

Summary of Product Characteristics

1 NAME OF THE MEDICINAL PRODUCT

By-Mycin 50 mg Capsules

2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Each capsule contains:

Doxycycline base 50 mg
(as doxycycline hyclate)

Excipient with known effect:
Each capsule contains 12.13mg of sucrose.

For a full list of excipients see section 6.1

3 PHARMACEUTICAL FORM

Capsules, hard (Capsules)

Size 4, opaque pale green cap and opaque white body, hard gelatin capsules, containing spherical yellow to yellowish micro granules.

4 CLINICAL PARTICULARS

4.1 Therapeutic Indications

By-Mycin has been found clinically effective in the treatment of a variety of infections caused by susceptible strains of Gram-positive and Gram-negative bacteria and certain other micro-organisms.

Respiratory Tract Infections:

Pneumonia and other lower respiratory tract infections due to susceptible strains of *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Klebsiella pneumoniae*, *Moraxella catarrhalis* and other organisms. *Mycoplasma pneumonia pneumonia*. Treatment of chronic bronchitis, sinusitis.

Urinary Tract Infections:

Infections caused by susceptible strains of *Klebsiella* species, *Enterobacter* species, *Escherichia coli*, *Streptococcus faecalis* and other organisms.

Sexually Transmitted Diseases:

Infections due to *Chlamydia trachomatis* including uncomplicated urethral, endocervical or rectal infections. Non-gonococcal urethritis caused by *Ureaplasma urealyticum* (Tmycoplasma).

By-Mycin is also indicated in infections due to *Calymmatobacterium granulomatis*. By-Mycin is an alternative drug in the treatment of gonorrhoea and syphilis.

Dermatological infections:

Acne vulgaris and acne conglobata.

Since By-Mycin is a member of the tetracycline series of antibiotics, it may be expected to be useful in the treatment of infections, which respond to other tetracyclines such as:

Ophthalmic infections:

By-Mycin is indicated in the treatment of trachoma, although the infectious agent is not always eliminated, as judged by immunofluorescence. Inclusion conjunctivitis may be treated with oral By-Mycin alone or in combination with topical agents.

Rickettsial Infections:

Rocky Mountain spotted fever, typhus group, Q fever and Coxiella endocarditis.

Other Infections:

Psittocosis, brucellosis (in combination with streptomycin), cholera, bubonic plague, louse and tick-borne relapsing fever, including stage 1 and stage 2 Lyme disease, leptospirosis, tularaemia glanders, chloroquine-resistant falciparum malaria and acute intestinal amoebiasis (as an adjunct to amoebicides). Infections due to susceptible strains of *Bacteroides* species, *Listeria* species and *Bacillus anthracis*.

By-Mycin is an alternative drug in the treatment of leptosporosis, gas gangrene and tetanus. By-Mycin is indicated for prophylaxis in the following conditions: Scrub typhus travellers' diarrhoea (enterotoxigenic *Escherichia coli*) leptospirosis, malaria and cholera.

Consideration should be given to official guidance on the appropriate use of antibacterial agents.

4.2 Posology and method of administrationPosology**Adults and children aged 12 years to less than 18 years**

The usual dose of By-Mycin for the treatment of acute infections in adults and children aged 12 years to less than 18 years is an initial dose of 200mg on the first day (administered as a single dose or divided into two equal doses with a 12 hour interval) followed by a maintenance dose of 100mg/day. For more severe infections (particularly chronic infections of the urinary tract) 200mg daily should be given throughout the treatment period.

Method of Administration

By-Mycin should be administered with adequate amounts of fluid (at least 100ml of water). This should be done in the sitting or standing position and the patient should be advised to remain upright for at least thirty minutes and well before retiring at night to reduce the risk of oesophageal irritation and ulceration. If gastric irritation occurs, it is recommended that By-Mycin be given with food or milk. Studies indicate that the absorption of By-Mycin is not notably influenced by simultaneous ingestion of food or milk.

Exceeding the recommended dosage may result in an increased incidence of side effects.

Therapy should be continued at least 24 to 48 hours after symptoms and fever have subsided.

