

4. STANDARDIZED TREATMENT REGIMENS

4.1 Objectives of chapter

This chapter describes the recommended standardized treatment regimens for the different categories of tuberculosis cases.

4.2 Aims of treatment

The aims of treatment of tuberculosis are:

- to cure the patient of TB;
- to prevent death from active TB or its late effects;
- to prevent relapse of TB;
- to decrease transmission of TB to others;
- to prevent the development of acquired drug resistance.

It is vital to achieve these aims while preventing the selection of resistant bacilli in infectious patients.

4.3 Essential antituberculosis drugs

There are three main properties of antituberculosis drugs: bactericidal activity, sterilizing activity and the ability to prevent resistance. The essential antituberculosis drugs possess these properties to different extents. Isoniazid and rifampicin are the most powerful bactericidal drugs, active against all populations of TB bacilli. Rifampicin is the most potent sterilizing drug available. Pyrazinamide and streptomycin are also bactericidal against certain populations of TB bacilli. Pyrazinamide is only active in an acid environment. Streptomycin is bactericidal against rapidly multiplying TB bacilli. Ethambutol and thiocetazone are used in association with more powerful drugs to prevent the emergence of resistant bacilli.

Table 4.1 shows the essential antituberculosis drugs and their recommended dosage (range in parentheses).

Table 4.1 **Essential antituberculosis drugs**

Essential drug (abbreviation)	Recommended dosage (dose range) in mg/kg	
	Daily	3 times weekly ^a
isoniazid (H)	5 (4–6)	10 (8–12)
rifampicin (R)	10 (8–12)	10 (8–12)
pyrazinamide (Z)	25 (20–30)	35 (30–40)
streptomycin (S)	15 (12–18)	15 (12–18)
ethambutol (E)	15 (15–20)	30 (20–35)
thioacetazone ^b (T)	2.5	Not applicable

^a WHO does not recommend twice-weekly regimens. If a patient receiving a twice-weekly regimen misses a dose of tablets, this missed dose represents a larger fraction of the total number of treatment doses than if the patient were receiving a thrice-weekly or daily regimen. There is therefore an increased risk of treatment failure. Moreover, HIV-positive patients receiving therapy with twice-weekly doses or less are at increased risk of failure or relapse with acquired rifampicin-resistant TB.

^b WHO discourages the use of thioacetazone because of the risk of severe toxicity, in particular in HIV-infected individuals. It should be replaced by ethambutol, especially in areas where HIV infection is common. Thioacetazone may be used in combination with isoniazid in the continuation phase in areas with low prevalence of HIV infection when financial circumstances preclude the use of ethambutol.

Annex 2 provides information on the recommended dosage and common adverse events of essential antituberculosis drugs. The WHO recommended formulations of antituberculosis drugs and fixed-dose combinations (FDCs) of drugs appear in the WHO Essential Drugs List (EDL). The available formulations and combinations of antituberculosis drugs within each country should conform to this List.

Fixed-dose combination tablets

Tablets of fixed-dose drug combinations have several advantages over individual drugs. First, prescription errors are likely to be less frequent because dosage recommendations are more

straightforward and adjustment of dosage according to patient weight is easier. Second, the number of tablets to ingest is smaller and may thus encourage patient adherence. Third, if treatment is not observed, patients cannot be selective in the choice of drugs to ingest.

Fixed-dose combinations of drugs also have disadvantages. First, if prescription errors do occur, excess dosage (risk of toxicity) or sub-inhibitory concentrations of all drugs (favouring development of drug resistance) may result. Second, health care workers may be tempted to evade directly observed therapy, erroneously believing that adherence is automatically guaranteed. Third, poor rifampicin bioavailability has been found for some FDCs, particularly in combinations of 3- and 4-drugs. Quality assurance is therefore essential. Finally, using FDCs does not obviate the need for separate drugs for a minority of cases that develop drug toxicity.

WHO strongly recommends the use of fixed-dose combination tablets for the treatment of TB. The recommended formulations currently available are shown in Table 4.2.

