

Therapeutic Class Overview

Cephalosporins, Third-generation

INTRODUCTION

- Cephalosporins are used to treat a variety of infections. They have a broad spectrum of activity, are usually well tolerated, and are easy to administer (AHFS 2020).
- The cephalosporins are grouped into generations based on their spectrum of activity.
 - Generally, the first- and second-generation cephalosporins are used in the treatment of infections caused by susceptible staphylococci or streptococci. Use of first-generation cephalosporins in the treatment of gram-negative infections is generally limited as compared to second- and third-generation agents (AHFS 2020).
 - Third-generation cephalosporins are less active than first and second-generation cephalosporins against gram-positive aerobic bacteria, especially staphylococci. These agents may be used for infections caused by the following susceptible gram-negative bacteria: *Escherichia coli*, *Haemophilus influenzae*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Enterobacter*, *Neisseria*, and *Serratia*, among others. Cefdinir, cefixime, and cefpodoxime are inactive against most strains of *Enterobacter* (AHFS 2020).
 - Fourth and fifth generation cephalosporins are available in injectable formulations. They provide expanded gram-negative coverage, especially against bacteria resistant to third-generation cephalosporins. In addition, they have improved gram-positive coverage than third-generation cephalosporins (AHFS 2020).
- Enterobacteriaceae continue to develop more β -lactamase-mediated resistance. Additionally, other modes of resistance to the third-generation cephalosporins are becoming more prevalent. These resistance patterns are threatening the utility of this class of drugs (Lepak et al 2020).
- This review will focus on the oral third-generation cephalosporins as listed in Table 1. Review of each drug will focus on its Food and Drug Administration (FDA)-approved indications.
- Medispan class: Cephalosporins – third-generation

Table 1. Medications Included Within Class Review

Drug*	Generic Availability
cefdinir [†]	✓
cefpodoxime [‡]	✓
Spectracef (cefditoren pivoxil)	✓
Suprax (cefixime) [§]	✓

* Cedax (ceftibuten) is an FDA-approved third-generation cephalosporin which has been discontinued.

[†] Branded product, Omnicef, is no longer marketed.

[‡] Branded product, Vantin, is no longer marketed.

[§] Generic available for cefixime capsule and oral suspension; Suprax chewable tablets remain a branded product.

(Drugs@FDA 2020; Orange Book: Approved Drug Products with Therapeutic Equivalence Evaluations 2020, Clinical Pharmacology 2020)

INDICATIONS

Table 2. FDA Approved Indications

Indication	cefdinir	cefpodoxime	Spectracef (cefditoren)	Suprax (cefixime)
Acute Bacterial Exacerbations of Chronic Bronchitis due to <i>H. influenzae</i> (including β -lactamase-producing strains), <i>M. catarrhalis</i> (including β -lactamase-producing strains), or <i>S. pneumoniae</i> (penicillin-susceptible strains only)	✓ *	✓ ‡	✓ *	✓ **

Indication	cefdinir	cefpodoxime	Spectracef (cefditoren)	Suprax (cefixime)
Acute Bacterial Otitis Media due to <i>H. influenzae</i> (including β -lactamase-producing strains), <i>M. catarrhalis</i> (including β -lactamase-producing strains), or <i>S. pyogenes</i>	✓ †	✓ §		✓
Acute Maxillary Sinusitis caused by <i>H. influenzae</i> (including β -lactamase producing strains), <i>S. pneumoniae</i> (penicillin-susceptible strains only), and <i>M. catarrhalis</i> (including β -lactamase producing strains)	✓	✓		
Acute, Uncomplicated Ano-rectal Infections in women due to <i>N. gonorrhoeae</i> (including penicillinase-producing strains)		✓		
Community-Acquired Pneumonia caused by <i>H. influenzae</i> (including β -lactamase-producing strains), <i>H. parainfluenzae</i> (including β -lactamase-producing strains), <i>S. pneumoniae</i> (penicillin-susceptible strains only), or <i>M. catarrhalis</i> (including β -lactamase producing strains)	✓	✓	✓	
Pharyngitis and Tonsillitis due to <i>S. pyogenes</i>	✓	✓	✓	✓
Uncomplicated Gonorrhea (cervical/urethral) caused by <i>N. gonorrhoeae</i> (penicillinase- and non-penicillinase-producing strains)		✓		✓
Uncomplicated Skin and Skin-Structure Infections caused by <i>S. aureus</i> (including β -lactamase-producing strains) or <i>S. pyogenes</i>	✓	✓	✓	
Uncomplicated Urinary Tract Infections caused by <i>E. coli</i> and <i>P. mirabilis</i>		✓ ¶		✓

