

## NEW ZEALAND DATA SHEET

### 1. NAME OF THE MEDICINAL PRODUCT

CEFTRIAXONE 0.5 g & 1 g Powder For Injection & CEFTRIAXONE 2 g Powder For Infusion

### 2. QUALITATIVE AND QUANTITATIVE COMPOSITION

#### Active Substance

Each 0.5 g vial contains Ceftriaxone sodium equivalent to 0.5 g of Ceftriaxone.

Each 1 g vial contains Ceftriaxone sodium equivalent to 1 g of Ceftriaxone.

Each 2 g vial contains Ceftriaxone sodium equivalent to 2 g of Ceftriaxone.

#### Excipients:

For full list of excipients see 6.1.

### 3. PHARMACEUTICAL FORM

Powder for Injection/Infusion

Sterile, non-pyrogenic, almost white or yellowish, crystalline powder.

### 4. CLINICAL PARTICULARS

#### 4.1 Therapeutic indications

Infections caused by pathogens sensitive to ceftriaxone, e.g.:

- Sepsis
- Meningitis
- Abdominal infections (peritonitis, infections of the biliary and gastrointestinal tracts)
- Infections of the bones, joints, soft tissue, skin and of wounds
- Infections in patients with impaired defense mechanisms
- Renal and urinary tract infections
- Respiratory tract infections, particularly pneumonia, and ear, nose and throat infections
- Genital infections, including gonorrhoea
- Perioperative prophylaxis of infections

#### 4.2 Posology and method of administration

##### Posology

##### *Adults and children over 12 years*

The usual dosage is 1 to 2 g Ceftriaxone Injection once daily (every 24 hours). In severe cases or in infections caused by moderately sensitive organisms, the dosage may be raised to 4 g, once daily.

##### *Neonates, infants and children up to 12 years*

The following dosage schedules are recommended for once daily administration:

Neonates (up to 14 days): 20 to 50 mg/kg bodyweight once daily. The daily dose should not exceed 50 mg/kg on account of the immaturity of the infant's enzyme systems. It is not necessary to differentiate between premature and term infants.

Infants and children (15 days to 12 years): 20 to 80 mg/kg once daily.

For children with bodyweights of 50 kg or more, the usual adult dosage should be used.

Intravenous doses of not less than 50 mg/kg bodyweight should be given by infusion over at least 30 minutes.

### Combination therapy

Synergy between ceftriaxone and aminoglycosides has been demonstrated with many Gram negative bacteria under experimental conditions. Although enhanced activity of such combinations is not always predictable, it should be considered in severe, life threatening infections due to micro-organisms such as *Pseudomonas aeruginosa*. To avoid an incompatibility reaction, the two medicines must be administered separately at the recommended dosages.

### Special dosage instructions

#### *Meningitis*

In bacterial meningitis in infants and children, treatment begins with doses of 100 mg/kg (up to a maximum of 4 g) once daily. As soon as the causative organism has been identified and its sensitivity determined, the dosage can be reduced accordingly. The following duration of therapy has shown to be effective: *Neisseria meningitidis* 4 days; *Haemophilus influenzae* 6 days; *Streptococcus pneumoniae* 7 days.

#### *Gonorrhoea*

For penicillinase-producing and non-penicillinase-producing strains, give a single intramuscular dose of 250 mg.

#### *Perioperative prophylaxis*

A single dose of 1 to 2 g depending on the risk of infection given at 30 to 90 minutes prior to surgery. In colorectal surgery, administration of Ceftriaxone Injection with or without a 5- nitroimidazole, e.g. ornidazole (separate administration, refer to Administration) has proven effective.

### Frequency and duration of administration

The duration of therapy varies according to the course of the disease. As with antibiotic therapy in general, administration of Ceftriaxone Injection should be continued for a minimum of 48 to 72 hours after the patient has become afebrile or evidence of bacterial eradication has been obtained.

### Method of administration

As a general rule, use the solutions immediately after preparation. Reconstituted solutions retain their physical and chemical stability for 24 hours at 25°C (or for 3 days when stored between 2 to 8°C). The solutions are pale yellowish in color; this characteristic of the active ingredient is of no significance to the efficacy or tolerance of the medicine.

Do NOT use diluents containing calcium, such as Ringer's solution or Hartmann's solution, to reconstitute ceftriaxone. Particulate formation can result.

Ceftriaxone and calcium-containing solutions, including continuous calcium-containing infusions such as parenteral nutrition, should not be mixed or administered simultaneously to any patient irrespective of age, even via different infusion lines or at different infusion sites.