When used in streptococcal infections, therapy should be continued for 10 days to prevent the development of rheumatic fever or glomerulonephritis.

Dosage recommendations in specific infections:

Acne vulgaris: the recommended dose is 50mg daily, for a minimum of 6 weeks.

Sexually Transmitted Diseases: 100mg twice daily for 7 days is recommended in the following infections:

Uncomplicated urethral, endocervical or rectal infection caused by *Chlamydia trachomatis*, non-gonococcal urethritis caused by *Ureaplasma urealyticum*.

Uncomplicated gonococcal infections (except anorectal infections in men) doxycycline 100mg twice daily for 7 days together with intramuscular ceftriaxone.

Acute epididymo-orchitis caused by *Chlamydia trachomatis* or *Neisseria gonorrhoeae*

Doxycycline 100mg twice daily for 10 days together with intramuscular ceftriaxone.

Primary and Secondary syphilis: Non-pregnant penicillin-allergic patients who have primary or secondary syphilis can be treated with the following regimen: doxycycline 100mg orally twice daily for two weeks, as an alternative to penicillin therapy.

Louse and tick-borne relapsing fevers and louse borne typhus: A single dose of 100 to 200mg according to severity.

Early Lyme disease (Stage 1 and 2): 100mg twice daily for 10-30 days according to clinical signs, symptoms and response.

Chloroquine-resistant falciparum malaria: 200mg daily for at least 7 days. Due to the potential severity of the infection, a rapid-acting schizonticide such as quinine should always be given in conjunction with By-Mycin, quinine dosage recommendations vary in different areas.

Prophylaxis of Malaria: 100mg daily in adults. Prophylaxis can begin 1-2 days before travel to malarious areas. It should be continued daily during travel in the malarious areas and for 4 weeks after the traveller leaves the malarious area.

For the treatment and selective prophylaxis of cholera in adults: 300mg as a single dose.

For the prevention of scrub typhus: 200mg as a single dose, once weekly.

For the prevention of travellers' diarrhoea in adults: 200mg on the first day of travel (administered as a single dose or as 100mg every 12 hours) followed by 100mg daily throughout the stay in the area. Data on the use of the drug prophylactically are not available beyond 21 days.

For the treatment of leptospirosis: 100mg twice daily for 7 days.

For the prevention of leptospirosis: 200mg once each week throughout the stay in the area and 200mg at the completion of the trip. Data on the use of the drug prophylactically are not available beyond 21 days.

Infections due to susceptible strains of *Bacillus anthracis*: Adults: 100mg of doxycycline, by mouth, twice a day for 60 days.

Use in patients with impaired hepatic function: By-Mycin should be administered with caution to patients with hepatic impairment or those receiving potentially hepatotoxic drugs.

Use in patients with renal impairment: Studies to date have indicated that administration of By-Mycin at the usual recommended doses does not lead to accumulation of the antibiotic in patients with renal impairment.

Use in the elderly: By-Mycin may be prescribed in the usual dose with no special precautions. No dosage adjustment is necessary in the presence of renal impairment.

Rocky Mountain spotted fever

By-Mycin is the first line treatment for adults and children of all ages:

ADULTS: 100 mg every 12 hours.

CHILDREN: weighing less than 45 kg: 2.2 mg/kg body weight given twice a day.

Children weighing 45 kg or more should receive the adult dose (see section 4.4 paediatric population).

Patients should be treated for at least 3 days after the fever subsides and until there is evidence of clinical improvement.

Minimum course of treatment is 5-7 days.

Paediatric population

Children aged 8 years to less than 12 years. (Section 4.4)

The use of doxycycline for the treatment of acute infections in children aged 8 years to less than 12 years should be carefully justified in situations where other drugs are not available, are not likely to be effective or are contraindicated.

In such circumstance, the doses for the treatment of acute infections are:

For children 45 kg or less- Initial dose: 4.4 mg/kg (in single or 2 divided doses) with maintenance dose: 2.2 mg/kg (in single or 2 divided doses). In the management of more severe infections, up to 4.4 mg/kg should be given throughout treatment.

For children, over 45 kg - Dose administered for adults should be used.

Children aged from birth to less than 8 years.

