department of Microbiology, Faculty of medical laboratory Sciences, Al Neelain University, Khartoum, Sudan.
[2]Department of Microbiology and Parasitology , College of Medicine , University of Bisha , Saudi Arabia
[3]Department of Microbiology, Faculty of Medical Laboratory Sciences, University of Khartoum, Sudan

***Corresponding Author**

Received 19th May 2015; Published 28th June 2015

Abstract

Background
Tuberculosis (TB) and hepatitis viruses infection are the two common co-infections in patients infected with human immunodeficiency virus (HIV). Hepatitis B and Hepatitis C infections are common in Sudan where TB is endemic and HIV is prevalent. Since anti-retroviral drugs and some of the anti- TB drugs are hepatotoxic, in HIV/TB co-infected patients, the management may be difficult, thus early detection of these viruses will influence the outcome of the disease. The objective of this study to determine the Seroprevalence of Hepatitis B (HBs Ag) and Hepatitis C (Anti-HCV) viruses among Sudanese patients with HIV/TB co-infection

Methodology
From November 2014 to March 2015 , a cross-sectional hospital based study was conducted among HIV/TB co infected patients attended at a reference centers in Khartoum State ,Sudan .The participants were tested for serological markers of HBC infection and HBV antibodies.
Sera samples were collected from patients and tested for HBsAg and anti- HCV bodies using Enzyme-Linked ImmunoSorbent Assay (ELISA).

Results
Out of 53 HIV/ TB co-infected patients recruited in the study, HBsAg was detected in 9.4% while anti HCV antibodies was detected in 1.9% of patients using ELISA and there was no patient had both HBV and HCV co- infection.

Conclusion
HIV/TB infected patients have high probability of getting HBV and or HCV infection due to enhanced immunodeficiency by HIV. Shared route of transmission also plays significant role and is of epidemiological importance in our country .Thus routine screening of HIV/TB infected patients for concurrent infection with HBV and HCV should be made mandatory because co-infection with these hepatitis viruses will increase the risk of cirrhosis, liver deficiency and mortalities in comparison to when a person is infected with HIV and this may minimize the risk of hepatotoxicity occurring during treatment of such patient.

Keywords: HIV/TB Co-Infection, Hepatitis B (HBs Ag), Hepatitis C (Anti-HCV).

To cite this paper: *Khalid, H. Idris and Bahaeldin, K. Elamin. 2015. Seroprevalence of hepatitis b (hbs ag) and hepatitis c (anti-hcv) viruses among sudanese patients with hiv/tb co-infection, International Journal of Information Research and Review.* Vol. 2, Issue, 06, pp. 765-768.

INTRODUCTION

Tuberculosis and viral hepatitis are two of the commonest co-infections, seen among HIV-positive patients worldwide. Infection with hepatitis B (HBV) and hepatitis C viruses (HCV) are especially common and more significant in HIV patients. Hepatitis B virus (HBV) and hepatitis C Virus (HCV) are among the primary causes of morbidity and mortality in HIV patients. Coinfection of HBV and HCV with HIV has been associated with reduced survival, increased risk of progression to liver disease, and increased risk of hepatotoxicity, associated with antiretroviral therapy(Highleyman, 2010, Rosenthal *et al*., 2003) .

HBV and HCV share common pathways of transmission with HIV, including injection drug use, sexual intercourse, and mother-to-child transmission (Gonzalez and Keeffe, 2011). In the past few years, several guidelines and reviews have highlighted this problem and have provided recommendations about how to best manage patients coinfected with HIV and HBV, HCV(Gonzalez and Keeffe, 2011, Ranjbar *et al*., 2011).
Human immunodeficiency virus (HIV) and Tuberculosis (TB) infection pose particular diagnostic and therapeutic importance and exert massive pressure on health care systems in African and Asian countries with large population of co-infected individuals; constitute the main problem of infectious disease in resource restricted countries(WHO, 2010, UNAIDS, 2010).

