

## **DOXYCYCLINE- doxycycline tablet** **Chartwell RX, LLC**

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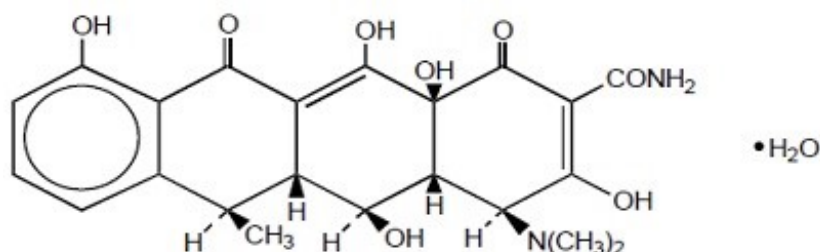
### **DOXYCYCLINE tablets, USP** **Rx only**

To reduce the development of drug-resistant bacteria and maintain the effectiveness of doxycycline tablets and other antibacterial drugs, doxycycline tablets should be used only to treat or prevent infections that are proven or strongly suspected to be caused by bacteria.

### **DESCRIPTION**

Doxycycline, USP is a broad-spectrum antibacterial synthetically derived from oxytetracycline. Doxycycline 100 mg and 50 mg tablets contain doxycycline monohydrate equivalent to 100 mg, or 50 mg of doxycycline, USP for oral administration. The chemical designation of the light-yellow crystalline powder is alpha-6-deoxy-5-oxytetracycline.

Structural formula:



$C_{22}H_{24}N_2O_8 \cdot H_2O$

M.W. = 462.45

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

Inert ingredients: lactose monohydrate, microcrystalline cellulose, sodium starch glycolate, hypromellose 2910, magnesium stearate and opadry 04G84829 pink which contains: hypromellose 2910, talc, titanium dioxide, propylene glycol, polyethylene glycol 6000, iron oxide yellow and iron oxide red.

### **CLINICAL PHARMACOLOGY**

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 feces at high concentrations in a biologically active form. Doxycycline is virtually completely absorbed after oral administration.

Following a 200 mg dose of doxycycline monohydrate, 24 normal adult volunteers averaged the following serum concentration values:

| Time (hr):                    | 0.5                       | 1.0  | 1.5  | 2.0  | 3.0  | 4.0  | 8.0  | 12.0 | 24.0 | 48.0 | 72.0         |
|-------------------------------|---------------------------|------|------|------|------|------|------|------|------|------|--------------|
| Conc.                         | 1.02                      | 2.26 | 2.67 | 3.01 | 3.16 | 3.03 | 2.03 | 1.62 | 0.95 | 0.37 | 0.15 (µg/mL) |
| Average Observed Values       |                           |      |      |      |      |      |      |      |      |      |              |
| Maximum Concentration         | 3.61 µg/mL (± 0.9 sd)     |      |      |      |      |      |      |      |      |      |              |
| Time of Maximum Concentration | 2.60 hr (± 1.10 sd)       |      |      |      |      |      |      |      |      |      |              |
| Elimination Rate Constant     | 0.049 per hr (± 0.030 sd) |      |      |      |      |      |      |      |      |      |              |
| Half-Life                     | 16.33 hr (± 4.53 sd)      |      |      |      |      |      |      |      |      |      |              |

Excretion of doxycycline by the kidney is about 40%/72 hours in individuals with normal function (creatinine clearance about 75 mL/min). This percentage excretion may fall as low as 1-5%/72 hours in individuals with severe renal insufficiency (creatinine clearance below 10 mL/min). Studies have shown no significant difference in serum half-life of doxycycline (range 18-22 hours) in individuals with normal and severely impaired renal function.

Hemodialysis does not alter serum half-life.

Population pharmacokinetic analysis of sparse concentration-time data of doxycycline following standard of care intravenous and oral dosing in 44 pediatric patients (2-18 years of age) showed that allometrically -scaled clearance (CL) of doxycycline in pediatric patients  $\geq 2$  to  $\leq 8$  years of age (median [range] 3.58 [2.27-10.82] L/h/70 kg, N =11) did not differ significantly from pediatric patients  $>8$  to 18 years of age (3.27 [1.11-8.12] L/h/70 kg, N=33). For pediatric patients weighing  $\leq 45$  kg, body weight normalized doxycycline CL in those  $\geq 2$  to  $\leq 8$  years of age (median [range] 0.071 [0.041-0.202] L/kg/h, N=10) did not differ significantly from those  $>8$  to 18 years of age (0.081 [0.035-0.126] L/kg/h, N=8). In pediatric patients weighing  $>45$  kg, no clinically significant differences in body weight normalized doxycycline CL were observed between those  $\geq 2$  to  $\leq 8$  years (0.050 L/kg/h, N=1) and those  $>8$  to 18 years of age (0.044 [0.014-0.121] L/kg/h, N=25). No clinically significant difference in CL between oral and IV dosing was observed in the small cohort of pediatric patients who received the oral (N=19) or IV (N=21) formulation alone.

## Microbiology:

### Mechanism of Action

Doxycycline inhibits bacterial protein synthesis by binding to the 30S ribosomal subunit. Doxycycline has bacteriostatic activity against a broad range of Gram-positive and Gram-negative bacteria.

### Resistance

Cross resistance with other tetracyclines is common.

