



**衛生防護中心**  
Centre for Health Protection

**Recommendations on the Management of  
Human Immunodeficiency Virus  
and Tuberculosis Coinfection**

**Scientific Committee on AIDS and STI (SCAS),  
Centre for Health Protection,  
Department of Health**



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- (a) to advise the Controller of the Centre for Health Protection (CHP) on the scientific basis for the prevention, care and control of HIV/AIDS and STI in Hong Kong;
- (b) to develop recommendations and guidance regarding HIV/AIDS and STI in Hong Kong; and
- (c) to keep under review local and international development of HIV/AIDS and STI.

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# Recommendations on the Management of Human Immunodeficiency Virus and Tuberculosis Coinfection

## Background

Worldwide, tuberculosis (TB) infects one third of the population. One of its main drivers has been the epidemic of human immunodeficiency virus (HIV) infection. On a biological and clinical level, it has been shown that HIV and TB reinforce each other. HIV increases the risk of TB disease by up to 100-fold. On the other hand, active TB is associated with an increased risk of opportunistic infections and rise in HIV viral load.<sup>1,2</sup> Their coexistence in an individual also produces atypical features of TB complicating management.

2. The prognosis has dramatically improved for HIV infected patients with or without TB,<sup>3</sup> following the availability of highly active antiretroviral therapy (HAART). Nevertheless, its concurrent use with anti-tuberculosis treatment may be complicated by immune reconstitution inflammatory syndrome (IRIS) and complex drug-drug interactions.

3. In 1995, the Scientific Committee on AIDS published an information paper on the prevention and treatment of TB in HIV disease.<sup>4</sup> This was prior to the HAART era. Since then, significant gains have been made in the understanding of drug interactions, clinical presentations, and IRIS involving TB. Both new diagnostic methods and new antiretrovirals have also been developed.

4. The emergence of multidrug-resistant TB (MDR-TB), including extensively drug-resistant TB (XDR-TB), has been linked with though not explained by the HIV epidemic.<sup>5</sup> Evidence supports the pivotal role of a well funded public health infrastructure and appropriate clinical management in preventing resistance.

5. In this context, the Scientific Committee on AIDS and STI set out to provide recommendations for management of HIV-TB coinfection, in order to achieve a standard of care in Hong Kong that will translate into clinical

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<sup>1</sup> Munsiff SS, Alpert PL, Gourevitch MN, et al. A prospective study of tuberculosis and HIV disease. *J Acquir Immune Defic Syndr* 1998;19:361-8

<sup>2</sup> Day JH, Grant AD, Fielding KL, et al. Does tuberculosis increase HIV load? *J Infect Dis*. 2004;1490:1677-87

<sup>3</sup> Hung CC, Chen MY, Hsiao CF, et al. Improved outcomes of HIV-1 infected adults with tuberculosis in the era of highly active antiretroviral therapy. *AIDS* 2003;17:2615-22

<sup>4</sup> Scientific Committee of Advisory Council on AIDS. Prevention and Management of Tuberculosis in HIV infected Patients in Hong Kong - an information paper. April 1995. (Available at <http://www.info.gov.hk/aids/pdf/g36.pdf>. Accessed 28 Feb 2008)

<sup>5</sup> Wells CD, Cegielski P, Nelson LJ, et al. HIV infection and multidrug-resistant tuberculosis – the perfect storm. *J Infect Dis* 2007;196:S86-107

benefit and public health control.

## Screening

6. Given the close association and mutual aggravation between HIV and TB, as well as the treatable nature of both diseases, it is important that screening be done for a patient with either diagnosis, regardless of symptoms, signs and risk factors.