In 2013 of the estimated 9 million people who developed TB an estimated 1.1 million (13%) were HIV positive. There were also in 2013 360,000 deaths from HIV associated TB equivalent to 25% of all TB deaths, and around 25% of the estimated 1.5 million deaths from HIV/AIDS(WHO, Global Tuberculosis Control 2014).The HIV globally has dramatic association on epidemiology of TB in which prevalence of active TB increase by more than one third among 36 million estimated patients infected with HIV(Godfrey-Faussett *et al*., 2002). This dramatically increases due to fact that of higher probability of either primary progression or reactivation of latent TB in HIV infected patient(Jon, 2004). With 1.3 million TB deaths (including TB deaths in HIV-positive individuals) in 2012 (WHO., 2013), TB and the human immunodeficiency virus (HIV) are the top causes of death from a single infectious agent worldwide (Lozano, 2012, Ortblad *et al*., 2013) . In Sudan the prevalence of tuberculosis are 209 cases per 100,000 of population and 50,000 incident cases during 2009(Organization., 2010). Also the estimated prevalence of HIV among adults is 1.5% which remains lower than that of Southern Sudan and other African neighbors and report from 2002 suggest that 4% of TB patient are co-infected with HIV(El-Sony *et al*., 2002). HIV with HBV or HCV co-infection began as a leading cause of morbidity due to liver disease throughout the world in the last two decades (Rockstroh, 2006, Stabinski *et al*., 2015, Carrat and Perronne, 2005). HBV and HCV are more prevalent among HIV patients due to sharing the same route of transmission(Alter, 2006). The co-infection with hepatitis viruses increase risk of liver related mortality and morbidity due to hepatotoxicity result from antiretroviral medication in patient on protease inhibitors or risk of fatty liver disease due to taking nucleoside/nucleotide reverse transcriptase inhibitors(Sulkowski *et al*., 2000, Barbaro *et al*., 1999, Clausen *et al*., 2014).And also HIV accelerates the natural course of HBV and HCV infection and facilitates faster progression of liver disease to cirrhosis and hepatocellular carcinoma. Disease progression to cirrhosis in HIV positive patients is almost three-times faster as compared to HIV negative patients(Mocroft *et al*., 2003, Vallet-Pichard and Pol, 2006).

On the other hand HCV and HBV infection complicate treatment of TB patient, in which the Hepatotoxicity is the major adverse effect of three of the first line anti-TB agents: isoniazid (INH), rifampin (RIF), and pyrazinamide (PZA) and the high risk of hepatotoxicity during anti-tuberculosis treatment reach up to five time more than TB patient without viral hepatitis (Steele *et al*., 1991, Jeong *et al*., 2015, Ramappa and Aithal, 2013). The risk of anti-TB hepatotoxicity increase to fourteen fold in HIV/HCV co-infected has been reported (Saukkonen *et al*., 2006). Hepatitis B and Hepatitis C infections are common in Sudan where TB is endemic and HIV is prevalent. Since anti-retroviral drugs and some of the anti- TB drugs are hepatotoxic, in HIV/TB co-infected patients, the management may be difficult. This will be even worse if an HIV/TB patient is co-infected with HBV or HCV which will increase the rate of hepatotoxicity and complicate the management. Till now there is no data about seroprevalence of HBsAg or anti-HCV Abs among HIV/TB co-infected patients in Sudan.

Hence, this study will be carried out to high-light this point which may help in the management of the patients.

MATERIALS AND METHODS

This was Cross sectional- hospital based study conducted at Khartoum state in three HIV centers in the period from November 2014 to March 2015. 53 HIV positive patient (diagnose by ELISA and confirmed by a licensed western blot assay) co-infected with TB (by clinical diagnosis, Chest CT scan and positive AFB smear) were enrolled in this study . The demographic and clinical data were collected via questionnaires adopted for the study. Three ml of venous blood sample was collected from each patient; then serum was prepared and stored at -20 ^{o}C until analysis. Serum samples were tested for HBsAg and anti-HCV antibodies using enzyme-link immunosorbent assay (ELISA) (Fortress Diagnostics Limited, Unit 2C Antrim Technology Park, United Kingdom). The ELISA was performed as per manufacturer's instructions. The data was entered and analyzed using statistical Package for social sciences 16 (SPSS – 21).This study was approved by faculty of medical laboratory sciences, Al Neelain University, Khartoum, Sudan, and ethical clearance was obtained from ministry of health . Written consent was taken from selected subjects prior to questionnaire filling and blood sampling.

RESULTS

A total of 53 confirmed HIV/TB co-infected Sudanese patients were enrolled in this study. 20 (37.7%) were females and 33(62.3%) were males; age range between 13 and 60 years. Sociodemographic characteristics of the study population are shown in Table 1. HBS Ag and anti-HCV antibodies were detected in 9.4% (5) and 1.9% (1) patients respectively and Co-infection of both hepatitis B and hepatitis C with HIV/TB was found to be 0%. The distribution of HBV and HCV co-infection in patients infected with HIV/TB is shown in Table 2. Four patients out of five infected with HBV the route of transmission of HIV was sexual intercourse and the rest with unknown route of transmission. The only one patient with HCV infection his route of transmission was sexual intercourse, the statistical analysis showed that there was in significant association between rout of transmission and HBV or HCV infection (P value:0.92 and 0.94 respectively).