### Antimicrobial Activity

Doxycycline has been shown to be active against most isolates of the following microorganisms, both *in vitro* and in clinical infections (see INDICATIONS AND USAGE)

### Gram-Negative Bacteria

*Acinetobacter species*

*Bartonella bacilliformis*

*Brucella species*

*Campylobacter fetus*

*Enterobacter aerogenes*

*Escherichia coli*

*Francisella tularensis*

*Haemophilus ducreyi*

*Haemophilus influenzae*

*Klebsiella granulomatis*

*Klebsiella species*

*Neisseria gonorrhoeae*

*Shigella species*

*Vibrio cholerae*

*Vibrio fetus*

*Yersinia pestis*

### **Gram-Positive Bacteria**

*Bacillus anthracis*

*Listeria monocytogenes*

*Streptococcus pneumoniae*

### **Anaerobes**

*Clostridium species*

*Fusobacterium fusiforme*

*Propionibacterium acnes*

### **Other Bacteria**

*Nocardiae and other aerobic Actinomyces species*

*Borrelia recurrentis*

*Chlamydophila psittaci*

*Chlamydia trachomatis*

*Mycoplasma pneumoniae*

*Rickettsiae*

*Treponema pallidum*

*Treponema pallidum subspecies pertenue*

*Ureaplasma urealyticum*

### **Parasites**

*Balantidium coli*

*Entamoeba species*

## **Susceptibility Testing Methods**

When available, the clinical microbiology laboratory should provide the results of *in vitro* susceptibility test results for antimicrobial drugs used in local hospitals and practice areas as periodic reports that describe the susceptibility profile of nosocomial and community-acquired pathogens. These reports should aid the physician in selecting the most effective antimicrobial.

### **Dilution Techniques**

Quantitative methods are used to determine antimicrobial minimum inhibitory concentrations (MICs). These MICs provide estimates of the susceptibility of bacteria to antimicrobial compounds. The MICs should be determined using a standardized test method (broth and/or agar). 1,2,4,6,7 The MIC values should be interpreted according to the criteria provided in Table 1.

### **Diffusion Techniques**

Quantitative methods that require measurement of zone diameters can also provide reproducible estimates of the susceptibility of bacteria to antimicrobial compounds. The zone size provides an estimate of the susceptibility of bacteria to antimicrobial compounds. The zone size should be determined using a standard test method. 1,3,4 This procedure uses paper disks impregnated with 30 mcg doxycycline to test the susceptibility of bacteria to doxycycline. The disk diffusion interpretive criteria are provided in Table 1.

### **Anaerobic Techniques**

For anaerobic bacteria, the susceptibility to doxycycline can be determined by a standardized test method. 1,5 The MIC values obtained should be interpreted according to the criteria provided in Table 1.

Table 1: Susceptibility Test Interpretive Criteria for Doxycycline and Tetracycline

| Bacteria*   | Minimal Inhibitory Concentration (mcg/mL) |          |            | Zone Diameter (mm) |                |            | Agar Dilution (mcg/mL) |        |        |
|---|---|----------|------------|--------------------|----------------|------------|------------------------|--------|--------|
|   | S   | I        | R          | S                  | I              | R          | S                      | I      | R      |
| <i>Acinetobacter</i> spp.<br>Doxycycline<br>Tetracycline                        | ≤4<br>≤4                                  | 8<br>8   | ≥16<br>≥16 | ≥13<br>≥15         | 10-12<br>12-14 | ≤9<br>≤11  | -<br>-                 | -<br>- | -<br>- |
| <i>Anaerobes</i><br>Tetracycline  | -   | -        | -          | -                  | -              | -          | ≤4                     | 8      | ≥16    |
| <i>Bacillus anthracis</i> <sup>†</sup><br>Doxycycline<br>Tetracycline           | ≤1<br>≤1                                  | -<br>-   | -<br>-     | -<br>-             | -<br>-         | -<br>-     | -<br>-                 | -<br>- | -<br>- |
| <i>Brucella species</i> <sup>†</sup><br>Doxycycline<br>Tetracycline             | ≤1<br>≤1                                  | -<br>-   | -<br>-     | -<br>-             | -<br>-         | -<br>-     | -<br>-                 | -<br>- | -<br>- |
| <i>Enterobacteriaceae</i><br>Doxycycline<br>Tetracycline                        | ≤4<br>≤4                                  | 8<br>8   | ≥16<br>≥16 | ≥14<br>≥15         | 11-13<br>12-14 | ≤10<br>≤11 | -<br>-                 | -<br>- | -<br>- |
| <i>Francisella tularensis</i> <sup>†</sup><br>Doxycycline<br>Tetracycline       | ≤4<br>≤4                                  | -<br>-   | -<br>-     | -<br>-             | -<br>-         | -<br>-     | -<br>-                 | -<br>- | -<br>- |
| <i>Haemophilus influenzae</i><br>Tetracycline                                   | ≤2  | 4        | ≥8         | ≥29                | 26-28          | ≤25        | -                      | -      | -      |
| <i>Mycoplasma pneumoniae</i> <sup>†</sup><br>Tetracycline                       | -   | -        | -          | -                  | -              | -          | ≤2                     | -      | -      |
| <i>Neisseria gonorrhoeae</i> <sup>†</sup><br>Tetracycline                       | -   | -        | -          | ≥38                | 31-37          | ≤30        | ≤0.25                  | 0.5-1  | ≥2     |
| <i>Nocardiae</i> and other aerobic<br><i>Actinomyces</i> species<br>Doxycycline | ≤1  | 2-4      | ≥8         | -                  | -              | -          | -                      | -      | -      |
| <i>Streptococcus pneumoniae</i><br>Doxycycline<br>Tetracycline                  | < 0.25<br><1                              | 0.5<br>2 | ≥1<br>≥4   | ≥28<br>≥28         | 25-27<br>25-27 | <24<br>≤24 | -<br>-                 | -<br>- | -<br>- |
| <i>Vibrio cholerae</i><br>Doxycycline<br>Tetracycline                           | ≤4<br>≤4                                  | 8<br>8   | ≥16<br>≥16 | -<br>-             | -<br>-         | -<br>-     | -<br>-                 | -<br>- | -<br>- |
| <i>Yersinia pestis</i><br>Doxycycline<br>Tetracycline                           | ≤4<br>≤4                                  | 8<br>8   | ≥16<br>≥16 | -<br>-             | -<br>-         | -<br>-     | -<br>-                 | -<br>- | -<br>- |
| <i>Ureaplasma urealyticum</i><br>Tetracycline                                   | -   | -        | -          | -                  | -              | -          | ≤1                     | -      | ≥2     |