Doxycycline should not be used in children aged younger than 8 years due to the risk of teeth discolouration. (Section 4.4 and 4.8)

4.3 Contraindications

Hypersensitivity to doxycycline, or to any other tetracyclines or to any of the excipients listed in section 6.1.

- Pregnancy

Doxycycline is contra-indicated in pregnancy. It appears that the risks associated with the use of tetracyclines during pregnancy are predominantly due to effects on teeth and skeletal development. (See Section 4.4 regarding use during tooth development).

- Nursing Mothers

Tetracyclines are excreted into milk and are therefore contra-indicated in nursing mothers. (See Section 4.4 regarding use during tooth development).

- Paediatric population

By-Mycin is contraindicated in children under the age of 8 years. As with other tetracyclines, By-Mycin forms a stable calcium complex in any bone-forming tissue. A decrease in the fibula growth rate has been observed in prematures given oral tetracyclines in doses of 25 mg/kg every 6 hours. This reaction was shown to be reversible when the drug was discontinued. (See above about use during tooth development).

- Obstructive oesophageal disorders, such as stricture or achalasia.

4.4 Special warnings and precautions for use

- **Paediatric population**

The use of drugs of the tetracycline class during tooth development (last half of pregnancy; infancy and childhood to the age of 8 years) may cause permanent discolouration of the teeth (yellow-grey-brown). This adverse reaction is more common during long-term use of the drugs but has been observed following repeated short-term courses. Enamel hypoplasia has also been reported. Use doxycycline in paediatric patients aged younger than 8 years only when the potential benefits are expected to outweigh the risks in severe or life-threatening conditions (e.g. Rocky Mountain spotted fever), only when there are no adequate alternative therapies.

Although the risk of permanent teeth staining is rare in children aged 8 years to less than 12 years, the use of doxycycline should be carefully justified in situations where other drugs are not available, are not likely to be effective or are contraindicated.

- **Use in Patients with Impaired Hepatic Function:**

Doxycycline should only be used with caution in patients with hepatic dysfunction or those receiving potentially hepatotoxic drugs. Abnormal hepatic function has been reported rarely and has been caused by both the oral and parenteral administration of tetracyclines, including doxycycline.

- **Use in Patients with Renal Impairment:**

Excretion of doxycycline by the kidney is about 40%/72 hours in individuals with normal renal function. This percentage excretion may fall to a range as low as 1-5%/72 hours in individuals with severe renal insufficiency (creatinine clearance below 10ml/min).

Studies have shown no significant difference in the serum half-life of doxycycline in individuals with normal and severely impaired renal function. Haemodialysis does not alter the serum half-life of doxycycline.

The anti-anabolic action of the tetracyclines may cause an increase in blood urea. Studies to date indicate that this does not occur with doxycycline in patients with impaired renal function.

- **General**

Severe skin reactions, such as exfoliative dermatitis, erythema multiforme, Stevens-Johnson syndrome, toxic epidermal necrolysis, and drug reaction with Eosinophilia and systemic symptoms (DRESS) have been reported in patients receiving doxycycline (see section 4.8). If severe skin reactions occur, doxycycline should be discontinued immediately and appropriate therapy should be instituted.

- **Oesophagitis:** Cases of oesophageal injuries (oesophagitis and ulceration), sometimes serious, have been reported. Patients should be instructed to take doxycycline with plenty of water (at least 100ml), remain upright and not take their treatment before going to bed (see section 4.2). Withdrawal of doxycycline and investigation of oesophageal disorder should be considered if symptoms such as dyspepsia or retrosternal pain occur.

Caution is required in the treatment of patients with known oesophageal reflux disorders.

- **Patients with rare hereditary problems of fructose intolerance, glucose-galactose malabsorption or sucrose-isomaltase insufficiency should not take this medicine.**
- **Photosensitivity**

Photosensitivity manifested by an exaggerated sunburn reaction has been observed in some individuals taking tetracyclines, including doxycycline. Patients likely to be exposed to direct sunlight or ultraviolet light should be advised that this reaction can occur with tetracycline drugs and treatment should be discontinued at the first evidence of skin erythema.