Table 4.2 **WHO recommended formulations of essential antituberculosis drugs^a**

Separate drugs			
Drug	Dose form	Strength	
isoniazid	tablet	100 mg, 300 mg	
rifampicin	tablet or capsule	150 mg, 300 mg	
pyrazinamide	tablet	400 mg	
ethambutol	tablet	100 mg, 400 mg	
streptomycin	powder for injection in vial	1 g	

Fixed-dose combinations of drugs			
Drug	Dose form	Strength for daily use	Strength for use 3 times weekly
isoniazid + rifampicin	tablet	75 mg + 150 mg 150 mg + 300 mg	150 mg + 150 mg
	tablet or pack of granules ^b	30 mg + 60 mg	60 mg + 60 mg
isoniazid + ethambutol	tablet	150 mg + 400 mg	-
isoniazid + thioacetazone	tablet	100 mg + 50 mg	-
		300 mg + 150 mg	-
isoniazid + rifampicin + pyrazinamide	tablet	75 mg + 150 mg + 400 mg	150 mg + 150 mg + 500 mg
	tablet or pack of granules ^b	30 mg + 60 mg + 150 mg	-
isoniazid + rifampicin + pyrazinamide + ethambutol	tablet	75 mg + 150 mg + 400 mg + 275 mg	-

^a From Essential drugs: WHO Model List (revised December 1999). In: *WHO drug information*, 1999, 13(4):249–262.

^b For paediatric use.

Intermittent use

Isoniazid, rifampicin, pyrazinamide and ethambutol may be as efficacious when given three times weekly as when given daily. Thioacetazone is the only antituberculosis drug ineffective when given intermittently.

Thrice-weekly drug intake facilitates observation, reduces costs and inconvenience for the patient because of fewer visits, and liberates staff for patient retrieval on alternate days. Fully intermittent regimens are used in the two largest TB programmes (China and India) with high levels of effectiveness under programme conditions.

It should be noted that intermittent initial phase therapy is not recommended when the continuation phase of isoniazid and ethambutol is used.

Standardized regimens

The choice by each country of a limited number of standardized regimens should be based on the availability of financial resources, efficacy, effectiveness and applicability in the current health system network, and population distribution and mobility. Standardized regimens have the following advantages over individualized prescription of drugs:

- reduces errors in prescription thereby reducing the risk of development of drug resistance
- facilitates estimates of drug needs, purchasing, distribution and monitoring
- facilitates staff training
- reduces costs
- facilitates regular drug supply when patients move from one area to another.

To facilitate procurement, distribution and administration of treatment to patients, daily dosage may be standardized for 3- or 4- body weight bands – for instance, 30–39, 40–54, 55–70 and over 70 kg (*see Annex 4*) – or a single dosage for most patients with additional rifampicin for patients over 60 kg and individual calculation for children, as in India.

4.4 Recommended standardized treatment regimens

New cases

Treatment regimens have an initial (or intensive) phase lasting two months and a continuation phase usually lasting four or six months. During the initial phase, normally consisting of isoniazid, rifampicin, pyrazinamide and ethambutol, the tubercle bacilli are killed rapidly. Infectious patients quickly become non-infectious (within approximately two weeks). Symptoms abate. The vast majority of patients with sputum smear-positive TB become smear-negative within two months. During the continuation phase, fewer drugs are necessary but for a longer time. The sterilizing effect of the drugs eliminates the remaining bacilli and prevents subsequent relapse.

Patients with a large bacillary load (smear-positive pulmonary TB and many HIV-infected patients with smear-negative pulmonary TB) have an increased risk of selecting resistant bacilli because a large population of bacilli develops spontaneous resistance to a single drug. Short-course chemotherapy regimens, consisting of 4 drugs during the initial phase and 2 drugs during the continuation phase, reduce this risk. Such regimens are highly effective in patients with susceptible bacilli, and almost as effective in patients with initially isoniazid-resistant organisms.

Patients negative for HIV, with smear-negative pulmonary or extrapulmonary TB that is fully drug-susceptible, have little risk of selecting resistant bacilli because their lesions generally harbour fewer bacilli. However, since initial resistance to isoniazid is common in many areas, and HIV testing of tuberculosis patients is not routinely practised, it is now recommended that ethambutol be included as a fourth drug during the initial phase of treatment for most patients with smear-negative and extrapulmonary TB. Ethambutol may be omitted for patients with non-cavitary, smear-negative pulmonary TB who are known to be HIV-negative, patients known to be infected with fully drug-susceptible bacilli, and young children with primary TB.

Re-treatment cases

Previously treated TB patients include those patients treated as new cases for more than one month who are now smear- or culture-positive (failure, relapse, return after default). Re-treatment cases have a higher likelihood of drug resistance, which may have been acquired through inadequate prior chemotherapy. Adherent patients who fail initial treatment are at high risk of having MDR TB.