\*Organisms susceptible to tetracycline are also considered susceptible to doxycycline. However, some organisms that are intermediate or resistant to tetracycline may be susceptible to doxycycline.

†The current absence of resistance isolates precludes defining any results other than "Susceptible". If isolates yielding MIC results other than susceptible, they should be submitted to a reference laboratory for further testing.

‡Gonococci with 30 mcg tetracycline disk zone diameters of less than 19 mm usually indicate a plasmid-mediated tetracycline resistant *Neisseria gonorrhoeae* isolate. Resistance in these strains should be confirmed by a dilution test (MIC  $\geq$  16 mcg/mL).

A report of Susceptible (S) indicates that antimicrobial is likely to inhibit growth of the microorganism if the antimicrobial drug reaches the concentration usually achievable at the site of infection. A report of Intermediate (I) indicates that the result should be considered equivocal, and, if the microorganism is not fully susceptible to alternative, clinically feasible drugs, the test should be repeated. This category implies possible clinical applicability in body sites where the drug product is physiologically concentrated or in situations where high dosage of drug can be used. This category also provides a buffer zone that prevents small uncontrolled technical factors from causing major discrepancies in interpretation. A report of Resistant (R) indicates that the antimicrobial drug is not likely to inhibit growth of the microorganism if the antimicrobial drug reaches the concentrations usually achievable at the infection site; other therapy should be selected.

### Quality Control

Standardized susceptibility test procedures require the use of laboratory controls to monitor and ensure the accuracy and precision of supplies and reagents used in the assay, and the techniques of the individuals performing the test. 1,2,3,4,5,6,7 Standard doxycycline and tetracycline powders should provide the following range of MIC values noted in Table 2. For the diffusion technique using the 30 mcg doxycycline disk or 30 mcg tetracycline disk, the criteria noted in Table 2 should be achieved.

Table 2: Acceptable Quality Control Ranges for Susceptibility Testing for Doxycycline and Tetracycline

| QC Strain   | Minimal Inhibitory Concentration (mcg per mL) | Zone Diameter (mm) | Agar Dilution (mcg per mL) |
|---|---|--------------------|----------------------------|
| <i>Enterococcus faecalis</i> ATCC 29212<br>Doxycycline<br>Tetracycline        | 2 – 8<br>8 – 32                               | -<br>-             | -<br>-                     |
| <i>Escherichia coli</i> ATCC 25922<br>Doxycycline<br>Tetracycline             | 0.5 – 2<br>0.5 – 2                            | 18 – 24<br>18 – 25 | -<br>-                     |
| <i>Eggerthella lenta</i> ATCC 43055<br>Doxycycline                            | 2 – 16  | -                  | -                          |
| <i>Haemophilus influenzae</i> ATCC 49247<br>Tetracycline                      | 4 - 32  | 14 - 22            | -                          |
| <i>Neisseria gonorrhoeae</i> ATCC 49226<br>Tetracycline                       | -   | 30 - 42            | 0.25 - 1                   |
| <i>Staphylococcus aureus</i> ATCC 25923<br>Doxycycline<br>Tetracycline        | -<br>-  | 23 - 29<br>24 - 30 | -<br>-                     |
| <i>Staphylococcus aureus</i> ATCC 29213<br>Doxycycline<br>Tetracycline        | 0.12 - 0.5<br>0.12 - 1                        | -<br>-             | -<br>-                     |
| <i>Streptococcus pneumoniae</i> ATCC 49619<br>Doxycycline<br>Tetracycline     | 0.015 - 0.12<br>0.06 - 0.5                    | 25 - 34<br>27 - 31 | -<br>-                     |
| <i>Bacteroides fragilis</i> ATCC 25285<br>Tetracycline                        | -   | -                  | 0.125 - 0.5                |
| <i>Bacteroides thetaiotaomicron</i> ATCC 29741<br>Doxycycline<br>Tetracycline | 2 - 8<br>-                                    | -<br>-             | -<br>08 - 32               |
| <i>Mycoplasma pneumoniae</i> ATCC 29342<br>Tetracycline                       | 0.06 - 0.5                                    | -                  | 0.06 - 0.5                 |
| <i>Ureaplasma urealyticum</i> ATCC 33175<br>Tetracycline                      | -   | -                  | ≥8                         |

\*ATCC is the American Type Culture Collection

## INDICATIONS AND USAGE

To reduce the development of drug-resistant bacteria and maintain effectiveness of doxycycline tablets and other antibacterial drugs, doxycycline tablets should be used only to treat or prevent infections that are proven or strongly suspected to be caused by susceptible bacteria. When culture and susceptibility information are available, they

should be considered in selecting or modifying antibacterial therapy. In the absence of such data, local epidemiology and susceptibility patterns may contribute to the empiric selection of therapy.