- **Microbiological overgrowth**

The use of antibiotics may occasionally result in over-growth of non-susceptible organisms. Constant observation of the patient is essential. If a resistant organism appears, the antibiotic should be discontinued and appropriate therapy instituted. Cross-resistance between tetracyclines may develop in micro-organisms and cross-sensitisation in patients. Prolonged use of an anti-infective may result in the development of infection due to micro-organisms resistant to the anti-infective.

- **General**

Benign intracranial hypertension (pseudotumorcerebri) has been associated with the use of tetracyclines including doxycycline. Benign intracranial hypertension (pseudotumorcerebri) is usually transient; however cases of permanent visual loss secondary to benign intracranial hypertension (pseudotumorcerebri) have been reported with tetracyclines including doxycycline. If visual disturbance occurs during treatment, prompt ophthalmologic evaluation is warranted. Since intracranial pressure can remain elevated for weeks after drug cessation patients should be monitored until they stabilize. Concomitant use of isotretinoin and doxycycline should be avoided because isotretinoin is also known to cause benign intracranial hypertension (pseudotumorcerebri).

- Pseudomembranous colitis has been reported with nearly all antibacterial agents, including doxycycline, and has ranged in severity from mild to life-threatening. It is important to consider this diagnosis in patients who present with diarrhoea subsequent to the administration of antibacterial agents.

Clostridium difficile associated diarrhoea (CDAD) has been reported with use of nearly all antibacterial agents, including doxycycline, and may range in severity from mild diarrhoea to fatal colitis. Treatment with antibacterial agents alters the normal flora of the colon leading to overgrowth of *C. difficile*.

C. difficile produces toxins A and B which contribute to the development of CDAD.

Hypertoxin producing strains of *C. difficile* cause increased morbidity and mortality, as these infections can be refractory to antimicrobial therapy and may require colectomy. CDAD must be considered in all patients who present with diarrhoea following antibiotic use. Careful medical history is necessary since CDAD has been reported to occur over two months after the administration of antibacterial agents.

- **Bulging fontanelles** in infants and benign intracranial hypertension in juveniles and adults have been reported in individuals receiving full therapeutic dosages. These conditions disappeared rapidly when the drug was discontinued.
- **Venereal disease**

When treating venereal disease where co-existent syphilis is suspected, proper diagnostic procedures, including dark-field examinations, should be utilised. In all such cases monthly serological tests should be made for at least four months.

- **Beta-haemolytic streptococci infections**

Infections due to a group A beta-haemolytic streptococci should be treated for at least 10 days.

- **Jarisch-Herxheimer reaction**

Some patients with spirochete infections may experience a Jarisch-Herxheimer reaction shortly after doxycycline treatment is started. Patients should be reassured that this is a usually self-limiting consequence of antibiotic treatment of spirochete infections.

- **Myasthenia gravis**

Due to a potential for weak neuromuscular blockade, care should be taken in administering tetracyclines to patients with myasthenia gravis.

- **Systemic lupus erythematosus**

Tetracyclines can cause exacerbation of SLE (see section 4.8).

4.5 Interaction with other medicinal products and other forms of interactions

- There have been reports of prolonged prothrombin time in patients taking warfarin and doxycycline. Because the tetracyclines have been shown to depress plasma prothrombin activity, patients who are on anticoagulant therapy may require downward adjustment of their anticoagulant dosage.
- The absorption of doxycycline is impaired by concurrently administered antacids containing aluminium, calcium, magnesium or other drugs containing these cations; oral zinc, iron salts or bismuth preparations.
- Tetracyclines may prolong the action of coumarin anti-coagulants and per se delay coagulation.
- The serum half-life of doxycycline is shortened when patients are concurrently receiving alcohol, barbiturates, carbamazepine or phenytoin.
- Since bacteriostatic drugs may interfere with the bactericidal action of penicillin, it is advisable to avoid giving doxycycline in conjunction with penicillin.
- The concurrent use of tetracyclines and methoxyflurane has been reported to result in fatal renal toxicity.
- A few cases of pregnancy or breakthrough bleeding have been attributed to the concurrent use of tetracyclines with oral contraceptives.