The standard re-treatment regimen consists of 5 drugs in the initial phase and 3 drugs in the continuation phase. The patient receives 3 drugs throughout the treatment: RHE. This standardized regimen can cure patients excreting bacilli still fully sensitive to the drugs and those excreting bacilli resistant to isoniazid and/or streptomycin. Under proper case management conditions, MDR-TB cases are those most at risk of failure in the re-treatment regimen.

When program conditions permit the use of alternate treatment regimens, the standard retreatment regimen should not be used for failure cases at high risk of MDR TB (see Section 4.8).

4.5 Rationale for prioritizing TB diagnostic categories

From a public health perspective, the highest priority of an NTP is the identification and cure of infectious TB cases, i.e. patients with sputum smear-positive pulmonary TB. In settings of resource constraint, the rational allocation of resources is necessary to prioritize diagnostic categories according to the impact and cost-effectiveness of treatment for each category. Diagnostic categories are therefore ranked from I (highest priority) to IV (lowest priority).

The new WHO recommendations for TB treatment regimens appropriate to the different diagnostic categories (shown in Table 4.3) reflect developments in drug formulations and advances in understanding the response to TB treatment in HIV-infected persons. For example, the benefits of using a single regimen with 4 drugs in the initial phase of treatment for all new patients may outweigh the disadvantages (including over-treatment of many patients with non-severe smear-negative and extrapulmonary TB).

4.6 Standard code for TB treatment regimens

Treatment regimens for TB have a standard code. Each antituberculosis drug has an abbreviation (shown in Table 4.1).

A TB treatment regimen consists of two phases: an initial phase and a continuation phase. The number before a phase is the duration of that phase in months. Letters in parentheses indicate fixed-dose combinations of those drugs. A number in subscript (e.g. ₃) after a letter or letters in parentheses indicates the number of doses of that drug per week. If there is no subscript number, treatment is daily (or 6 times weekly, excluding for instance Sundays). Examples are shown below. An alternative drug (or drugs) appears as a letter (or letters) in square brackets [example not shown].

Examples

2 (HRZE)/4 (HR)₃

The **initial phase** is 2 (HRZE). The duration of the phase is 2 months. Drug treatment is daily, with isoniazid (H), rifampicin (R), pyrazinamide (Z) and ethambutol (E) in fixed-dose combination.

The **continuation phase** is 4 (HR)₃. The duration is 4 months, with isoniazid and rifampicin, in fixed-dose combination, 3 times per week.

2 (HR)ZE/6 (HE)

The **initial phase** is 2 (HR)ZE. The duration of the phase is 2 months. Drug treatment is daily, with isoniazid (H) and rifampicin (R) in fixed-dose combination, plus pyrazinamide (Z) and ethambutol (E).

The **continuation phase** is 6 (HE). The duration of the phase is 6 months. Drug treatment is daily, with isoniazid (H) and ethambutol (E) in fixed-dose combination.

4.7 Recommended treatment regimens for TB diagnostic categories

There are several possible regimens. The regimens recommended in each country's NTP depend on that country's budget, access of patients to PHC services, qualifications of health staff at

peripheral level and current best medical practice. The regimen recommended for each patient depends on the diagnostic category for each patient. Table 4.3 and section 4.8 show alternative regimens for each diagnostic category, which can be used under various circumstances and in certain sub-populations. National TB programmes should decide the most appropriate regimens to be followed at national level.

Table 4.2 shows the recommended formulations of essential antituberculosis drugs. Tables 1 to 4 in Annex 4 show the number of tablets by weight band appropriate for most TB patients.

4.8 Considerations for the continuation phase in new patients (Category I and III)

National TB programmes should choose one of the continuation phase regimens listed below. To facilitate training, drug procurement and supply, and drug administration and to minimize errors in prescription, national recommendations should be as simple as possible and avoid multiple alternatives. The options are:

- **4 HR** daily or three times weekly, given under direct observation, is the preferred continuation phase regimen. The primary advantage of this regimen is the low rate of treatment failure and relapse for both HIV negative and HIV infected patients with fully drug-susceptible TB and those with initial isoniazid resistance. The use of HR requires patient oriented measures to ensure adherence to treatment including wider community and/or family participation in treatment observation, support and health education for the patients and their families, and in some settings the use of incentives and enablers. Disadvantages of this regimen include the possibility of the development of rifampicin-resistant disease in patients with initial isoniazid resistance and drug-drug interactions with some antiretroviral drugs used for HIV-infected patients
- - Daily treatment may be especially appropriate if the patient is hospitalised, or the observer is nearby (neighbour) or at the patient's home (for example mother to small child). *The use of FDCs is highly recommended.*
 - Three times weekly therapy always requires direct observation. Its effectiveness is similar to that of daily therapy. Thrice weekly treatment allows the treatment observer to dedicate alternative days to find and recover patients who interrupted treatment. *The use of FDCs is highly recommended..*
- **6 HE¹** daily, self-administered treatment, with drug provided every two weeks to one month is an acceptable option that should be used when adherence to treatment with HR cannot be assured, e.g., for mobile populations and patients with very limited access to health services. It may be especially appropriate for countries with limited PHC access that are unable to organize a system of direct observation through health facilities, community health workers or volunteers. For HIV-infected patients, any antiretroviral drug combination may be given concomitantly with this regimen. Although drug costs for this regimen are essentially

¹ Some countries still use HT (isoniazid/thioacetazone) instead of HE. Although WHO discourages the use of thioacetazone due to the risk of toxicity, it may be continued in countries where HIV infection is uncommon.

equivalent to that of 4HR, the costs of supervision are much less. In addition, not using rifampicin in the continuation phase may reduce acquired resistance to this drug. However, there is no assurance that the patient is taking all the drugs and treatment interruption is noted only when the patient does not return to collect drugs. Moreover, results from an international multicenter randomised clinical trial found that the combined rate of treatment failure and relapse for this regimen is significantly higher than that for the 6-month regimen with rifampicin throughout (11% vs. 5%). While less effective than HR, the HE regimen is expected to cure the large majority of adherent patients, and its use may help preserve the effectiveness of a rifampicin-based retreatment regimen for patients who fail or relapse. This regimen should be administered daily throughout treatment. ***The use of FDCs is highly recommended.***

4.9 Considerations for the choice of regimen for cases who fail Category I regimen

In most settings treatment failures of the Category I regimen have a higher probability of being multidrug-resistant, particularly if the whole treatment was directly observed and included rifampicin in the continuation phase. The Category II regimen has poor results in MDR-TB cases (less than 50% cure rate) and may result in amplification of drug-resistance.

For this reason, countries with a high proportion of MDR-TB among failures of the Category I regimen should consider to treat such failures with a Category IV regimen. However, it needs to be stressed that the introduction of these regimens for failures of the Category I regimen requires either individualized susceptibility testing (DST) or representative drug-resistance surveillance (DRS) data in the patient category concerned. Culture and DST should be quality assured and all programmatic conditions for the introduction of a DOTS-plus component within the regular DOTS-programme should be met (see chapter 5). In principle, Category IV regimens should only be introduced in well performing DOTS programmes and be tailored to the local situation (drug-resistance patterns, history of drug-use in the country, human and financial resources).

The use of Category IV regimens for failures of the Category I regimen is not recommended in settings where relevant programmatic and DRS data are lacking, nor in programmes where most of the failures to the Category I regimen are due to poor programme performance. In these situations the standard Category II regimen should be applied until sufficient resources are available, the programme is strengthened, and the conditions listed above are met. At the same time, these programs should work toward meeting the conditions required to eliminate the routine use of the Category II regimen in failure cases with moderate to high rates of MDR-TB.

Table 4.3 Recommended treatment regimens for each diagnostic category

TB diagnostic category	TB patients	TB treatment regimens ⁱ	
		Initial phase	Continuation phase
I	New smear-positive patients; new smear-negative PTB with extensive parenchymal involvement; concomitant HIV disease or severe forms of extra-pulmonary TB ⁱⁱ	Preferred 2 HRZE ⁱⁱⁱ	Preferred 4 HR 4 (HR) ₃
		Optional 2 (HRZE) ₃ or 2 HRZE ^{iv}	Optional 4 (HR) ₃ or 6 HE ^v
II	Previously treated sputum smear-positive PTB: - relapse; - treatment after default	Preferred 2 HRZES / 1 HRZE ^{vi}	Preferred 5 HRE ^{vi}
		Optional 2 (HRZES) ₃ /1 HRZE ₃	Optional 5 (HRE) ₃
	- treatment failure of Category I ^{vii} in settings with: - adequate program performance; - representative DRS data showing high rates of MDR TB and/or capacity for DST of cases, and - availability of Category IV regimens	specially designed standardized or individualized regimens are often needed for these patients. (See Section 4.9 and Chapter 5)	
	in settings where - representative DRS data show low rates of MDR TB or individualized DST shows drug-susceptible disease or in settings of - poor program performance, - absence of representative DRS data, - insufficient resources to implement Category IV treatment	Preferred 2 HRZES / 1 HRZE	Preferred 5 HRE ^{vi}
		Optional 2 (HRZES) ₃ /1 HRZE ₃	Optional 5 (HRE) ₃