7. In Hong Kong, extrapulmonary TB and, at CD4 count  $<200/\mu\text{L}$ , pulmonary TB and TB of cervical lymph node, are AIDS-defining conditions. In recent years, TB incidence in HIV infected patients has steadily increased, despite a gradually declining notification rate in the general population. Among 855 cases of AIDS reported up to the end of 2006, 214 (25%) had been primarily defined by TB. In 2007, it overtook *Pneumocystis jiroveci* pneumonia as the most common primary AIDS-defining condition (41 vs 35%).<sup>6</sup>

8. It is therefore important to screen for TB in HIV-infected subjects by performing annual tuberculin skin tests (TST) using 2 units of PPD-RT23 and using 5 mm of induration as the cutoff as previously recommended.<sup>7</sup> Newer blood tests based on the detection of interferon-gamma released by T cells in response to *Mycobacterium tuberculosis* specific antigens may be useful alternatives to TST<sup>8</sup> and is being evaluated in Hong Kong. If a patient tests positive and active TB disease has been ruled out, treatment of latent infection is recommended. Of note, the standard therapy is isoniazid of 9 months. The two-month regimen of pyrazinamide and rifampicin is no longer recommended in HIV-uninfected persons because of hepatotoxicity.<sup>9</sup> It may be considered in HIV coinfecting patients if no alternative exists and if benefits outweigh the risks.

9. It is equally important that all patients newly diagnosed with TB are screened for HIV. Diagnosis of coinfection should prompt the involvement of the HIV physician so that assessment can be made of

- ♦ the patient's immune and virologic status
- ♦ the need to provide prophylactic treatment against other opportunistic infections

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<sup>6</sup> Tuberculosis and Chest Service, Department of Health. Annual Report 2006 (Available at [http://www.info.gov.hk/tb\\_chest/doc/Annual%20Report%202006.pdf](http://www.info.gov.hk/tb_chest/doc/Annual%20Report%202006.pdf). Accessed 15 April 2008)

<sup>7</sup> Scientific Committee on AIDS. Recommendations on the treatment of latent TB infection in HIV-positive persons in Hong Kong. 2002. (Available at <http://www.info.gov.hk/aids/pdf/g101.pdf>. Accessed 28 Feb 2008)

<sup>8</sup> US CDC. Guidelines for using the QuantiFERON-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54:RR-15

<sup>9</sup> US CDC. Update: adverse event data and revised American Thoracic Society/CDC recommendations against the use of rifampin and pyrazinamide for treatment of latent tuberculosis infection – United States 2003. *MMWR* 2003;52(31):735-9

- ♦ the timing of appropriate antiretroviral therapy and necessary adjustments in anti-TB treatment

## Clinical diagnosis

10. In HIV disease, TB may present atypically, especially in those with a low CD4 count. As of end of 2006, there had been 129 HIV-infected patients seen at the Government HIV and Chest Clinics with TB as the AIDS-defining illness. Among them, 48 (37.2%) had extrapulmonary disease, most of whom had a CD4 count <200/uL.<sup>6</sup> Extrapulmonary TB commonly takes the form of lymphadenitis (other than cervical), bacteraemia, disseminated disease, pleural or pericardial disease, meningitis and tuberculomas. Chest radiography may show more frequent involvement of the lower lobes, or appear normal. Not uncommonly, sputum acid-fast bacilli (AFB) smear examination is negative. On the other hand, TB in those with higher CD4 cell counts present with more typical findings, similar to those in HIV-negative patients.

11. Thus, a high index of suspicion is necessary. A full medical evaluation for TB begins with history and physical examination. Subsequent investigations will be guided by the presentation and should usually include sputum examination and chest radiography. There should be a low threshold in proceeding to bronchoscopy. Depending on clinical circumstances, gastric aspiration, blood culture, bone marrow biopsy and lumbar puncture may also be required for a definitive diagnosis.

12. AFB in the sputum are not necessarily *M. tuberculosis*. In the HIV infected patient, *M. avium* complex (MAC) colonisation of the respiratory and gastrointestinal tracts may occur, especially in those with a very low CD4 count. Nucleic acid amplification tests such as PCR are useful for differentiating *M. tuberculosis* from nontuberculosis mycobacteria in smear-positive samples. Localised MAC disease is distinctly uncommon unless the patient has been newly put on HAART. *M. kansasii* may rarely cause pulmonary disease and should be considered in the differential diagnosis.