* Also approved for *H. parainfluenzae* (including β -lactamase producing strains)

† Approved for *S. pneumoniae* (penicillin-susceptible strains only), not for *S. pyogenes*

‡ *H. influenzae* (non-beta-lactamase-producing strains only)

§ Also approved for *S. pneumoniae* (excluding penicillin-resistant strains)

|| Not for *H. parainfluenzae* or *M. catarrhalis*

¶ Also approved for *K. pneumoniae* or *S. saprophyticus*

** Not for *M. catarrhalis*

(Prescribing information: cefdinir powder for suspension 2020, cefdinir capsule 2020, cefpodoxime tablet 2018, cefpodoxime granule for suspension 2018, Spectracef 2013, Suprax 2020)

- Information on indications, mechanism of action, pharmacokinetics, dosing, and safety has been obtained from the prescribing information for the individual products, except where noted otherwise.

CLINICAL EFFICACY SUMMARY

- Studies evaluating the third-generation cephalosporins for the treatment of acute exacerbations of chronic bronchitis did not consistently demonstrate significant differences in clinical response or eradication rate when compared to other cephalosporin agents (*Alvarez-Sala et al 2006, Fogarty et al 2000, Phillips et al 1993, Van Herwaarden et al 1999, Zuck et al 1999*). A study compared cefixime and cephalexin in the treatment of hospitalized patients with exacerbations of chronic bronchitis and demonstrated significantly better clinical cure rates in patients treated with cefixime compared to cephalexin (70.8% vs 50%; $p < 0.05$). The incidence of diarrhea was higher in the cefixime group (*Verghese et al 1990*).
- In the treatment of gonorrhea, cefixime and cefpodoxime have generally demonstrated comparable efficacy in the rate of bacteriologic cure (> 90%) in open-label and dose-response studies; cefixime also demonstrated comparable efficacy when compared to ceftriaxone (*Handsfeld et al 1991, Novak et al 1992, Plourde et al 1992, Portilla et al, 1992, Verdon et al 1993*). In a meta-analysis in pregnant women, there was no significant difference between intramuscular ceftriaxone and oral cefixime for gonococcal infection cure based on 1 study and very low-quality evidence (*Comunián-Carrasco et al 2018*).

- A study compared cefixime and cefpodoxime in the treatment of acute otitis media. By day 15, bacteriologic cure was reported in 83% and 81% of patients treated with cefpodoxime and cefixime, respectively ($p = 0.541$) (*Asmar et al 1994*). Other head-to-head studies of the third-generation cephalosporins in the treatment of acute otitis media demonstrated no statistically significant differences in efficacy between the agents (*Blumer et al 2000, MacLoughlin et al 1996, Piippo et al 1991*). However, 1 study did show that high-dose amoxicillin/clavulanic acid for 10 days of therapy was more effective than 5 days of therapy with cefdinir (*Casey et al 2012*).
- Studies evaluating the use of the third-generation cephalosporins for the treatment of pharyngitis and/or tonsillitis have failed to consistently demonstrate “superiority” of any third-generation cephalosporins over penicillin or amoxicillin (*Adam et al 1995, Block et al 1992, Brook 2005, Nemeth et al 1999, Ozaki et al 2008, Pichichero et al 1994, Tack et al 1998a*).
- In the treatment of lower respiratory tract infections including community-acquired pneumonia, no cephalosporin consistently demonstrated significant differences when the third-generation cephalosporins were compared with each other, cephalosporins in other generations, or amoxicillin/clavulanate (*Drehobl et al 1997, Fogarty et al 2002, Lodha et al 2013, Sengupta et al 2004, van Zyle et al 2002*).
- Studies evaluating the treatment of skin and soft tissue infections, sinusitis, and urinary tract infections did not consistently demonstrate the “superiority” of any third-generation cephalosporin when compared to 1 another or to cephalosporins in other generations (*Bucko et al 2002, Gehanno et al 1990, Ho et al 2001, Koning et al 2012, Leigh et al 2000, Stevens et al 1993, Tack et al 1997, Tack et al 1998b*). One trial determined that a switch from intravenous (IV) ceftriaxone to oral cefditoren provided similar clinical cure rates as continuation of IV ceftriaxone in treatment of acute pyelonephritis (*Monmaturapoj et al 2012*).