III	New smear-negative PTB (other than in category I) and less severe forms of extra-pulmonary TB	Preferred 2 HRZE ^{viii}	Preferred 4 HR 4 (HR) ₃
		Optional 2 (HRZE) ₃ or 2 HRZE	Optional 4 (HR) ₃ or 6 HE
IV	Chronic (still sputum-positive after supervised re-treatment); proven or suspected MDR TB cases ^{ix}	Specially designed standardized or individualized regimens	

ⁱ Numbers preceding regimens indicate length of treatment (months). Subscripts following regimens indicate frequency of administration (days per week). When no subscripts are given, the regimen is daily. Direct observation of drug intake is always required during the initial phase of treatment and strongly recommended when rifampicin is used in the continuation phase and required when treatment is given intermittently. FDCs are highly recommended for use in both the initial and continuation phases of treatment.

ⁱⁱ Severe forms of extrapulmonary TB are listed elsewhere (Section 3.5.3).

ⁱⁱⁱ Streptomycin may be used instead of ethambutol. In tuberculous meningitis ethambutol should be replaced by streptomycin.

^{iv} Intermittent initial phase therapy is not recommended when the continuation phase of isoniazid and ethambutol is used.

^v This regimen may be considered in situations where the preferred regimen cannot be applied as recommended. However, it is associated with a higher rate of treatment failure and relapse compared with the 4HR continuation phase regimen (see Section 4.8). Intermittent initial phase treatment is not recommended when followed by the 6HE continuation phase regimen.

^{vi} Daily treatment is preferred. However, thrice weekly treatment during the continuation phase or during both phases is an acceptable option.

^{vii} Treatment failures may be at increased risk of MDR TB, particularly if rifampicin was used in the continuation phase (See Section 4.9). Drug susceptibility testing is recommended for these cases if available. Treatment failures with known or suspected MDR TB should be treated with a Category IV regimen (See Chapter 5).

^{viii} Ethambutol in the initial phase may be omitted for patients with limited, non-cavitary, smear-negative pulmonary TB who are known to be HIV-negative, patients with less severe forms of extrapulmonary TB, and young children with primary TB.

^{ix} Drug susceptibility testing is recommended for patients who are contacts of MDR TB patients.

4.10 Treatment of extrapulmonary TB

Although most commonly affecting the lungs, tuberculosis can involve virtually any organ of the body. In countries with comprehensive diagnostic and reporting systems, extrapulmonary tuberculosis accounts for 20–25% of reported cases, being relatively more frequent in children and persons with HIV infection. Of specific forms, lymphatic, pleural, and bone or joint disease are the most common, while pericardial, meningeal, and disseminated (miliary) forms are more likely to result in a fatal outcome.

In general, extrapulmonary tuberculosis is more difficult to diagnose than pulmonary disease, often requiring invasive procedures to obtain diagnostic specimens and more sophisticated laboratory techniques than sputum microscopy. From a public health perspective, extrapulmonary TB is not of great importance, because patients with this form of disease are not infectious unless they also have pulmonary involvement. Perhaps as a consequence of these two factors, most guidelines for tuberculosis treatment intended for use in low-income countries have not addressed in any detail the treatment of extrapulmonary TB.

Treatment recommendations are further complicated by the paucity of data from controlled clinical trials of extrapulmonary forms of TB. In the pre-rifampicin era, most experts believed that 18–24 months of isoniazid-based treatment (together with para-aminosalicylic acid or ethambutol and supplemented by initial streptomycin) was required to achieve satisfactory results. Subsequently, a number of clinical trials demonstrated that rifampicin-based treatment for 6–9 months gave comparable results. Consequently, most experts now agree that virtually all forms of extrapulmonary TB can be treated with the regimens shown in Table 4.3. Eight-month regimens (2 HRZ/6 HE) have not been evaluated in extrapulmonary TB, but would probably be satisfactory for treatment of less severe forms of disease. In TB meningitis, a 6-month regimen with rifampicin throughout was shown to be as effective as the traditional 9–12 month regimens, with streptomycin used instead of ethambutol in the initial phase.^{ix} Finally, adjunctive steroids may be useful in pericardial and meningeal tuberculosis. Surgery plays little role in the treatment of extrapulmonary TB, being reserved for management of late complications of disease such as hydrocephalus, obstructive uropathy, constrictive pericarditis, and neurological involvement from Pott's disease (spinal TB).