13. Failure to diagnose TB early could be lethal. When TB is suspected, nuclei acid amplification tests should be considered even in smear-negative sputum samples.<sup>10</sup> Where available, fluorescence microscopy is preferred to Kinyoun or Ziehl-Neelsen stain. Similarly, automated liquid culture systems such as BACTEC<sup>TM</sup> should be used instead of or concurrently with solid media. DNA hybridisation probes also aid in the rapid characterisation of culture isolates. Novel diagnostic approaches may find clinical roles in the near future.<sup>11</sup>

<sup>10</sup> US CDC. Update: Nucleic acid amplification tests for tuberculosis. *MMWR* 2000;49(26):593-4

<sup>11</sup> Perkins MD, Cunningham J. Facing the crisis: improving the diagnosis of tuberculosis in the HIV era. *J Infect Dis* 2007;196(Suppl 1): S15-27

## Treatment of tuberculosis

14. Treatment should be initiated promptly on the basis of clinical grounds before culture and drug sensitivity tests results are available. In disseminated disease, consideration should be given for empiric coverage of MAC as well. For TB, a standard initial phase of treatment comprising four drugs as used for HIV-negative patients is given, followed by a continuation phase with a reduced number of drugs. Rifabutin should generally substitute for rifampicin if protease inhibitors (PI) are contemplated. (Appendix 1 and 2)

15. Although international guidelines have recommended using a standard six-month regime for pulmonary TB in HIV positive patients,<sup>12,13</sup> there is concern about a higher risk of relapse.<sup>14</sup> Thus, extending the treatment duration to a total of nine months is preferred and especially recommended for those who have previously been treated for TB or have a delayed clinical or microbiologic response (e.g. persistence of positive culture by two months of treatment). For those who are put on a non-rifamycin regimen, or have TB of the CNS, bone and joint diseases, even longer durations of treatment are necessary.

16. 'Directly observed treatment' (DOT) should be employed for the treatment of all TB patients, including those who are HIV coinfecting. This is the standard practice in the TB and Chest Services of the Centre for Health Protection, and should be conducted as a comprehensive package incorporating education, enablers, incentives and holistic care which are conducive to treatment adherence.

17. Highly intermittent therapy as with twice or once weekly regimens is associated with a high risk of acquired rifamycin resistance and relapse among TB-HIV coinfecting patients and cannot be recommended. For those patients with severe immune deficiency, e.g. CD4 <100/ $\mu$ L, drugs should preferably be given daily in the initial phase.<sup>15</sup>

18. Susceptibility tests against all first line anti-TB drugs should be performed routinely to guide treatment, as drug-resistant TB adversely impacts on prognosis and survival. Treatment of drug-resistant TB, especially MDR-TB and XDR-TB is complex<sup>16</sup> and should be undertaken in consultation with

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<sup>12</sup> World Health Organisation (WHO). Treatment of tuberculosis: guidelines for national programmes. 3<sup>rd</sup> ed. WHO/CDS/TB/2003.313. Geneva: WHO, 2003. (Available at [http://www.who.int/tb/publications/cds\\_tb\\_2003\\_313/en/index.html](http://www.who.int/tb/publications/cds_tb_2003_313/en/index.html). Accessed 29 Feb 2008)

<sup>13</sup> British HIV Association. BHIVA treatment guidelines for TB/HIV infection - Feb 2005. (Available at <http://www.bhiva.org>. Accessed 29 Feb 2008)

<sup>14</sup> Perriens JH, Louis ME, Mukadi YB, et al. Pulmonary tuberculosis in HIV infected patients in Zaire: a controlled trial of treatment for either 6 or 12 months. *N Eng J Med* 1995;332:779-84

<sup>15</sup> US CDC. Acquired rifamycin resistance in persons with advanced HIV disease being treated for active tuberculosis with intermittent rifamycin-based regimens. *MMWR* 2002;51:214-5

<sup>16</sup> Tam CM, Leung CC, Yew WW. Guidelines on treatment. In: Tam CM, Leung CC (eds). TB Manual 2006, Centre for Health Protection, Department of Health 2006

experts in the field.