Doxycycline is indicated for the treatment of the following infections:

Rocky mountain spotted fever, typhus fever and the typhus group, Q fever, rickettsialpox, and tick fevers caused by *Rickettsiae*.

Respiratory tract infections caused by *Mycoplasma pneumoniae*.

Lymphogranuloma venereum caused by *Chlamydia trachomatis*.

Psittacosis (ornithosis) caused by *Chlamydophila psittaci*.

Trachoma caused by *Chlamydia trachomatis*, although the infectious agent is not always eliminated as judged by immunofluorescence.

Inclusion conjunctivitis caused by *Chlamydia trachomatis*.

Uncomplicated urethral, endocervical or rectal infections in adults caused by *Chlamydia trachomatis*.

Nongonococcal urethritis caused by *Ureaplasma urealyticum*.

Relapsing fever due to *Borrelia recurrentis*.

Doxycycline is also indicated for the treatment of infections caused by the following gram-negative microorganisms:

Chancroid caused by *Haemophilus ducreyi*.

Plague due to *Yersinia pestis*.

Tularemia due to *Francisella tularensis*.

Cholera caused by *Vibrio cholerae*.

Campylobacter fetus infections caused by *Campylobacter fetus*.

Brucellosis due to *Brucella species* (in conjunction with streptomycin).

Bartonellosis due to *Bartonella bacilliformis*.

Granuloma inguinale caused by *Calymmatobacterium granulomatis*.

Because many strains of the following groups of microorganisms have been shown to be resistant to doxycycline, culture and susceptibility testing are recommended.

Doxycycline is indicated for treatment of infections caused by the following gram-negative microorganisms, when bacteriologic testing indicates appropriate susceptibility to the drug:

*Escherichia coli*

*Enterobacter aerogenes*

*Shigella species*

*Acinetobacter species*

Respiratory tract infections caused by *Haemophilus influenzae*.



Respiratory tract and urinary tract infections caused by *Klebsiella species*.

Doxycycline is indicated for treatment of infections caused by the following gram-positive microorganisms when bacteriologic testing indicates appropriate susceptibility to the drug:

Upper respiratory infections caused by *Streptococcus pneumoniae*.

Anthrax due to *Bacillus anthracis*, including inhalational anthrax (post-exposure): to reduce the incidence or progression of disease following exposure to aerosolized *Bacillus anthracis*.

When penicillin is contraindicated, doxycycline is an alternative drug in the treatment of the following infections:

Uncomplicated gonorrhea caused by *Neisseria gonorrhoeae*.

Syphilis caused by *Treponema pallidum*.

Yaws caused by *Treponema pallidum* subspecies *pertenue*.

Listeriosis due to *Listeria monocytogenes*.

Vincent's infection caused by *Fusobacterium fusiforme*.

Actinomycosis caused by *Actinomyces israelii*.

Infections caused by *Clostridium species*.

In acute intestinal amebiasis, doxycycline may be a useful adjunct to amebicides.

In severe acne, doxycycline may be useful adjunctive therapy.

## **CONTRAINDICATIONS**

This drug is contraindicated in persons who have shown hypersensitivity to any of the tetracyclines.

## **WARNINGS**

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

*Clostridium difficile* associated diarrhea (CDAD) has been reported with use of nearly all antibacterial agents, including doxycycline, and may range in severity from mild diarrhea 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 diarrhea following antibiotic use. Careful medical history is necessary since CDAD has been reported to occur over two months after the administration of antibacterial agents.

If CDAD is suspected or confirmed, ongoing antibiotic use not directed against *C. difficile* may need to be discontinued. Appropriate fluid and electrolyte management, protein supplementation, antibiotic treatment of *C. difficile*, and surgical evaluation should be instituted as clinically indicated.

Intracranial hypertension (IH, pseudotumor cerebri) has been associated with the use of tetracyclines including Monodox. Clinical manifestations of IH include headache, blurred vision, diplopia, and vision loss; papilledema can be found on fundoscopy. Women of childbearing age who are overweight or have a history of IH are at greater risk for developing tetracycline associated IH. Concomitant use of isotretinoin and Monodox should be avoided because isotretinoin is also known to cause pseudotumor cerebri.

Although IH typically resolves after discontinuation of treatment, the possibility for permanent visual loss exists. 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.

All tetracyclines form a stable calcium complex in any bone-forming tissue. A decrease in the fibula growth rate has been observed in prematures given oral tetracycline in doses of 25 mg/kg every six hours. This reaction was shown to be reversible when the drug was discontinued.

Results of animal studies indicate that tetracyclines cross the placenta, are found in fetal tissues, and can have toxic effects on the developing fetus (often related to retardation of skeletal development). Evidence of embryo toxicity has been noted in animals treated early in pregnancy. If any tetracycline is used during pregnancy or if the patient becomes pregnant while taking these drugs, the patient should be apprised of the potential hazard to the fetus.

The antianabolic action of the tetracyclines may cause an increase in BUN. Studies to date indicate that this does not occur with the use of doxycycline in patients with impaired renal function.

Photosensitivity manifested by an exaggerated sunburn reaction has been observed in some individuals taking tetracyclines. Patients apt 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.

## **PRECAUTIONS**

### **General:**

As with other antibacterial preparations, use of this drug may result in overgrowth of non-susceptible organisms, including fungi. If superinfection occurs, doxycycline should be discontinued and appropriate therapy instituted.

Incision and drainage or other surgical procedures should be performed in conjunction with antibacterial therapy when indicated.

Prescribing doxycycline tablets in the absence of proven or strongly suspected bacterial infection or a prophylactic indication is unlikely to provide benefit to the patient and increases the risk of the development of drug-resistant bacteria.