4.11 Treatment regimens in special situations

Pregnancy

A woman should be asked before starting TB treatment if she is pregnant. Most antituberculosis drugs are safe for use in pregnancy. The exception is streptomycin, which is ototoxic to the fetus and should not be used during pregnancy. A pregnant woman should be advised that successful treatment of TB with the recommended standardized regimen is important for successful outcome of pregnancy.

Breastfeeding

A breastfeeding woman who has TB should receive a full course of TB treatment. Timely and properly applied chemotherapy is the best way to prevent transmission of tubercle bacilli to her

baby. All antituberculosis drugs are compatible with breastfeeding; a woman taking them can safely continue to breastfeed. Mother and baby should stay together and the baby continue to be breastfed in the normal way, but be given prophylactic isoniazid for at least 3 months beyond the time the mother is considered to be non-infectious. BCG vaccination of the newborn should be postponed until the end of isoniazid prophylaxis.

Oral contraception

Rifampicin interacts with oral contraceptive medications with a risk of decreased protective efficacy against pregnancy. A woman receiving oral contraception may choose between two options while receiving treatment with rifampicin: following consultation with a clinician, an oral contraceptive pill containing a higher dose of estrogen (50 µg) may be taken, or another form of contraception used.

Liver disorders

Isoniazid, rifampicin and pyrazinamide are all associated with hepatitis. Of the three drugs, R is least likely to cause hepatocellular damage, although it is associated with cholestatic jaundice. Of the three agents, Z is the most hepatotoxic.

Patients with the following conditions can receive the usual short-course chemotherapy regimens provided there is no clinical evidence of chronic liver disease: hepatitis virus carriage, a past history of acute hepatitis, excessive alcohol consumption. However, hepatotoxic reactions to antituberculosis drugs may be more common among these patients and should therefore be anticipated.

Established chronic liver disease

Patients with liver disease should not receive pyrazinamide. Isoniazid plus rifampicin plus one or two non-hepatotoxic drugs such as streptomycin and ethambutol can be used for a total treatment duration of 8 months. Alternative regimens are 9 RE or SHE in the initial phase followed by HE in the continuation phase, with a total treatment duration of 12 months. Recommended regimens are therefore 2 SHRE/6 HR, 9 RE or 2 SHE/10 HE.

Acute hepatitis (e.g. acute viral hepatitis)

Uncommonly, a patient has TB and concurrently acute hepatitis unrelated to TB or TB treatment. Clinical judgement is necessary. In some cases, it is possible to defer TB treatment until the acute hepatitis has resolved. In other cases, when it is necessary to treat TB during acute hepatitis, the combination of (SE) for 3 months is the safest option. If the hepatitis has resolved, the patient can then receive a continuation phase of 6 months isoniazid and rifampicin 6 (HR). If the hepatitis has not resolved, (SE) should be continued for a total of 12 months.

Renal failure

Isoniazid, rifampicin and pyrazinamide are either eliminated almost entirely by biliary excretion or metabolized into non-toxic compounds. These drugs can therefore be given in normal dosage

to patients with renal failure. Patients with severe renal failure should receive pyridoxine with isoniazid in order to prevent peripheral neuropathy.

Streptomycin and ethambutol are excreted by the kidney. Where facilities are available to monitor renal function closely, streptomycin and ethambutol may be given in reduced doses. Thioacetazone is partially excreted in the urine; however, since the margin between a therapeutic dose and a toxic dose is too narrow, patients in renal failure should not receive this drug. The safest regimen for patients with renal failure is 2 HRZ/4 HR.

HIV infection

Generally, TB treatment is the same for HIV-infected as for non-HIV-infected TB patients, with the exception that thioacetazone is contraindicated in those HIV-infected. Streptomycin remains a useful drug in those countries with the capability to ensure the use of sterile needles and syringes. Deaths during treatment, partly due to TB itself and partly due to other HIV-related diseases, are more frequent in HIV-infected patients, particularly in the advanced stages of immunodeficiency. If a pregnant woman is known to be HIV-positive, the availability of antiviral treatment to prevent mother-to-child transmission should be considered. Chapter 10 provides more detailed information.

Suggestions for further reading

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