The results of the present study showed that there was insignificant association between duration of the disease and HBV and HCV infection (P. Value: 0.63 and 0.9 respectively). The results list in Table No. 3 showed that three patients from the five patients positive for HBV were receiving antiretroviral treatment and the remaining two cases were free from that therapy and there was insignificant association between the antiretroviral therapy and HBV infection (P.value:0.37) whereas the single case positive for HCV was free from antiretroviral therapy with insignificant association also (P. value : 0.53). Univariate analysis of risk factors for HBV infection revealed that male gender and sexual transmission were associated with this infection. In a multivariate analysis, age ≥16 years and sexual transmission were independent risk factors associated with HBV infection (Table No. 1).

Table 1. Incident HIV/AIDS cases by selected characteristics

			HBS Ag	Anti HCV
	MALE	33(62.2%)	5 (15.2%)	1 (3.0%)
Gender	FEMALE	20(37.7%)	0 (0 %)	0 (0 %)
			P value : 0.08	**P value :0.60**
	0-15 Years	1 (3.0%)	0	0
	16-30 Years	15 (28.3%)	3(20 %)	1(6.6%)
Age group	31-45 Years	31 (58.4%)	2(6.4%)	0
	>45 Years	6 (11.3%)	0	0
			P value :0.90	**P value : 1.00**
	Sexual	38(71.6%)	4 (10.5%)	
	Blood transfusion	3 (5.6 %)	0 (0.0%)	
HIV Transmission	Vertical	1 (1.8 %)	0 (0.0%)	
	Unknown	11 (20.7%)	1 (9.0%)	
			P value: 0.92	**P value : 0.94**

Table 2. ELISA result status of study population (n= 53)

HBs Ag	Anti HCV Antibodies	ELISA Results
5 (9.4%)	1 (1.9%)	Positive
48 (90.6%)	52 (98.1%)	Negative

Table 3. antiretroviral and TB treatments among study group with Hepatitis infections

	NO	HBS Ag	Anti HCV
ART Taking treatment	23(43.3%)	3(13.0%)	0 (0.0%)
No ART Tasking treatment	30(56.6%	2(6.6%)	1(3.3%)
		P value : 0.60	**P value : 0.53**
Anti TB Taking treatment	30(56.6%)	4(3.3%)	0(0.0%)
No Anti TB Taking treatment	23(43.3%)	1(4.3%)	1(4.3%)
		P value : 0.37	**P value : 0.43**

DISCUSSION

The present study represents- to the best of our knowledge-the first study in Sudan about the seroprevalence of hepatitis B and C virus among HIV/TB patients. Our study is the first to indicate that infection with HBV and HCV is a significant problem among patients with HIV/TB in Sudan. The co-infection of Hepatitis B or Hepatitis C virus with HIV/TB patients accelerates disease progression and may complicate the management of patients infected with HIV. Overall, the prevalence of hepatitis B, hepatitis C, or both, with HIV/TB Coinfection, is 11.3%. Among these, HBV/HIV is 9.4%, HCV/HIV is 1.9%. We did not assess prevalence of other hepatitis viruses in the HIV positive population, such as hepatitis A, hepatitis D, and hepatitis E. Different prevalence rates of hepatitis and HIV Coinfection have been reported by study by country, as well as by hepatitis subtype(Gupta and Singh, 2006, Rebbani *et al*., 2013, Tremeau-Bravard *et al*., 2012, Rao *et al*., 2015). The prevalence of HBV is similar to the finding of 6.6% in Nigeria (Soriano *et al*., 2002).However, the prevalence of HIV/HBV co-infection in this study is lower to the findings of 11.9% in Ibadan (Otegbayo *et al*., 2008)and 11.5% in Abuja(Adewole *et al*., 2009), both in Nigeria . The differences in prevalence in these studies could be attributed to differences in patient selection. In this study the seroprevalence of HCV among HIV/TB patients was 1.9% and this was similar to that study carried TB patients in Gezira area (2.2%) (Mudawi *et al*., 2007) and Kassala State (1%) (Abdallah, 2015)and lower than that carried among tuberculosis patients (19.4%) reported in high epidemic country in which it was attributed to high risk factors such as intravenous drug abuse(Hajek, 2010).