CLINICAL GUIDELINES

- Organizations differ in their recommendations regarding the use of third-generation cephalosporins for the treatment of acute bacterial rhinosinusitis. The American College of Allergy, Asthma, and Immunology allows for the empiric use of third-generation cephalosporins for acute bacterial rhinosinusitis, while the Infectious Diseases Society of America discourages their use due to emerging resistance patterns (*Chow et al 2012, Peters et al 2014*). Combination therapy with clindamycin may be used as an alternative to amoxicillin in children and adults with non-type 1 hypersensitivity reactions to penicillins (*Chow et al 2012, Rosenfeld et al 2015*). Other authors state that third-generation cephalosporins and clindamycin are an appropriate alternative for treatment of acute bacterial rhinosinusitis in children with a history of any type of hypersensitivity reaction to amoxicillin (*Wald et al 2013*).
- For empiric treatment of outpatients with community acquired pneumonia, a β -lactam plus a macrolide or doxycycline may be used as an alternative to a respiratory fluoroquinolone in patients with risk factors for drug-resistant *S. pneumoniae*. While high-dose amoxicillin and amoxicillin-clavulanate are the preferred β -lactams, ceftriaxone, cefpodoxime, and cefuroxime are recommended alternatives (*Metlay et al 2019*).
- Although not first-line treatment, third-generation oral cephalosporins may also be considered as a part of the treatment regimen in patients with skin and soft-tissue diseases (*Stevens et al 2014*).
- For Group A streptococcal pharyngitis, penicillin or amoxicillin are the recommended therapies. In patients with penicillin allergies, first generation cephalosporins (non-anaphylaxis type reactions) for 10 days, clindamycin or clarithromycin for 10 days, or azithromycin for 5 days are recommended (*Shulman et al 2012*).
- Third-generation cephalosporins are also recommended as an alternative treatment for acute otitis media and acute cystitis (*Gupta et al 2011, Lieberthal et al 2013*). Cefixime is a treatment option for acute pyelonephritis in children > 1 month of age (*Strohmeier et al 2014*).
- Due to treatment failures, the CDC no longer recommends the routine use of cefixime as a first-line regimen for treatment of gonorrhea in the United States (*CDC 2015*). Cefixime should only be considered as an alternative regimen if ceftriaxone is not available, and only in combination with azithromycin. Other oral cephalosporins (eg, cefpodoxime) are not recommended because of inferior efficacy and less favorable pharmacodynamics.
- Third-generation cephalosporins may be an option for empiric treatment of bloody diarrhea in infants < 3 months of age and others with neurologic involvement (*Shane et al 2017*).
- In treatment of uncomplicated pyelonephritis, cefpodoxime or cefibuten may be used in combination with an initial IV dose of a long-acting parenteral antimicrobial; oral fluoroquinolones also comprise the suggested regimens if resistance is below 10% (*Bonkat et al 2020*).