## **The concomitant use of anti-TB and highly active antiretroviral therapy**

19. If an HIV-positive patient has already been put on HAART, it should be continued even if incident TB is diagnosed and anti-TB treatment is to be initiated. However, adjustments may be needed to prevent adverse drug-drug interactions. Timely initiation of HAART should also be considered if HIV is diagnosed in a patient with TB, as the occurrence of TB is indicative of significant immune deficiency. Although the optimal timing of combined therapy is uncertain, anti-TB treatment should not be delayed whenever TB is diagnosed.

### ***For a patient on HAART newly diagnosed with TB***

20. Anti-TB treatment should be initiated as soon as possible. However, care must be exercised in the choice of drugs and their dosage. For example, rifampicin and, to a lesser extent, rifabutin induce the cytochrome P450 enzyme system. This may reduce plasma concentrations of protease inhibitors (PI) to subtherapeutic levels, resulting in the emergence of drug-resistant HIV. On the other hand, by inhibiting the cytochrome P450 enzyme, PI may increase the toxicity of rifamycins. Of note, other mechanisms are at play and some commonly used drugs may also inhibit the cytochrome system, such as the azoles and macrolides.

21. The interactions between antiretrovirals and rifamycins are complex but better understood now, so that fairly standard recommendations can be made (Appendix 3). As such, past approaches of interrupting antiretrovirals or changing to double nucleoside therapy are no longer acceptable. Rifamycins should be included in the anti-TB regimen as far as possible because of their potency. If the decision is made to omit rifamycins, then the treatment duration should be appropriately prolonged. Nevertheless, the recommended dosage adjustments are approximate and based on normal liver function. In cases of doubt, therapeutic drug monitoring is recommended.

22. It cannot be overemphasised that good communication with the HIV physician is key to arrive at the optimal combination of drugs. In the uncommon event that a PI were to be discontinued so that rifampicin could be used, 2-3 days of washout are advisable. Rifampicin is then started at half dose and increased to full dose after a week.

### ***For a patient diagnosed with TB who is not on HAART***

23. As manifestation of immune deficiency, the occurrence of TB is a clinical indication of HAART. Studies have shown improved mortality and

morbidity when HAART is added to TB treatment particularly in those with advanced immune deficiency. Nevertheless, there was also increased risk of adverse events and IRIS during the initial phase of anti-TB treatment which might require interruption of HAART and TB treatment.<sup>17,18,19</sup>

24. Simultaneous initiation of TB and HIV treatment is not recommended because of the sudden burden of polypharmacy and the difficulty in identifying the culprits in the event of hypersensitivity and other adverse reactions. There is no consensus on a CD4 threshold for initiating HAART, although a count below 100/ $\mu$ L should indicate urgency.

25. In principle, HAART should be initiated after the following issues are addressed:

- ◆ The patient has shown tolerance to the anti-TB regimen,
- ◆ There is reliable GI absorption,
- ◆ The patient understands and accepts this life-long treatment, and
- ◆ A potent and durable antiretroviral regimen is constructed given the patient's treatment history, known or suspected antiretroviral resistance, and potential interactions with the anti-TB drugs.

26. As aforementioned, the risk of adverse events is particularly high if HAART is added in the initial phase of TB treatment. Even with standard dose adjustment, the risk of hepatotoxicity is significant, especially with nevirapine-containing regimens and with hepatitis B and C coinfection.<sup>20,21</sup> HAART interruption may result in resistance that can be difficult to manage. Similarly, re-initiation of TB treatment is cumbersome and may also result in resistance.