However, in patients older than 28 days of age ceftriaxone and calcium-containing solutions may be administered sequentially one after another if infusion lines at different sites are used, or if the infusion lines are replaced or thoroughly flushed between infusions with physiological salt-solution to avoid precipitation. In patients requiring continuous infusion with calcium-containing TPN solutions, healthcare professionals may wish to consider the use of alternative antibacterial treatments which do not carry a similar risk of precipitation. If use of ceftriaxone is considered necessary in patients requiring continuous nutrition, TPN solutions and ceftriaxone can be administered simultaneously, albeit via different infusion lines at different sites. Alternatively, infusion of TPN solution could be stopped for the period of ceftriaxone infusion, considering the advice to flush infusion lines between solutions.

#### *Intramuscular injection*

For intramuscular injection, dissolve Ceftriaxone Injection 0.5 g in 2 ml, and Ceftriaxone Injection 1 g in 3.5

ml lidocaine hydrochloride solutions 1% w/v and inject well within the body of a relatively large muscle. It is recommended not to inject more than 1 g at one site. Never administer the lidocaine solution intravenously.

#### ***Intravenous injection***

For intravenous injection, dissolve Ceftriaxone Injection 0.5 g in 5 ml, and Ceftriaxone Injection 1 g in 10 ml water for injections. The intravenous administration should be given over 2 to 4 minutes.

#### ***Intravenous infusion***

The infusion should be given over at least 30 minutes.

For intravenous infusion, dissolve Ceftriaxone Injection 2 g in 40 ml of one of the following calcium-free infusion solutions: sodium chloride 0.9%, sodium chloride 0.45% + dextrose 2.5%, dextrose 5%, dextrose 10%, dextran 6% in dextrose 5%, hydroxyethyl starch 6 to 10%, water for injections. Ceftriaxone solutions may be incompatible with other medicines or diluents and should not be mixed with or piggybacked into solutions or diluents containing antibiotics or solutes different to those listed above.

### **Additional information on special populations**

#### ***Elderly patients***

The dosages recommended for adults require no modification for geriatric patients.

#### ***Renal/Hepatic impairment***

In patients with impaired renal function, there is no need to reduce the dosage of Ceftriaxone Injection provided hepatic function is intact. Only in cases of pre-terminal renal failure (creatinine clearance less than 10 ml/min) should the ceftriaxone dosage not exceed 2 g daily.

In patients with liver damage, there is no need to reduce the dosage provided renal function is intact.

In cases of concomitant severe renal and hepatic dysfunction, determine the plasma concentrations of ceftriaxone at regular intervals and if necessary, adjust the dose.

Patients undergoing dialysis require no additional supplementary dosing following the dialysis. Plasma concentrations should, however, be monitored, to determine if dosage adjustments are necessary, since in these patients, the elimination rate may be altered.

### **4.3 Contraindications**

Ceftriaxone is contraindicated in patients with known hypersensitivity to ceftriaxone or the excipients or to the cephalosporin class of antibiotics. In patients hypersensitive to penicillin, the possibility of allergic cross-reactions should be borne in mind. Although the relevant preclinical investigations revealed neither mutagenic nor teratogenic effects, ceftriaxone should not be used in pregnancy (particularly in the first trimester) unless absolutely indicated.

#### ***Hyperbilirubinemic Neonates:***

Ceftriaxone is contraindicated in hyperbilirubinemic neonates, especially prematures. *In vitro* studies have shown that ceftriaxone can displace bilirubin from its binding to serum albumin and bilirubin encephalopathy can possibly develop in these patients.

#### ***Neonates (≤28 days)***

Ceftriaxone is contraindicated in neonates if they require (or are expected to require) treatment with calcium-containing intravenous solutions because of the risk of precipitation of ceftriaxone-calcium salt.

Cases of fatal reactions with ceftriaxone-calcium precipitates in lung and kidneys in neonate have been described. In some cases the infusion lines and the times of administration of ceftriaxone and calcium-containing solutions differed.

### **4.4 Special warnings and precautions for use**

Ceftriaxone Injection should not ordinarily be given to those allergic to cephalosporins or to penicillins,

especially where an allergic or urticarial reaction has occurred. As with other cephalosporins, anaphylactic shock cannot be ruled out even if a thorough patient history is taken.

#### **Antibiotic Associated Pseudomembranous Colitis**

Antibiotic associated pseudomembranous colitis has been reported with many antibiotics including ceftriaxone. A toxin produced by *Clostridium difficile* appears to be the primary cause. The severity of the colitis may range from mild to life threatening. It is important to consider this diagnosis in patients who develop diarrhea or colitis in association with antibiotic use (this may occur up to several weeks after cessation of antibiotic therapy). Mild cases usually respond to medicine discontinuation alone. However, in moderate to severe cases appropriate therapy with a suitable oral antibacterial agent effective against *C. difficile* should be considered. Fluids, electrolytes and protein replacement should be provided when indicated.