SAFETY SUMMARY

- The most common adverse effects seen with the cephalosporins are gastrointestinal disturbances, with diarrhea and nausea reported most frequently. Female patients can develop vaginal yeast infections. Changes in laboratory parameters such as increased blood urea nitrogen (BUN) and creatinine, decreased hematocrit and hemoglobin, increased liver enzymes, and increased glucose levels may also be seen.
- Dose adjustment of third-generation cephalosporins is recommended in renal impairment.
- Cephalosporins should not be given to patients who have experienced a previous allergic reaction to a cephalosporin. Caution should be utilized if administering to penicillin-allergic patients; however, the risk of a cross-reaction is less than 10 percent with the third-generation cephalosporins (*The Medical Letter 2012*).
- Patients should be monitored for *Clostridium difficile*-associated diarrhea.
- Antacids and H₂-antagonists can inhibit the absorption of cephalosporins; administration should be separated by at least 2 hours.
- A false-positive reaction for ketones and glucose in the urine can be seen when using certain tests.
- Cefixime, cefdinir, cefditoren, and cefpodoxime are Pregnancy Category B (no evidence of risk in humans, but there remains a remote possibility; animal reproductive studies have failed to demonstrate a risk to the fetus, and there are no adequate and well-controlled studies in pregnant women).
- Cefixime chewable tablets contain aspartame, which may be harmful to patients with phenylketonuria.
- Cefditoren causes renal excretion of carnitine and is contraindicated in patients with carnitine deficiency or with inborn errors of metabolism that may result in carnitine deficiency.
- Cefditoren is contraindicated in patients with milk protein hypersensitivity.

DOSING AND ADMINISTRATION

Table 3. Dosing and Administration

Drug	Available Formulations	Route	Usual Recommended Frequency	Comments
cefdinir	Capsule, suspension	Oral	Every 12 or 24 hours	Dosing adjustments are recommended in renal impairment
cefpodoxime	Tablet, suspension	Oral	Every 12 hours	
Spectracef (cefditoren)	Tablet	Oral	Every 12 hours	
Suprax (cefixime)	Capsule, chewable tablet, suspension	Oral	Every 12 or 24 hours	

See the current prescribing information for full details

CONCLUSION

- Current clinical evidence supports the efficacy of each third-generation cephalosporin for their FDA-approved indications, including the treatment of acute otitis media, upper and lower respiratory tract infections, pharyngitis, tonsillitis, uncomplicated urinary tract infections, and skin and soft-tissue infections.
- The safety and efficacy of the third-generation cephalosporins are generally comparable among agents, with the exception of variation in coverage of specific bacterial strains. No agent has consistently demonstrated superiority over another.
 - The overall place in therapy for third-generation cephalosporins in the treatment of various infections is limited by increasing resistance.
 - Local resistance patterns should be checked before prescribing a third-generation cephalosporin. More isolates of *H. influenzae*, *S. pneumonia*, and *N. gonorrhoeae* have become resistant.
- Cross-sensitivity reactions can occur with cephalosporins in patients with a penicillin allergy.

REFERENCES

- Adam D, Hostalek U, Troster K, et al for the Cefixime Study Group. 5-day cefixime therapy for bacterial pharyngitis and/or tonsillitis: comparison with 10-day penicillin V therapy. *Infection*. 1995;23(Suppl 2):S83-86.
- AHFS. Cephalosporins general statement. In McEvoy GK ed. American Hospital Formulary Services, AHFS Drug Information 2020. Bethesda, MD: American Society of Health-System Pharmacists. Available from: <https://www.medicinescomplete.com/#/content/ahfs/a382930>. Accessed May 21, 2020.