27. If PI-based HAART were to be interrupted, all components should be stopped together. If not, mono or dual therapy will effectively be given which can easily lead to viral resistance. Of note, rifabutin should be increased to full dose accordingly in a few days' time. Interruption of therapy based on efavirenz or nevirapine is more complex. These non-nucleosides have long half lives and therefore should theoretically be stopped three to seven days prior to the other components. The HIV physician should be involved in the process.

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<sup>17</sup> Dheda K, Lampe FC, Johnson MA, Lipman MC. Outcome of HIV-associated tuberculosis in the era of highly active antiretroviral therapy. *J Infect Dis* 2004;190:1670-6

<sup>18</sup> Schiffer JT, Sterling TR. Timing of antiretroviral therapy initiation in tuberculosis patients with AIDS: a decision analysis. *J Acquir Immune Defic Syndr* 2007;44:229-234

<sup>19</sup> Dean GL, Edwards SG, Ives NJ, et al. Treatment of tuberculosis in HIV-infected persons in the era of highly active antiretroviral therapy. *AIDS* 2002;16:75-83

<sup>20</sup> Hoffmann CJ, Charalambous S, Thio CL, et al. Hepatotoxicity in an African antiretroviral therapy cohort: the effect of tuberculosis and hepatitis B. *AIDS* 2007;21:1301-8

<sup>21</sup> Law WP, Dore GJ, Duncombe CJ, et al. Risk of severe hepatotoxicity associated with antiretroviral therapy in the HIV-NAT Cohort, Thailand, 1996-2001. *AIDS* 2003;17:2191-9

28. Combination therapy is the standard in anti-TB treatment, as drug resistance emerges when there are inadequate effective drugs. Reintroduction or desensitisation of anti-TB drugs should therefore be done carefully to avoid any unduly prolonged period of suboptimal therapy which may induce resistance.

29. It is important to monitor adherence as well as adverse events. The dose adjustments necessary in combined treatment means that even if a patient is selectively non-adherent to the antiretrovirals, the dosages of his prescribed anti-TB drugs like the rifamycins may also become inadequate.

### **Immune reconstitution inflammatory syndrome**

30. TB-associated IRIS is similar to the paradoxical reaction in HIV-uninfected patients. IRIS may be defined as 'presentation or clinical deterioration of opportunistic infections in HIV-infected patients as a direct result of the enhancement of immune responses to these pathogens during HAART'.<sup>22</sup> It occurs usually within 6 months, and occasionally as early as 10 days after the initiation of HAART.<sup>23</sup>

31. It is manifested as aggravation of original disease, constitutional deterioration with weight loss and fever, or occurrence of disease in a new site. IRIS may also present as unmasking of subclinical TB after HAART is started.<sup>24</sup> The clinical challenge is to differentiate IRIS from treatment failure and non-adherence, as the principles of management are very different (Box 1).

32. In general, HAART should be continued in the face of IRIS. There is no proven treatment but for mild to moderate disease, non-steroidal inflammatory drugs are used. In more severe disease, a short course of prednisolone up to 1mg/kg may be tried.<sup>25</sup> Interruption of HAART is a last resort in life-threatening

#### **Box 1. Clues suggestive of IRIS**

- ◆ Temporal association between HAART and clinical phenomena (usually within 3 months)
- ◆ Unusual clinical manifestations
- ◆ Unexpected clinical course
- ◆ Exclusion of alternative explanations, e.g. drug resistance and non-compliance
- ◆ Evidence of immune restoration – e.g. rise in CD4 count, restoration of a positive PPD reaction, etc
- ◆ Histopathological appearance of florid cell-mediated response
- ◆ Preceding fall in viral load

*Adapted from Lawn SD. Lancet Infect Dis 2005;5:361-73*

<sup>22</sup> Lawn DS, Bekker L-G, Miller RF. Immune reconstitution disease associated with mycobacterial infections in HIV-infected individuals receiving antiretrovirals. *Lancet Infect Dis* 2005;5:361-73