- **Laboratory Test Interactions**

False elevations of urinary catecholamine levels may occur due to interference with the fluorescence test.

4.6 Fertility, pregnancy and lactation

Pregnancy

By-Mycin has not been studied in pregnant patients. It should not be used in pregnancy unless, in the judgement of the physician, it is essential for the welfare of the patient. (See contraindications section about use during tooth development).

Results of animal studies indicate that tetracyclines cross the placenta, are found in foetal tissues and can have toxic effects on the developing foetus (often related to retardation of skeletal development). Evidence of embrotoxicity has also been noted in animals treated in early pregnancy.

Breast-feeding

Doxycycline crosses the placenta and is present in the milk of lactating women who are taking a drug of this kind and; it should not be used in pregnant women and in nursing mothers (See contraindications 4.3 section about use during tooth development).

4.7 Effects on ability to drive and use machines

Patients on this drug should not drive or operate machinery unless the doxycycline has been shown not to affect their physical ability. The effect of doxycycline on the ability to drive and operate heavy machinery has not been studied. There is no evidence to suggest that doxycycline may affect these abilities.

4.8 Undesirable effects

The following convention has been utilised for the classification of undesirable effects:-

Very common ($\geq 1/10$), Common ($\geq 1/100$ to $< 1/10$), Uncommon ($\geq 1/1,000$ to $< 1/100$), Rare ($\geq 1/10,000$ to $< 1/1,000$), Very rare ($< 1/10,000$), not known (cannot be estimated from the available data)

The following adverse reactions have been observed in patients receiving tetracyclines, including doxycycline.

Adverse Reactions Table

System Organ Class	Very Common $\geq 1/10$	Common $\geq 1/100$ to $< 1/10$	Uncommon $\geq 1/1000$ to $< 1/100$	Rare $\geq 1/10000$ to $< 1/1000$	Not known
Infections and Infestations				Pseudomembranous colitis <i>C.difficile</i> diarrhoea	
Blood and Lymphatic System Disorders				Thrombocytopaenia Haemolytic anaemia Neutropenia Eosinophilia	
Immune System Disorders		Anaphylactic Reaction (including Hypersensitivity, Anaphylactic Shock, Anaphylactoid reaction, Henoch-Schonlein purpura, Pericarditis, Angioedema, Exacerbation of systemic lupus erythematosus (see section 4.4), Dyspnoea, Serum sickness, Peripheral oedema and Urticaria)		Drug Rash with Eosinophilia and Systemic Symptoms (DRESS), Jarisch-Herxheimer reaction ^c (see Section 4.4)	
Endocrine Disorders				Brown-black microscopic discoloration of thyroid glands	
Metabolism and Nutrition Disorders				Anorexia, decreased appetite	
Nervous System Disorders		Headache		Fontanelle bulging, Benign intracranial hypertension, (pseudotumorcerebri) ^d	
Cardiac Disorders		Tachycardia			
Ear and Labyrinth Disorders				Tinnitus	

Eye disorders				Visual disturbance ^e	
Vascular Disorders		Hypotension		Flushing	
Gastrointestinal Disorders		Nausea/vomiting	Dyspepsia (Heartburn/gastritis)	Pancreatitis, pseudomembranous colitis, <i>Clostridium difficile</i> colitis, Oesophageal ulcerations Oesophagitis Enterocolitis Inflammatory lesions (with monilial overgrowth) in the anogenital region Abdominal pain Diarrhoea Dysphagia Glossitis	Tooth discolouration ^a
Hepatobiliary Disorders				Hepatotoxicity Hepatitis Hepatic Function Abnormal	
Skin and Subcutaneous Tissue Disorders	Photosensitivity Reaction, rash including maculopapular and erythematous rashes			Toxic epidermal necrolysis, Stevens-Johnson syndrome, erythema multiforme, dermatitis exfoliative, photoonycholysis, Skin Hyperpigmentation ^b	
Musculoskeletal, Connective Tissue and Bone Disorders				Arthralgia, myalgia	
Renal and Urinary Disorders				Blood urea increased	

^aReversible and superficial discolouration of permanent teeth has been reported with the use of doxycycline but frequency cannot be estimated from available data

^bwith chronic use of doxycycline.