- Alvarez-Sala JL, Kardos P, Martínez-Beltrán J, et al. Clinical and bacteriological efficacy in treatment of acute exacerbations of chronic bronchitis with cefditoren-pivoxil versus cefuroxime-axetil. *Antimicrob Agents Chemother.* 2006;50(5):1762-1767.
- Asmar BI, Dajani AS, Del Beccaro MA, et al. Comparison of cefpodoxime proxetil and cefixime in the treatment of acute otitis media in infants and children. *Pediatrics.* 1994;94(6):847-852.
- Block S, Hedrick J, Tyler R. Comparative study of the effectiveness of cefixime and penicillin V for the treatment of streptococcal pharyngitis in children and adolescents. *Pediatr Infect Dis J.* 1992;11:919-925.
- Blumer JL, McInn SE, Deabate CA, et al. Five-day cefdinir course vs ten-day cefprozil course for treatment of acute otitis media. *Pediatr Infect Dis J.* 2000;19(12):S147-S152.
- Bonkat G, Bartoletti RR, Bruyere F, et al. European Association of Urology urological infections guideline. European Association of Urology website. Available from: <https://uroweb.org/guideline/urological-infections/#1>. Updated 2020. Accessed May 22, 2020.
- Brook I. A pooled comparison of cefdinir and penicillin in the treatment of group A beta-hemolytic streptococcal pharyngotonsillitis. *Clin Ther.* 2005;27(8):1266-1273.
- Bucko AD, Hunt BJ, Kidd SL, Hom R. Randomized, double-blind, multicenter comparison of oral cefditoren 200 or 400 mg BID with either cefuroxime 250 mg BID or cefadroxil 500 mg BID for the treatment of uncomplicated skin and skin-structure infections. *Clin Ther.* 2002;24(7):1134-1147.
- Casey JR, Block SL, Hedrick J, et al. Comparison of amoxicillin/clavulanic acid high dose with cefdinir in the treatment of acute otitis media. *Drugs.* 2012; 72 (15): 1991-1997.
- Cefdinir capsule prescribing information. Lupin Pharmaceuticals, Inc. Baltimore, MD. June 2020.
- Cefdinir powder for suspension prescribing information. Lupin Pharmaceuticals, Inc. Baltimore, MD. March 2020.
- Cefpodoxime granule for suspension prescribing information. Aurobindo Pharma USA, Inc. East Windsor, NJ. October 2018.
- Cefpodoxime tablet prescribing information. Aurobindo Pharma USA, Inc. East Windsor, NJ. July 2018.
- Centers for Disease Control and Prevention (CDC). 2015 sexually transmitted diseases treatment guidelines. *MMWR Morb Mortal Wkly Rep.* 2015;64(3):1-138. Available from: <https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6403a1.htm>. Accessed May 22, 2020.
- Chow AW, Benninger MS, Brook I, et al. IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults. *Clin Infect Dis.* 2012 April:e72-e112. Available from: <https://academic.oup.com/cid/article/54/8/e72/367144/IDSA-Clinical-Practice-Guideline-for-Acute?searchresult=1>. Accessed May 22, 2020.
- Clinical Pharmacology [database on the Internet]. Tampa, FL: Gold Standard, Inc.; 2020. <https://www.clinicalpharmacology.com/>. Accessed May 21, 2020.
- Comunin-Carrasco G, Pena-Martí GE, Martí-Carvajal AJ. Antibiotics for treating gonorrhoea in pregnancy. *Cochrane Database Syst Rev.* 2018;2:CD011167. doi: 10.1002/14651858.CD011167.pub2.
- Dreihobl M, Bianchi P, Keyserling CH, et al. Comparison of cefdinir and cefaclor in the treatment of community-acquired pneumonia. *Antimicrob Agents Chemother.* 1997;41(7):1579-1583.