### **Information for Patients:**

All patients taking doxycycline should be advised:

-to avoid excessive sunlight or artificial ultraviolet light while receiving doxycycline and to discontinue therapy if phototoxicity (e.g., skin eruptions, etc.) occurs. Sunscreen or sunblock should be considered. (See WARNINGS.)

-to drink fluids liberally along with doxycycline to reduce the risk of esophageal irritation and ulceration. (See ADVERSE REACTIONS.)

-that the absorption of tetracyclines is reduced when taken with foods, especially those which contain calcium. However, the absorption of doxycycline is not markedly influenced by simultaneous ingestion of food or milk. (See Drug Interactions.)

-that the absorption of tetracyclines is reduced when taking bismuth subsalicylate. (See Drug Interactions.)

-not to use outdated or poorly stored doxycycline.

-that the use of doxycycline might increase the incidence of vaginal candidiasis.

Diarrhea is a common problem caused by antibiotics which usually ends when the antibiotic is discontinued. Sometimes after starting treatment with antibiotics, patients can develop watery and bloody stools (with or without stomach cramps and fever) even as late as two or more months after having taken the last dose of the antibiotic. If this occurs, patients should contact their physician as soon as possible.

Patients should be counseled that antibacterial drugs including doxycycline tablets should only be used to treat bacterial infections. They do not treat viral infections (e.g., the common cold). When doxycycline tablets are prescribed to treat a bacterial infection, patients should be told that although it is common to feel better early in the course of therapy, the medication should be taken exactly as directed. Skipping doses or not completing the full course of therapy may (1) decrease the effectiveness of the immediate treatment and (2) increase the likelihood that bacteria will develop resistance and will not be treatable by doxycycline tablets or other antibacterial drugs in the future.

### **Laboratory Tests:**

In venereal disease when coexistent syphilis is suspected, a dark-field examination should be done before treatment is started and the blood serology repeated monthly for at least four months.

In long-term therapy, periodic laboratory evaluations of organ systems, including hematopoietic, renal, and hepatic studies should be performed.

### **Drug Interactions:**

Because tetracyclines have been shown to depress plasma prothrombin activity, patients who are on anticoagulant therapy may require downward adjustment of their anticoagulant dosage.

Since bacteriostatic drugs may interfere with the bactericidal action of penicillin, it is advisable to avoid giving tetracyclines in conjunction with penicillin.

Absorption of tetracyclines is impaired by antacids containing aluminum, calcium, or magnesium, and iron-containing preparations.

Barbiturates, carbamazepine, and phenytoin decrease the half-life of doxycycline.

The concurrent use of tetracycline and methoxyflurane has been reported to result in fatal renal toxicity.

Concurrent use of tetracycline may render oral contraceptives less effective.

### **Drug/Laboratory Test Interactions:**

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

### **Carcinogenesis, Mutagenesis, Impairment of Fertility:**

Long-term studies in animals to evaluate the carcinogenic potential of doxycycline have not been conducted. However, there has been evidence of oncogenic activity in rats in studies with related antibacterial, oxytetracycline (adrenal and pituitary tumors) and minocycline (thyroid tumors). Likewise, although mutagenicity studies of doxycycline have not been conducted, positive results in *in vitro* mammalian cell assays have been reported for related antibacterial (tetracycline, oxytetracycline). Doxycycline administered orally at dosage levels as high as 250 mg/kg/day had no apparent effect on the fertility of female rats. Effect on male fertility has not been studied.

### **Pregnancy: Teratogenic Effects: Pregnancy Category D:**

There are no adequate and well-controlled studies on the use of doxycycline in pregnant short-term, first trimester exposure. There are no human data available to assess the effects of long-term therapy of doxycycline in pregnant women such as that proposed for treatment of anthrax exposure. An expert review of published data on experiences with doxycycline use during pregnancy by TERIS - the Teratogen Information System - concluded that therapeutic doses during pregnancy are unlikely to pose a substantial teratogenic risk (the quantity and quality of data were assessed as limited to fair), but the data are insufficient to state that there is no risk.<sup>8</sup>

A case-control study (18,515 mothers of infants with congenital anomalies and 32,804 mothers of infants with no congenital anomalies) shows a weak but marginally statistically significant association with total malformations and use of doxycycline anytime during pregnancy. (Sixty-three [0.19%] of the controls and 56 [0.30%] of the cases were treated with doxycycline.) This association was not seen when the analysis was confined to maternal treatment during the period of organogenesis (i.e., in the second and third months of gestation) with the exception of a marginal relationship with neural tube defect based on only two exposed cases.<sup>9</sup>

A small prospective study of 81 pregnancies describes 43 pregnant women treated for 10 days with doxycycline during early first trimester. All mothers reported their exposed infants were normal at 1 year of age.<sup>10</sup>

### **Labor and Delivery:**

The effect of tetracyclines on labor and delivery is unknown.

### **Nursing Mothers:**

Tetracyclines are excreted in human milk, however, the extent of absorption of

tetracyclines, including doxycycline, by the breastfed infant is not known. Short-term use by lactating women is not necessarily contraindicated; however, the effects of prolonged exposure to doxycycline in breast milk are unknown. <sup>11</sup>Because of the potential for adverse reactions in nursing infants from doxycycline, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother. (See WARNINGS.)

### **Pediatric Use:**

Because of the effects of drugs of the tetracycline-class, on tooth development and growth, use doxycycline in pediatric patients 8 years of age or less only when the potential benefits are expected to outweigh the risks in severe or life-threatening conditions (e.g. anthrax, Rocky Mountain spotted fever), particularly when there are no alternative therapies. (see WARNINGS and DOSAGE AND ADMINISTRATION).