The prevalence of HBV among general population was reported as 6.8 %and 8.2 % in central and eastern Sudan respectively (Abdallah, 2015, Hajek, 2010, Abdlah, 2011). In this study among HBV infected individuals, 38(71.6%) HIV/ TB patients had history of sexual transmission, 3 (5.6 %) of blood transfusion, 1 (1.8 %) vertical and 11 (20.7%) of unknown causes. In case of HCV infected persons, 4 (10.5%) HIV/ TB infected individuals had history sexual transmission, 1 % with no history of injecting drug user and surgery. According to our knowledge a very limited data is available regarding co-infection of HIV/ TB and hepatitis at national and international history. In a study, Kuniholm *et al* reported that history of blood transfusion; injection of drug and prison were significant risk factors for HBV and HCV among Georgian TB patients(Kuniholm *et al*., 2008). The spread of both HBV and HCV are mainly linked by poor knowledge, socioeconomic status, use of contaminated needles and syringes by quakes, barbers and drug users.

Conclusion

It is thus clear that apart from other infections like TB, HIV infected patients have high probability of getting HBV/HCV infection due to enhanced immunodeficiency by HIV. Shared route of transmission also plays significant role and is of epidemiological importance in our country .Thus routine screening of HIV/TB infected patients for concurrent infection with HBV and HCV should be made mandatory because co-infection with these hepatitis viruses will increase the risk of cirrhosis, liver deficiency and mortalities in comparison to when a person is infected with only one of these viruses(Mohammadi *et al*., 2009).

Furthermore, those found to be negative should be immunized with HBV vaccine to improve the prognosis of their HIV status. There is also an urgent need to conduct detailed studies on the interplay of HIV/TB and hepatotropic viruses in the Sudan community with a plethora of multipronged approaches to investigate the real crisis of HIV/hepatotropic viral infection pattern at the earliest to efficiently control and manage the situation.

Disclosure of conflict of interest

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Acknowledgements

We thank HIV centers in Khartoum state (Sudan) for their help and cooperation.

REFERENCES

Abdallah, T., Idriss, Mi., Ahmed, Am., Ali, Aa. and Saeed, Ok. 2015. Sero-Prevalence Of Hepatitis B And Hepatitis C Viruses Among Tuberculosis Patients In Kassala, Eastern Sudan. . *Glob J. Infect Dis. Clin. Res.,* 1**,** 01-003.

Abdlah, T., Mohammed, Mh. and Ali, Aa. 2011. Seroprevalence And Epidemiological Factors Of Hepatitis B Virus (Hbv) Infection In Eastern Sudan. *International Journal Of Medicine And Medical Sciences,* 3**,** 239-241.

Adewole, O. O., Anteyi, E., Ajuwon, Z., Wada, I., Elegba, F., Ahmed, P., Betiku, Y., Okpe, A., Eze, S., Ogbeche, T. and Erhabor, G. E. 2009. Hepatitis B And C Virus Co-Infection In Nigerian Patients With Hiv Infection. *J. Infect. Dev. Ctries.,* 3**,** 369-75.

Alter, M. J. 2006. Epidemiology Of Viral Hepatitis And Hiv Co-Infection. *J. Hepatol,* 44**,** S6-9.

Barbaro, G., Di Lorenzo, G., Asti, A., Ribersani, M., Belloni, G., Grisorio, B., Filice, G. and Barbarini, G. 1999. Hepatocellular Mitochondrial Alterations In Patients With Chronic Hepatitis C: Ultrastructural And Biochemical Findings. *Am. J. Gastroenterol,* 94**,** 2198-205.

Carrat, F. and Perronne, C. 2005. Hiv And Hepatitis C Virus Co-Infection. *Lancet Infect Dis.,* 5**,** 71.

Clausen, L. N., Lundbo, L. F. and Benfield, T. 2014. Hepatitis C Virus Infection In The Human Immunodeficiency Virus Infected Patient. *World J Gastroenterol,* 20**,** 12132-43.

El-Sony, A. I., Khamis, A. H., Enarson, D. A., Baraka, O., Mustafa, S. A. And Bjune, G. 2002. Treatment Results Of Dots In 1797 Sudanese Tuberculosis Patients With Or Without Hiv Co-Infection. *Int J Tuberc Lung Dis,* 6**,** 1058-66.