^cin the setting of spirochete infections treated with doxycycline.

^dIn association with tetracyclines, including doxycycline, benign intracranial hypertension has been reported with possible symptoms of headache, vomiting, visual disturbances including blurred vision, scotoma, diplopia or permanent loss of vision. The manifestation of clinical symptoms, including headache or visual disturbances, should suggest a possible diagnosis of intracranial hypertension. If an increase in intracranial pressure is suspected during treatment with tetracyclines, administration should be discontinued.

^eAssociated with Benign intracranial hypertension (pseudotumor cerebri).

Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via HPRA Pharmacovigilance, Earlsfort Terrace, IRL – Dublin 2; Tel: +353 1 6764971; Fax: +353 1 6762517. Website: www.hpra.ie; E-mail: medsafety@hpra.ie

4.9 Overdose

Acute over-dosage with antibiotics is rare. Toxic effects are usually due to hypersensitivity reactions and should be treated as such.

In the event of overdose discontinue medication. Gastric lavage plus appropriate supportive treatment is indicated. Dialysis does not alter serum half-life and thus would not be of benefit in treating cases of overdose.

5 PHARMACOLOGICAL PROPERTIES

5.1 Pharmacodynamic properties

Pharmacotherapeutic group: Tetracyclines, ATC Code: J01 AA02.

Doxycycline has a mode of action and a spectrum of anti-infective activity similar to but slightly broader than that of tetracycline.

By-Mycin is primarily bacteriostatic and is believed to exert its antimicrobial effect by the inhibition of protein synthesis. By-Mycin is active against a wide range of Gram-positive and Gram-negative bacteria and certain other micro-organisms.

By-Mycin has a high degree of lipid solubility and a low affinity for calcium. It is highly stable in normal human serum. By-Mycin will not degrade into an epianhydro form.

5.2 Pharmacokinetic properties

Absorption

Tetracyclines are readily absorbed and are bound to plasma proteins in varying degrees. They are concentrated by the liver in the bile and excreted in the urine and faeces at high concentrations and in a biologically active form. Doxycycline is virtually completely absorbed after oral administration. Studies reported to date indicate that the absorption of doxycycline, unlike certain other tetracyclines, is not notably influenced by the ingestion of food or milk.

Following a 200 mg dose, normal adult volunteers averaged peak serum levels of 2.6 micrograms/ml of doxycycline at 2 hours decreasing to 1.45 micrograms/ml at 24 hours.

Distribution

Studies have shown no significant difference in serum half-life of By-Mycin (range 18 to 22 hours) in individuals with normal or severely impaired renal function.

Elimination

Haemodialysis does not alter the serum half-life of By-Mycin.
The drug is lipid soluble.

5.3 Preclinical safety data

Not applicable.

6 PHARMACEUTICAL PARTICULARS

6.1 List of excipients

Sucrose
Maize starch
Crospovidone
Eudragit E100
(Poly [butylmethacrylate (2-dimethylaminoethyl) meth-acrylate Methyl methacrylate] 1:2:1)
Talc

Capsule shell

Gelatine
Titanium dioxide (E171)
Indigocarmine (E132)
Quinoline yellow (E104)

6.2 Incompatibilities

Not applicable.

6.3 Shelf life

3 years.

6.4 Special precautions for storage

Do not store above 25°C.

6.5 Nature and contents of container

Doxycycline capsules are packed in blister packs made of one sheet of 200 micron rigid, opaque white polyvinyl chloride and a second sheet of 20 micron aluminium.

Presented in boxes of 2 and 28 capsules.

Not all pack sizes may be marketed.

6.6 Special precautions for disposal of a used medicinal product or waste materials derived from such medicinal product and other handling of the product

No special requirements.

7 MARKETING AUTHORISATION HOLDER

Fannin Limited
Fannin House
South County Business Park
Leopardstown
Dublin 18
Ireland

8 MARKETING AUTHORISATION NUMBER

PA1457/010/001

9 DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION

Date of first authorisation: 8th September 1994

Date of last renewal: 8th September 2009

10 DATE OF REVISION OF THE TEXT

August 2021