## **ADVERSE REACTIONS**

Due to oral doxycycline's virtually complete absorption, side effects to the lower bowel, particularly diarrhea, have been infrequent. The following adverse reactions have been observed in patients receiving tetracyclines.

**Gastrointestinal:** Anorexia, nausea, vomiting, diarrhea, glossitis, dysphagia, enterocolitis, and inflammatory lesions (with monilial overgrowth) in the anogenital region, and pancreatitis. Hepatotoxicity has been reported. These reactions have been caused by both the oral and parenteral administration of tetracyclines. Rare instances of esophagitis and esophageal ulcerations have been reported in patients receiving capsule and tablet forms of drugs in the tetracycline class. Most of these patients took medications immediately before going to bed. (See DOSAGE AND ADMINISTRATION.)

**Skin:** Maculopapular and erythematous rashes, Stevens-Johnson syndrome, toxic epidermal necrolysis, and erythema multiforme have been reported. Exfoliative dermatitis has been reported but is uncommon. Photosensitivity is discussed above. (See WARNINGS.)

**Renal Toxicity:** Rise in BUN has been reported and is apparently dose related. (See WARNINGS.)

**Hypersensitivity Reactions:** Urticaria, angioneurotic edema, anaphylaxis, anaphylactoid purpura, serum sickness, pericarditis, and exacerbation of systemic lupus erythematosus.

**Blood:** Hemolytic anemia, thrombocytopenia, neutropenia, and eosinophilia have been reported with tetracyclines.

**Other:** Intracranial hypertension (IH, pseudotumor cerebri) has been associated with the use of tetracyclines. (See PRECAUTIONS-General.)

When given over prolonged periods, tetracyclines have been reported to produce brown-black microscopic discoloration of the thyroid gland. No abnormalities of thyroid function are known to occur.

**To report SUSPECTED ADVERSE REACTIONS, contact Chartwell RX, LLC. at 1-845-232-1683 or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch).**

## OVERDOSAGE

In case of overdosage, discontinue medication, treat symptomatically and institute supportive measures. Dialysis does not alter serum half-life, and it would not be of benefit in treating cases of overdosage.

## DOSAGE AND ADMINISTRATION

THE USUAL DOSAGE AND FREQUENCY OF ADMINISTRATION OF DOXYCYCLINE DIFFERS FROM THAT OF THE OTHER TETRACYCLINES. EXCEEDING THE RECOMMENDED DOSAGE MAY RESULT IN AN INCREASED INCIDENCE OF SIDE EFFECTS.

**Adults:** The usual dose of oral doxycycline is 200 mg on the first day of treatment (administered 100 mg every 12 hours or 50 mg every 6 hours) followed by a maintenance dose of 100 mg/day. The maintenance dose may be administered as a single dose or as 50 mg every 12 hours. In the management of more severe infections (particularly chronic infections of the urinary tract), 100 mg every 12 hours is recommended.

### Pediatric Patients:

For all pediatric patients weighing less than 45 kg with severe or life-threatening infections (e.g., anthrax, Rocky Mountain spotted fever), the recommended dosage is 2.2 mg/kg of body weight administered every 12 hours. Children weighing 45 kg or more should receive the adult dose (see WARNINGS and PRECAUTIONS).

For pediatric patients with less severe disease (greater than 8 years of age and weighing less than 45 kg), the recommended dosage schedule is 4.4 mg/kg of body weight divided into two doses on the first day of treatment, followed by a maintenance dose of 2.2 mg/kg of body weight (given as a single daily dose or divided into twice daily doses). For pediatric patients weighing over 45 kg, the usual adult dose should be used.

The therapeutic antibacterial serum activity will usually persist for 24 hours following recommended dosage.

When used in streptococcal infections, therapy should be continued for 10 days.

Administration of adequate amounts of fluid along with capsule and tablet forms of drugs in the tetracycline class is recommended to wash down the drugs and reduce the risk of esophageal irritation and ulceration (see ADVERSE REACTIONS).

If gastric irritation occurs, it is recommended that doxycycline be given with food or milk. The absorption of doxycycline is not markedly influenced by simultaneous ingestion of food or milk.

Studies to date have indicated that administration of doxycycline at the usual recommended doses does not lead to excessive accumulation of doxycycline in patients with renal impairment.

**Uncomplicated gonococcal infections in adults (except anorectal infections in men):** 100 mg, by mouth, twice a day for 7 days. As an alternate single visit dose, administer 300 mg stat followed in one hour by a second 300 mg dose.

**Acute epididymo-orchitis caused by *N. gonorrhoeae*:** 100 mg, by mouth, twice a day for at least 10 days.

**Primary and secondary syphilis:** 300 mg a day in divided doses for at least 10 days.

**Uncomplicated urethral, endocervical, or rectal infection in adults caused by *Chlamydia trachomatis*:** 100 mg, by mouth, twice a day for at least 7 days.

**Nongonococcal urethritis caused by *C. trachomatis* and *U. urealyticum*:** 100 mg, by mouth, twice a day for at least 7 days.

**Acute epididymo-orchitis caused by *C. trachomatis*:** 100 mg, by mouth, twice a day for at least 10 days.

### **Inhalational anthrax (post-exposure):**

ADULTS: 100 mg of doxycycline, by mouth, twice a day for 60 days.

CHILDREN: weighing less than 45 kg; 2.2 mg/kg of body weight, by mouth, twice a day for 60 days. Children weighing 45 kg or more should receive the adult dose.