Godfrey-Faussett, P., Maher, D., Mukadi, Y. D., Nunn, P., Perriens, J. and Raviglione, M. 2002. How Human Immunodeficiency Virus Voluntary Testing Can Contribute To Tuberculosis Control. *Bull. World Health Organ.,* 80**,** 939-45.

Gonzalez, S. A. and Keeffe, E. B. 2011. Chronic Viral Hepatitis: Epidemiology, Molecular Biology, And Antiviral Therapy. *Front Biosci (Landmark Ed),* 16**,** 225-50.

Gupta, S. and Singh, S. 2006. Hepatitis B And C Virus Co-Infections In Human Immunodeficiency Virus Positive North Indian Patients. *World J. Gastroenterol,* 12**,** 6879-83.

Hajek, J., Hernández-Garduño,E., Amanda, Yu. *et al*. High Prevalence Of Hepatitis C Infection Among Patients With Tuberculosis In British Columbia. Idsa 48th Annual Meeting, 2010 Vancouver.

Highleyman, L. Hiv/Hbv And Hiv/Hcv Coinfected People With Impaired Liver Function And Inflammation Have Higher Risk Of Non-Aids Death. 17th Conference On Retroviruses And Opportunistic Infections (Croi '10), 2010 San Fransisco, Calif, Usa.

Jeong, I., Park, J. S., Cho, Y. J., Yoon, H. I., Song, J., Lee, C. T. and Lee, J. H. 2015. Drug-Induced Hepatotoxicity Of Anti-Tuberculosis Drugs And Their Serum Levels. *J. Korean Med. Sci.,* 30**,** 167-72.

Jon, F. 2004. Tuberculosis. *In:* Jonathan, C., Willium, P. (Ed.) *Infectious Diseases.* Spain: Mosby.

Kuniholm, M. H., Mark, J., Aladashvili, M., Shubladze, N., Khechinashvili, G., Tsertsvadze, T., Del Rio, C. and Nelson, K. E. 2008. Risk Factors And Algorithms To Identify Hepatitis C, Hepatitis B, And Hiv Among Georgian Tuberculosis Patients. *Int. J. Infect. Dis.,* 12**,** 51-6.

Lozano, R. N., M. Foreman, K. *et al.* 2012. Global And Regional Mortality From 235 Causes Of Death For 20 Age Groups In 1990 And 2010: A Systematic Analysis For The Global Burden Of Disease Study 2010. *Lancet,* 380**,** 2095-128.

Mocroft, A., Ledergerber, B., Katlama, C., Kirk, O., Reiss, P., D'arminio Monforte, A., Knysz, B., Dietrich, M., Phillips, A. N. and Lundgren, J. D. 2003. Decline In The Aids And Death Rates In The Eurosida Study: An Observational Study. *Lancet,* 362**,** 22-9.

Mohammadi, M., Talei, G., Sheikhian, A., Ebrahimzade, F., Pournia, Y., Ghasemi, E. And Boroun, H. 2009. Survey Of Both Hepatitis B Virus (Hbsag) And Hepatitis C Virus (Hcv-Ab) Coinfection Among Hiv Positive Patients. *Virol J.,* 6**,** 202.

Mudawi, H. M., Smith, H. M., Fletcher, I. A. And Fedail, S. S. 2007. Prevalence And Common Genotypes Of Hcv Infection In Sudanese Patients With Hepatosplenic Schistosomiasis. *J. Med. Virol.,* 79**,** 1322-4.

Organization., W. H. 2010. Global Tuberculosis Control: Who Report 2010. Geneva: Who.

Ortblad, K. F., Lozano, R. and Murray, C. J. 2013. The Burden Of Hiv: Insights From The Global Burden Of Disease Study 2010. *Aids.,* 27**,** 2003-17.

Otegbayo, J. A., Taiwo, B. O., Akingbola, T. S., Odaibo, G. N., Adedapo, K. S., Penugonda, S., Adewole, I. F., Olaleye, D. O., Murphy, R. and Kanki, P. 2008. Prevalence Of Hepatitis B And C Seropositivity In A Nigerian Cohort Of Hiv-Infected Patients. *Ann. Hepatol,* 7**,** 152-6.

Ramappa, V. and Aithal, G. P. 2013. Hepatotoxicity Related To Anti-Tuberculosis Drugs: Mechanisms And Management. *J Clin. Exp. Hepatol,* 3**,** 37-49.