<sup>23</sup> Kumarasamy N, Chaguturu S, Mayer KH, et al. Incidence of immune reconstitution syndrome in HIV/tuberculosis-coinfected patients after initiation of generic antiretroviral therapy in India. *J Acquir Immune Defic Syndr* 2004;37:1574-6

<sup>24</sup> Breen RAM, Smith CJ, Cropley I, et al. Does immune reconstitution syndrome promote active tuberculosis in patients receiving highly active antiretroviral therapy? *AIDS* 2005;19:1201-6

<sup>25</sup> Recommendations from CDC, NIH, and HIVMA/IDSA. Treating opportunistic infections among HIV-infected adults and adolescents. *Clin Infect Dis* 2005;40:S131-235

situations.

## Infection Control

33. *M. tuberculosis* is spread by the airborne route. Effective infection control follows the hierarchy of administrative, engineering and personal controls and, in the context of TB, begins with early suspicion and prompt respiratory isolation. Each institution should continually evaluate its facilities and isolation protocols to ensure effectiveness. In particular, the following should be in place for the management of TB disease, irrespective of the patient's HIV status: a practical and effective set of criteria for single and cohort isolation, adequate air change in the isolation room, availability of appropriate personal protective equipment, and continual education of front line health care staff regarding procedures and requirements of airborne isolation.

34. In general, respiratory isolation should not be terminated until after at least two weeks of effective treatment and the patient has clinically improved. For patients with MDR-TB, isolation should last till sputum conversion (three consecutive sputum smears negative for AFB collected 8-24 h apart).<sup>26</sup>

35. The decision to discharge a patient with TB should be individualised, taking into account treatment response, the extent of disease, the frequency of cough, circumstances of contact with household members, willingness to adhere to DOT and the likelihood of drug-resistant TB.<sup>27</sup> All TB patients should preferably be screened for HIV infection before discharge. As a statutorily notifiable disease, TB should be promptly reported to the Centre for Health Protection.

## Outlook

36. The incidence of TB in HIV infection is on an increasing trend and it is necessary that physicians who treat either disease be up to date with new developments in the field. In this regard, the evolution of MDR-TB, including XDR-TB, should be closely monitored.

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<sup>26</sup> Leung ECC, Yew WW, Seto WH. Tuberculosis control measures in the health care setting. In: Tam CM, Leung CC (eds). TB Manual 2006, Centre for Health Protection, Department of Health 2006

<sup>27</sup> Recommendations from American Thoracic Society, CDC, and the Infectious Diseases Society of America. Controlling tuberculosis in the United States. *MMWR* 2005;54(RR-12)

37. It is also likely that new drugs and diagnostic methods will be developed and the optimal timing of adding HAART to anti-TB therapy will be better determined. This document is based on the best available knowledgebase as it is today. As with most other areas of medicine, management should be individualised according to the unique circumstances of each and every patient.

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## Appendix 1. First line anti-TB drugs

### Standard dosage

Drug	Daily dose, mg/kg (maximum dose)	tiw dose
Isoniazid (INH)	5 (300 mg)	15 (900 mg)
Rifampicin (RIF)	10-12 (600 mg)	10 (600 mg)
Rifabutin (RFB)	5 (300 mg)	Not applicable
Pyrazinamide (PZA)	<50 kg: 1-1.5 g ≥50 kg: 1.5-2 g	<50 kg: 1.5-2 g ≥50 kg: 2-2.5 g
Ethambutol (EMB)	15-20 (1200 mg)	25-30 (2000 mg)
Streptomycin (SM)	15 (750 mg, 5 times per week)	15-20 (1000 mg)