When used in streptococcal infections, therapy should be continued for 10 days.

### **HOW SUPPLIED**

Doxycycline Tablets, USP 50 mg are a peach colored, film coated round biconvex tablets, debossed with 'I61' on one side and plain on the other side. Each tablet contains doxycycline monohydrate equivalent to 50 mg of doxycycline, USP. They are supplied as follows:

Doxycycline Tablets, USP 50 mg  
Bottles of 20 NDC 62135-725-20

Doxycycline Tablets, USP 100 mg are a peach colored, film coated, round biconvex tablets, debossed with 'I63' on one side and plain on the other side. Each tablet contains doxycycline monohydrate equivalent to 100 mg of doxycycline, USP. They are supplied as follows:

Doxycycline Tablets, USP 100 mg  
Bottles of 20 NDC 62135-726-20

STORE AT 20°-25°C (68°-77°F). [SEE USP CONTROLLED ROOM TEMPERATURE.]

PROTECT FROM LIGHT. DISPENSE IN A TIGHT LIGHT-RESISTANT CONTAINER AS DEFINED IN THE USP/NF.

### **ANIMAL PHARMACOLOGY AND ANIMAL TOXICOLOGY**

Hyperpigmentation of the thyroid has been produced by members of the tetracycline class in the following species: in rats by oxytetracycline, doxycycline, tetracycline PO<sub>4</sub>, and methacycline; in minipigs by doxycycline, minocycline, tetracycline PO<sub>4</sub>, and methacycline; in dogs by doxycycline and minocycline; in monkeys by minocycline.

Minocycline, tetracycline PO<sub>4</sub>, methacycline, doxycycline, tetracycline base, oxytetracycline HCl and tetracycline HCl were goitrogenic in rats fed a low iodine diet. This goitrogenic effect was accompanied by high radioactive iodine uptake. Administration of minocycline also produced a large goiter with high radioiodine uptake in rats fed a relatively high iodine diet.

Treatment of various animal species with this class of drugs has also resulted in the induction of thyroid hyperplasia in the following: in rats and dogs (minocycline), in chickens (chlortetracycline) and in rats and mice (oxytetracycline). Adrenal gland hyperplasia has been observed in goats and rats treated with oxytetracycline.

## REFERENCES

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2. Clinical and Laboratory Standards Institute (CLSI). Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria that Grow Aerobically; Approved Standard – Tenth Edition. CLSI document M07-A10 [2015], Clinical Laboratory Standards Institute, 950 West Valley Road, Suite 2500, Wayne Pennsylvania 19087, USA.
3. Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Disk Diffusion Susceptibility Tests; Approved Standard – Twelfth Edition. CLSI Document M02-A12 [2015], Clinical Laboratory Standards Institute, 950 West Valley Road, Suite 2500, Wayne Pennsylvania 19087, USA.
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11. Hale T. *Medications and Mothers Milk*. 9th edition. Amarillo, TX: Pharmasoft Publishing 2000; 225-226.

## Rx only

Manufactured by:

**USV Private Limited**

Daman - 396210, India



Manufactured for:  
Chartwell RX, LLC.  
Congers, NY 10920

Revised: 07/2023

L71631

**PACKAGE LABEL.PRINCIPAL DISPLAY PANEL**

**Doxycycline Tablets, USP 50 mg - NDC 62135-725-20 - 20's Tablets Bottle Label**

NDC 62135-725-20  
**Doxycycline**  
**Tablets, USP**

**50 mg**

Rx Only  
20 Tablets

Chartwell Rx

Each tablet contains:  
Doxycycline monohydrate equivalent to 50 mg of  
doxycycline USP

**USUAL DOSAGE:** See accompanying product literature.  
**Store at 20° to 25°C (68° to 77°F) [See USP Controlled  
Room Temperature].**  
Protect from light.  
Dispense in a tight, light- resistant container as defined in  
the USP.

**KEEP THIS AND ALL MEDICATIONS OUT OF THE  
REACH OF CHILDREN.**

Manufactured by: USV Private Limited  
Daman-396210, India

Manufactured For: Chartwell RX, LLC.  
Congers, NY 10920

GTIN 00362135725204 L71629 REV. 01 07/23



N 3 6213572520 4

No Varnish

**Doxycycline Tablets, USP 100 mg - NDC 62135-726-20 - 20's Tablets Bottle Label**

NDC 62135-726-20  
**Doxycycline**  
**Tablets, USP**

**100 mg**

Rx Only  
20 Tablets

Chartwell Rx

Each tablet contains:  
Doxycycline monohydrate equivalent to 100 mg of  
doxycycline USP


**USUAL DOSAGE:** See accompanying product literature.  
**Store at 20° to 25°C (68° to 77°F) [See USP Controlled  
Room Temperature].**  
Protect from light.  
Dispense in a tight, light- resistant container as defined in  
the USP.