- Drugs@FDA [database on the Internet]. Rockville (MD): Food and Drug Administration (US), Center for Drug Evaluation and Research; 2020. Available from: <http://www.accessdata.fda.gov/scripts/cder/daf/>. Accessed May 21, 2020.
- Fogarty CM, Bettis RB, Griffin TJ, et al. Comparison of a 5 day regimen of cefdinir with a 10 day regimen of cefprozil for treatment of acute exacerbation of chronic bronchitis. *J Antimicrob Chemother.* 2000;45:851-858.
- Fogarty CM, Cyganowski M, Palo WA, Hom RC, Craig WA. A comparison of cefditoren pivoxil and amoxicillin/clavulanate in the treatment of community-acquired pneumonia: a multicenter, prospective, randomized, investigator-blinded, parallel-group study. *Clin Ther.* 2002;24(11):1854-1870.
- Gehanno P, Depondt J, Barry B, et al. Comparison of cefpodoxime proxetil with cefaclor in the treatment of sinusitis. *J Antimicrob Chemother.* 1990;26(Suppl E): 87-91.
- Gupta K, Hooton TM, Naber KG, et al. International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: A 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. *Clin Infect Dis.* 2011 Mar;52(5):e103-120.
- Handsfield H, McCormack W, Hook E, et al. A comparison of single-dose cefixime with ceftriaxone as a treatment for uncomplicated gonorrhea. *N Engl J Med.* 1991;325(19):1337-1341.
- Ho MW, Wang FD, Fung CP, et al. Comparative study of ceftibuten and cefixime in the treatment of complicated urinary tract infections. *J Microbiol Immunol Infect.* 2001;34:185-189.
- Koning S, van der Sande R, Verhagen AP, et al. Interventions for impetigo (review). *Cochrane Database Syst Rev.* 2012;1:CD003261.
- Lepak AJ, Andes DR. Cephalosporins. In: Bennett JE, Dolin R, Blaser MJ, eds. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*, 9th ed. Philadelphia, PA; 2020.
- Leigh AP, Nemeth MA, Keyserling CH, et al. Cefdinir versus cefaclor in the treatment of uncomplicated urinary tract infection. *Clin Ther.* 2000;22(7):818-825.
- Lieberthal AS, Carroll AE, Chonmaitree T, et al. Clinical practice guideline: the diagnosis and management of acute otitis media. *Pediatrics.* 2013;131:e964-999. Available from: <http://pediatrics.aappublications.org/content/early/2013/02/20/peds.2012-3488.full.pdf+html>. Accessed May 21, 2020.
- Lodha R, Kabra SK, Pandey RM. Antibiotics for community-acquired pneumonia in children (review). *Cochrane Database Syst Rev.* 2013;6:CD004874.
- MacLoughlin GJ, Barreto DG, de la Torre C, et al. Cefpodoxime proxetil suspension compared with cefaclor suspension for treatment of acute otitis media in pediatric patients. *J Antimicrob Chemother.* 1996;37:565-573.
- Metlay JP, Waterer GW, Long AC, et al. Diagnosis and treatment of adults with community-acquired pneumonia. An official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America. *Am J Respir Crit Care Med.* 2019;200(7):e45-e67. doi:10.1164/rccm.201908-1581ST.
- Monmaturapoj T, Montakantikul P, Mootsikapun P, Tragulpiankit P. A prospective, randomized, double dummy, placebo-controlled trial of oral cefditoren pivoxil 400mg once daily as switch therapy after intravenous ceftriaxone in the treatment of acute pyelonephritis. *Int J Infect Dis.* 2012;16(12):e843-849.