Ranjbar, R., Davari, A., Izadi, M., Jonaidi, N. and Alavian, S. M. 2011. Hiv/Hbv Co-Infections: Epidemiology, Natural History, And Treatment: A Review Article. *Iran. Red. Crescent Med. J.,* 13**,** 855-62.

Rao, V. B., Johari, N., Du Cros, P., Messina, J., Ford, N. And Cooke, G. S. 2015. Hepatitis C Seroprevalence And Hiv Co-Infection In Sub-Saharan Africa: A Systematic Review And Meta-Analysis. *Lancet Infect. Dis*.

Rebbani, K., Ouladlahsen, A., Bensghir, A., Akil, A., Lamdini, H., Issouf, H., Brahim, I., Kitab, B., Fakhir, F. Z., Wakrim,

L., Marhoum El Filali, K., Himmich, H., Ezzikouri, S. and Benjelloun, S. 2013. Co-Infections With Hepatitis B And C Viruses In Human Immunodeficiency Virus-Infected Patients In Morocco. *Clin. Microbiol Infect.,* 19**,** E454-7.

Rockstroh, J. K. 2006. Influence Of Viral Hepatitis On Hiv Infection. *J. Hepatol,* 44**,** S25-7.

Rosenthal, E., Poiree, M., Pradier, C., Perronne, C., Salmon-Ceron, D., Geffray, L., Myers, R. P., Morlat, P., Pialoux, G., Pol, S. And Cacoub, P. 2003. Mortality Due To Hepatitis C-Related Liver Disease In Hiv-Infected Patients In France (Mortavic 2001 Study). *Aids.,* 17**,** 1803-9.

Saukkonen, J. J., Cohn, D. L., Jasmer, R. M., Schenker, S., Jereb, J. A., Nolan, C. M., Peloquin, C. A., Gordin, F. M., Nunes, D., Strader, D. B., Bernardo, J., Venkataramanan, R. and Sterling, T. R. 2006. An Official Ats Statement: Hepatotoxicity Of Antituberculosis Therapy. *Am. J. Respir Crit. Care. Med.,* 174**,** 935-52.

Soriano, V., Sulkowski, M., Bergin, C., Hatzakis, A., Cacoub, P., Katlama, C., Cargnel, A., Mauss, S., Dieterich, D., Moreno, S., Ferrari, C., Poynard, T. and Rockstroh, J. 2002. Care Of Patients With Chronic Hepatitis C And Hiv Co-Infection: Recommendations From The Hiv-Hcv International Panel. *Aids.,* 16**,** 813-28.

Stabinski, L., O'connor, S., Barnhart, M., Kahn, R. J. And Hamm, T. E. 2015. Prevalence Of Hiv and Hepatitis B Virus Co-Infection In Sub-Saharan Africa And The Potential Impact And Program Feasibility Of Hepatitis B Surface Antigen Screening In Resource-Limited Settings. *J. Acquir Immune Defic. Syndr.,* 68 Suppl 3**,** S274-85.

Steele, M. A., Burk, R. F. and Desprez, R. M. 1991. Toxic Hepatitis With Isoniazid And Rifampin. A Meta-Analysis. *Chest.,* 99**,** 465-71.

Sulkowski, M. S., Mast, E. E., Seeff, L. B. and Thomas, D. L. 2000. Hepatitis C Virus Infection As An Opportunistic Disease In Persons Infected With Human Immunodeficiency Virus. *Clin Infect Dis,* 30 Suppl 1**,** S77-84.

Tremeau-Bravard, A., Ogbukagu, I. C., Ticao, C. J. and Abubakar, J. J. 2012. Seroprevalence Of Hepatitis B And C Infection Among The Hiv-Positive Population In Abuja, Nigeria. *Afr. Health Sci.,* 12**,** 312-7.

Unaids 2010. Epidemic Update. *Unaids Report On The Global Aids Epidemic.*

Vallet-Pichard, A. And Pol, S. 2006. Natural History And Predictors Of Severity Of Chronic Hepatitis C Virus (Hcv) And Human Immunodeficiency Virus (Hiv) Co-Infection. *J. Hepatol,* 44**,** S28-34.

Who 2010. Who Global Tuberculosis Control Report 2010. Summary. *Cent. Eur. J. Public. Health,* 18**,** 237.

Who Global Tuberculosis Control 2014. 2014. Geneva.

Who. 2013. Global Tb Report 2013. Geneva: Who.

****