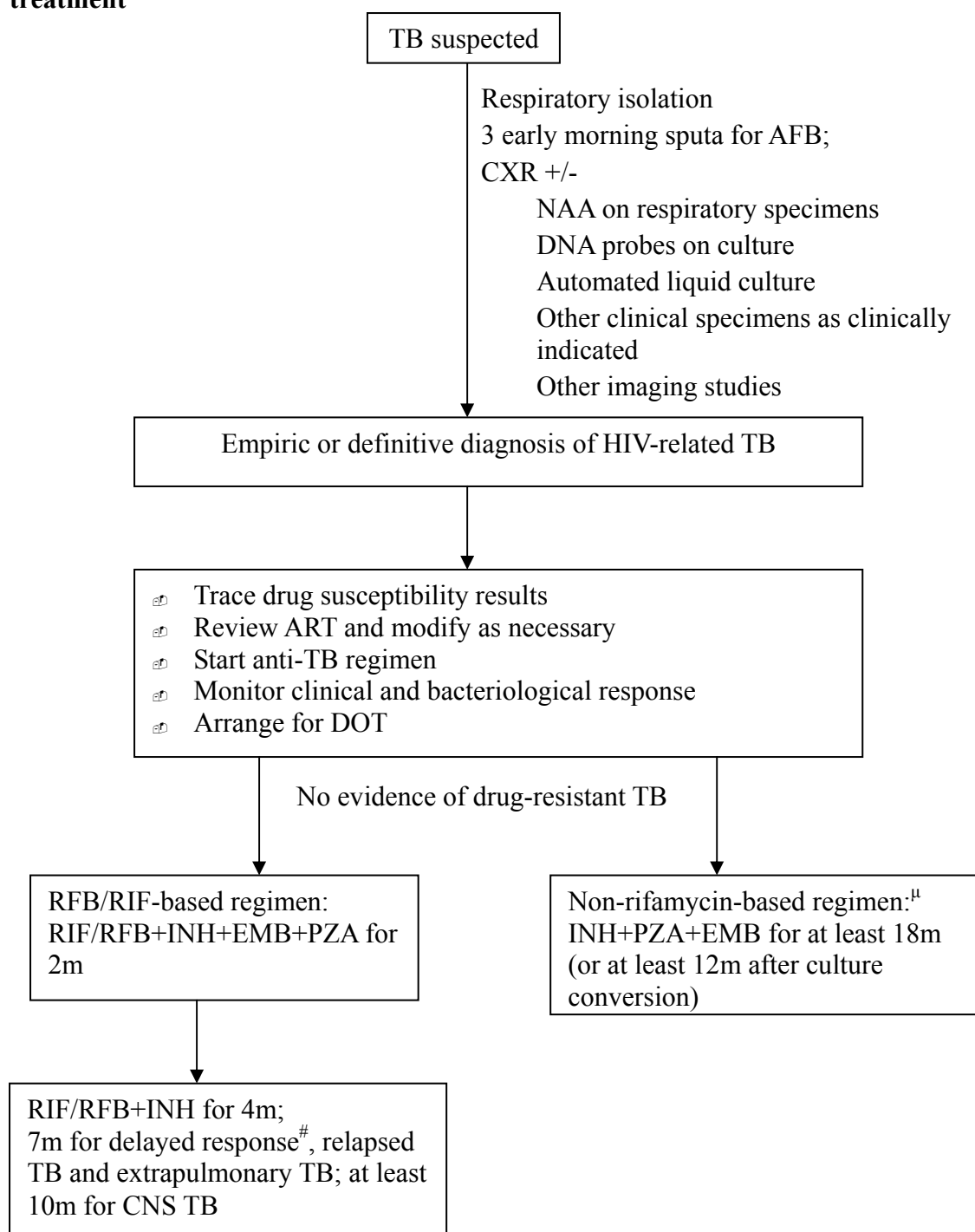
*tiw, three times per week*

### Important adverse reactions

INH*	Hepatitis, cutaneous hypersensitivity, peripheral neuropathy [Rare: optic neuritis, convulsion, mental symptoms, aplastic anaemia, lupoid reactions, gynecomastia, arthralgia]
RIF	Hepatitis, cutaneous hypersensitivity, gastrointestinal reactions, thrombocytopenic purpura, febrile reactions, 'flu' syndrome [Rare: shock, shortness of breath, haemolytic anaemia, acute renal failure]
RFB	Skin discoloration, uveitis, arthralgia, leukopaenia
PZA	Anorexia, nausea, flushing, photosensitisation, hepatitis, arthralgia, cutaneous reactions, hyperuricaemia, gout [Rare: sideroblastic anaemia]
EMB	Retrobulbar neuritis, arthralgia [Rare: hepatitis, cutaneous reactions, peripheral neuropathy]