**KEEP THIS AND ALL MEDICATIONS OUT OF THE  
REACH OF CHILDREN.**

Manufactured by: USV Private Limited  
Daman-396210, India

Manufactured For: Chartwell RX, LLC.  
Congers, NY 10920

GTIN 00362135726201 L71630 REV. 01 07/23



N 3 6213572620 1

No Varnish

**DOXYCYCLINE**  
doxycycline tablet

## Product Information

|                                |                         |                           |               |
|--------------------------------|-------------------------|---------------------------|---------------|
| <b>Product Type</b>            | HUMAN PRESCRIPTION DRUG | <b>Item Code (Source)</b> | NDC:62135-725 |
| <b>Route of Administration</b> | ORAL                    |                           |               |

## Active Ingredient/Active Moiety

| Ingredient Name  | Basis of Strength     | Strength |
|--|-----------------------|----------|
| <b>DOXYCYCLINE</b> (UNII: N1200U13O) (DOXYCYCLINE ANHYDROUS - UNII:334895S862) | DOXYCYCLINE ANHYDROUS | 50 mg    |

## Inactive Ingredients

| Ingredient Name   | Strength |
|---|----------|
| <b>LACTOSE MONOHYDRATE</b> (UNII: EWQ57Q8I5X)                   |          |
| <b>MICROCRYSTALLINE CELLULOSE</b> (UNII: OP1R32D61U)            |          |
| <b>SODIUM STARCH GLYCOLATE TYPE A POTATO</b> (UNII: 5856J3G2A2) |          |
| <b>HYPROMELLOSE 2910 (15 MPA.S)</b> (UNII: 365FW2JZ0W)          |          |
| <b>TITANIUM DIOXIDE</b> (UNII: 15FIX9V2JP)                      |          |
| <b>MAGNESIUM STEARATE</b> (UNII: 70097M6I3O)                    |          |
| <b>TALC</b> (UNII: 7SEV7J4R1U)                                  |          |
| <b>PROPYLENE GLYCOL</b> (UNII: 6DC9Q167V3)                      |          |
| <b>POLYETHYLENE GLYCOL 6000</b> (UNII: 30IQX730WE)              |          |
| <b>FERRIC OXIDE YELLOW</b> (UNII: EX438O2MRT)                   |          |
| <b>FERRIC OXIDE RED</b> (UNII: 1K09F3G675)                      |          |

## Product Characteristics

|                 |                |                     |          |
|-----------------|----------------|---------------------|----------|
| <b>Color</b>    | orange (Peach) | <b>Score</b>        | no score |
| <b>Shape</b>    | ROUND          | <b>Size</b>         | 7mm      |
| <b>Flavor</b>   |                | <b>Imprint Code</b> | I61      |
| <b>Contains</b> |                |                     |          |

## Packaging

| # | Item Code        | Package Description                               | Marketing Start Date | Marketing End Date |
|---|------------------|---|----------------------|--------------------|
| 1 | NDC:62135-725-20 | 20 in 1 BOTTLE; Type 0: Not a Combination Product | 07/27/2023           |                    |

## Marketing Information

| Marketing Category | Application Number or Monograph Citation | Marketing Start Date | Marketing End Date |
|--------------------|--|----------------------|--------------------|
| ANDA               | ANDA091605                               | 05/01/2012           |                    |

# DOXYCYCLINE

doxycycline tablet

## Product Information

|                                |                         |                           |               |
|--------------------------------|-------------------------|---------------------------|---------------|
| <b>Product Type</b>            | HUMAN PRESCRIPTION DRUG | <b>Item Code (Source)</b> | NDC:62135-726 |
| <b>Route of Administration</b> | ORAL                    |                           |               |

## Active Ingredient/Active Moiety

| Ingredient Name   | Basis of Strength     | Strength |
|---|-----------------------|----------|
| <b>DOXYCYCLINE</b> (UNII: N12000U13O) (DOXYCYCLINE ANHYDROUS - UNII:334895S862) | DOXYCYCLINE ANHYDROUS | 100 mg   |

## Inactive Ingredients

| Ingredient Name   | Strength |
|---|----------|
| <b>LACTOSE MONOHYDRATE</b> (UNII: EWQ57Q8I5X)                   |          |
| <b>MICROCRYSTALLINE CELLULOSE</b> (UNII: OP1R32D61U)            |          |
| <b>SODIUM STARCH GLYCOLATE TYPE A POTATO</b> (UNII: 5856J3G2A2) |          |
| <b>HYPROMELLOSE 2910 (15 MPA.S)</b> (UNII: 36SFW2JZ0W)          |          |
| <b>TITANIUM DIOXIDE</b> (UNII: 15FIX9V2JP)                      |          |
| <b>MAGNESIUM STEARATE</b> (UNII: 70097M6I3O)                    |          |
| <b>TALC</b> (UNII: 7SEV7J4R1U)                                  |          |
| <b>PROPYLENE GLYCOL</b> (UNII: 6DC9Q167V3)                      |          |
| <b>POLYETHYLENE GLYCOL 6000</b> (UNII: 30IQX730WE)              |          |
| <b>FERRIC OXIDE YELLOW</b> (UNII: EX438O2MRT)                   |          |
| <b>FERRIC OXIDE RED</b> (UNII: 1K09F3G675)                      |          |

## Product Characteristics

|                 |                |                     |          |
|-----------------|----------------|---------------------|----------|
| <b>Color</b>    | orange (Peach) | <b>Score</b>        | no score |
| <b>Shape</b>    | ROUND          | <b>Size</b>         | 9mm      |
| <b>Flavor</b>   |                | <b>Imprint Code</b> | I63      |
| <b>Contains</b> |                |                     |          |

## Packaging

| # | Item Code        | Package Description                               | Marketing Start Date | Marketing End Date |
|---|------------------|---|----------------------|--------------------|
| 1 | NDC:62135-726-20 | 20 in 1 BOTTLE; Type 0: Not a Combination Product | 07/27/2023           |                    |

## Marketing Information

| Marketing Category | Application Number or Monograph Citation | Marketing Start Date | Marketing End Date |
|--------------------|--|----------------------|--------------------|
| ANDA               | ANDA091605                               | 05/01/2012           |                    |

**Labeler** - Chartwell RX, LLC (079394054)

Revised: 8/2023

Chartwell RX, LLC