- Nemeth M, McCarty J, Gooch H, et al. Comparison of cefdinir and penicillin for the treatment of streptococcal pharyngitis. *Clin Ther.* 1999;21(11):1873-1881.
- Novak E, Paxton L, Tubbs H, et al. Orally administered cefpodoxime proxetil for treatment of uncomplicated gonococcal urethritis in males: a dose-response study. *Antimicrob Agents Chemother.* 1992;36(8):764-765.
- Orange Book: Approved Drug Products with Therapeutic Equivalence Evaluations [database on the internet]. Silver Spring, MD: Food and Drug Administration (US), Center for Drug Evaluation and Research; 2020. Available from: <https://www.accessdata.fda.gov/scripts/cder/ob/index.cfm>. Accessed May 21, 2020.
- Ozaki T, Nishimura N, Suzuki M, et al. Five-day oral cefditoren pivoxil versus 10-day oral amoxicillin for pediatric group A streptococcal pharyngotonsillitis. *J Infect Chemother.* 2008;14(3):213-218.
- Peters AT, Spector S, Hsu J, et al. Joint Task Force on Practice Parameters, representing the American Academy of Allergy, Asthma and Immunology, the American College of Allergy, Asthma and Immunology, and the Joint Council of Allergy, Asthma and Immunology. Diagnosis and management of rhinosinusitis: a practice parameter update. *Ann Allergy Asthma Immunol.* 2014;113:347-385.
- Phillips H, Van Hook CJ, Butler T, et al. A comparison of cefpodoxime proxetil and cefaclor in the treatment of acute exacerbation of COPD in adults. *Chest.* 1993;104(5):1387-1391.
- Pichichero ME, Gooch WM, Rodriguez W, et al. Effective short-course treatment of acute group A beta-hemolytic streptococcal tonsillopharyngitis. *Arch Pediatr Adolesc Med.* 1994;148:1053-1060.
- Piippo T, Stefansson S, Pitkääjärvi T, et al. Double-blind comparison of cefixime and cefaclor in the treatment of acute otitis media in children. *Scand J Infect Dis.* 1991;23:459-465.
- Plourde P, Tyndall M, Agoki E, et al. Single-dose cefixime versus single-dose ceftriaxone in the treatment of antimicrobial resistant *Neisseria gonorrhoeae* infection. *J Infect Dis.* 1992;166(4):919-922.
- Portilla I, Lutz B, Montalvo M, et al. Oral cefixime versus intramuscular ceftriaxone in patients with uncomplicated gonococcal infections. *Sexually Transmitted Diseases.* 1992;19(2):94-98.
- Shane AL, Mody RK, Crump et al For the Infectious Diseases Society of America. 2017 Infectious Diseases Society of America clinical practice guidelines for the diagnosis and management of infectious diarrhea. *Clin Infect Dis.* 2017;65:e45-80.
- Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical practice guideline (update): adult sinusitis. *Otolaryngol Head Neck Surg.* 2015;152(2 Suppl):S1-S39.
- Sengupta J, Mondal AK, Jain P, et al. Comparative evaluations of cefpodoxime versus cefixime in children with lower respiratory tract infections. *Indian J Pediatr.* 2004;71(6):517-21.
- Shulman ST, Bisno AL, Clegg HW, et al. Clinical practice guideline for the diagnosis and management of group a streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America. *Clin Infect Dis.* 2012;55(10):e86-102.
- Spectracef prescribing information. Vansen Pharma Inc. Westmount, QC. June 2013.
- Stevens DL, Bisno AL, Chambers HF, et al. Practice guidelines for the diagnosis and management of skin and soft-tissue infections: 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis.* 2014;59(2):e10-52.
- Stevens DL, Pien F, Drehobol M. Comparison of oral cefpodoxime proxetil and cefaclor in the treatment of skin and soft tissue infections. *Diagn Microbiol Infect Dis.* 1993;16:123-129.
- Strohmeier Y, Hodson EM, Willis NS, et al. Antibiotics for acute pyelonephritis in children. *Cochrane Database Syst Rev.* 2014 Jul 28;7:CD003772.
- Suprax prescribing information. Lupin Pharmaceuticals. Baltimore, MD. **January 2020.**
- Tack K, Henry D, Gooch W, et al for the Cefdinir Pharyngitis Study Group. Five-day cefdinir treatment for streptococcal pharyngitis. *Antimicrob Agents Chemother.* 1998[a];42(5):1073-1075.
- Tack K, Littlejohn T, Mailloux G, et al. Cefdinir versus cephalixin for the treatment of skin and skin structure infections. *Clin Ther.* 1998[b];20(2):244-256.
- Tack KJ, Keyserling CH, McCarty J, et al. Study of use of cefdinir versus cephalixin for treatment of skin infections in pediatric patients. *Antimicrob Agents Chemother.* 1997;41(4):739-742.
- The Medical Letter. Cephalosporins for patients with penicillin allergy. *Med Lett Drugs Ther.* 2012;54(1406):101.
- Van Herwaarden C, Langan C, Siemon G, et al. International study comparing cefdinir and cefuroxime axetil in the treatment of patients with acute exacerbation of chronic bronchitis. *Int J Infect Dis.* 1999;4:26-33.
- van Zyle L, le Roux J, LaFata J, et al. Cefditoren pivoxil versus cefpodoxime proxetil for community-acquired pneumonia: results from a multi-center, prospective, randomized, double-blind study. *Clin Ther.* 2002;24(11):1840-1853.
- Verdon M, Douglas J, Wiggins S, et al. Treatment of uncomplicated gonorrhea with single doses of 200 mg cefixime. *Sexually Transmitted Diseases.* 1993;20(5):290-293.
- Verghese A, Roberson D, Kalbfleisch JH, et al. Randomized comparative study of cefixime versus cephalixin in acute bacterial exacerbations of chronic bronchitis. *Antimicrob Agents Chemother.* 1990;34(6):1041-1044.
- Wald ER, Applegate KE, Bordley C, et al. Clinical practice guideline for the diagnosis and management of acute bacterial sinusitis in children aged 1 to 18 years. *Pediatrics.* 2013;132:e262-280.
- Zuck P, Petitpretz P, Geslin P, et al. Bacteriological eradication of streptococcus pneumoniae from patients with acute exacerbations of chronic bronchitis: cefuroxime axetil versus cefixime. *Int J Clin Prac.* 1999;53(6):437-43.

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