\*Co-administer pyridoxine 10-25 mg qd to prevent peripheral neuropathy; increase to 50-100 mg qd for 1-2 weeks for treatment.

**Appendix 2. Approach to the management of TB in known HIV disease on treatment\***



\*Adapted from Lee NLS, Leung ECC, Tam CM. Tuberculosis in HIV/AIDS. In: Lee SS, Wu JCY, Wong KH (eds). *HIV Manual 2007*. CEID, CUHK & CHP, DH 2007 (Available at <http://www.info.gov.hk/aids/english/hivmedcare/hivmanual2007.htm>)

#response is delayed when assessment at the end of the 2-month initial phase shows (a) lack of culture conversion, or (b) lack of resolution or progression of signs and symptoms of TB

#not generally recommended because of inferior treatment efficacy. May also consider using fluoroquinolone to construct alternative regimens.

NAA, Nucleic acid amplification; INH, isoniazid; RIF, rifampicin; RFB, rifabutin; EMB, ethambutol; PZA, pyrazinamide

### Appendix 3. Dosage adjustments for concurrent use of rifamycins and antiretrovirals<sup>28</sup>

Dosage adjustment of RIF in combination with some ARV (in mg)

	NVP	EFV	RTV/SQV combination*	LPVr (Kaletra™)	RTV*	MVC	RAL
<b>RIF</b>	<b>600 qd</b>	<b>600 qd</b>	<b>600 qd</b>	<b>600 qd</b>	<b>600 qd</b>	<b>600 qd</b>	<b>600 qd</b>
ARV	200 bid	600 qd <sup>#</sup>	400/400 bid	4 tablets bid or (2 tablets + RTV 300 mg) bid	600 bid	600 bid	400 bid

\*High risk of hepatotoxicity; <sup>#</sup>may consider increasing to EFV 800 mg in those who weigh >60 kg

Dosage adjustment of RFB in combination with ARV (in mg)

	NVP	EFV	ATV	FPV	IDV	NFV	RTV-boosted ATV, FPV, IDV, TPV, DRV, LPV	MVC	RAL
<b>RFB*</b>	<b>300 qd</b>	<b>450-600 qd</b>	<b>150 qod or tiw</b>	<b>150 qd or 300 tiw</b>	<b>150 qd or 300 tiw</b>	<b>150 qd or 300 tiw</b>	<b>150 qod or tiw</b>	<b>300 qd</b>	<b>300 qd</b>
ARV	200 bid	600 qd	400 qd	1400 bid	1000 q8h	1250 bid	No change	No change	400 bid

\*If RIF were to be replaced by RFB so that PI could be given, allow 2-3 weeks of full dose substitution (RFB 300 mg qd) before the PI is added.

ARV, antiretroviral  
RIF, rifampicin  
RFB, rifabutin  
NVP, nevirapine  
EFV, efavirenz  
RTV, ritonavir

SQV, saquinavir  
LPVr, lopinavir, coformulated with ritonavir  
FPV, fosamprenavir  
IDV, indinavir  
NFV, nelfinavir

TPV, tipranavir  
DRV, darunavir  
MVC, maraviroc  
RAL, raltegravir

<sup>28</sup> US CDC. Managing drug interactions in the treatment of HIV-related tuberculosis. Dec 2007 (Available at [http://www.cdc.gov/tb/TB\\_HIV\\_Drugs](http://www.cdc.gov/tb/TB_HIV_Drugs). Accessed 29 Feb 2008)