Medicines which delay peristalsis e.g. Opiates and diphenoxylate with atropine (Lomotil) may prolong and/or worsen the condition and should not be used.

Other causes of colitis should also be considered.

#### **Immune Mediated Hemolytic Anemia**

Immune mediated hemolytic anemia has been observed in patients receiving cephalosporin class antibacterials. Severe cases of hemolytic anemia, including fatalities, have been reported during treatment in both adults and children. If a patient develops anemia while on ceftriaxone, the diagnosis of a cephalosporin associated anemia should be considered and ceftriaxone discontinued until the etiology is determined.

#### **Alterations in Clotting Time**

Alterations in prothrombin times have occurred rarely in patients treated with ceftriaxone. Patients with impaired vitamin K synthesis or low vitamin K stores (eg. chronic hepatic disease and malnutrition) may require monitoring of prothrombin time during ceftriaxone treatment. Vitamin K administration (10 mg weekly) may be necessary if the prothrombin time is prolonged before or during therapy.

#### **Interactions with calcium-containing products**

There are no reports to date of intravascular or pulmonary precipitations in patients, other than neonates, treated with ceftriaxone and calcium-containing IV solutions. However, the theoretical possibility exists for an interaction between ceftriaxone and IV calcium-containing solutions in patients other than neonates.

In patients of any age ceftriaxone must not be mixed or administered simultaneously with any calcium-containing IV solutions, even via different infusion lines or at different infusion sites.

However, in patients older than 28 days of age ceftriaxone and calcium-containing solutions may be administered sequentially one after another if infusion lines at different sites are used or if the infusion lines are replaced or thoroughly flushed between infusions with physiological salt-solution to avoid precipitation.

In patients requiring continuous infusion with calcium-containing TPN solutions, healthcare professionals may wish to consider the use of alternative antibacterial treatments which do not carry a similar risk of precipitation. If use of ceftriaxone is considered necessary in patients requiring continuous nutrition, TPN solutions and ceftriaxone can be administered simultaneously, albeit via different infusion lines at different sites. Alternatively, infusion of TPN solution could be stopped for the period of ceftriaxone infusion, considering the advice to flush infusion lines between solutions. No data are available on the potential interaction between ceftriaxone and oral calcium-containing products or interaction between IM ceftriaxone and calcium-containing products (IV or oral).

#### **Hepatitis and hepatocellular injury**

Cases of hepatitis and hepatocellular injury with or without jaundice have been observed during ceftriaxone therapy and may occur early in the treatment period and independently of cholelithiasis. Patients should be advised to report immediately any symptoms suggestive of liver injury.

#### **Precautions**

Superinfections with non-susceptible micro-organisms may occur as with other antibacterial agents.

Shadows, which have been mistaken for gallstones, have been detected on sonograms of the gallbladder, usually following doses higher than the standard recommended dose. These shadows are, however, precipitates of calcium ceftriaxone that disappear on completion or discontinuation of ceftriaxone therapy. Rarely have these findings been associated with symptoms. In asymptomatic cases discontinuation of treatment is not recommended as the condition is reversible after completion of the treatment. In symptomatic cases, conservative non-surgical management is recommended. Discontinuation of ceftriaxone treatment in symptomatic cases should be at the discretion of the physician.

Cases of pancreatitis, possibly of biliary obstruction etiology, have been rarely reported in patients treated with ceftriaxone. Most patients presented with risk factors for biliary stasis and biliary sludge, e.g. preceding major therapy, severe illness and total parenteral nutrition. A trigger or cofactor role of ceftriaxone-related biliary precipitation cannot be eliminated.

Safety and effectiveness of ceftriaxone in neonates, infants and children have been established for the dosages described under Dosage and administration. *In vitro* studies have shown that ceftriaxone, like some other cephalosporins, can displace bilirubin from serum albumin. Ceftriaxone Injection should not be used in neonates (especially prematures) at risk of developing bilirubin encephalopathy.

During prolonged treatment, monitor the blood at regular intervals.

#### **4.5 Interaction with other medicinal products and other forms of interaction**

To date, no impairment of renal function has so far been observed after concurrent administration of large doses of ceftriaxone and potent diuretics (e.g. frusemide).

There is no evidence that ceftriaxone increases renal toxicity of aminoglycosides.

No effect similar to that of disulfiram has been demonstrated after ingestion of alcohol subsequent to the administration of ceftriaxone. Ceftriaxone does not contain an N-methylthiotetrazole moiety associated with possible ethanol intolerance and bleeding problems of certain other cephalosporins.

Probenecid does not modify the elimination of ceftriaxone.

Antagonistic effects have been observed *in vitro* with the combination of chloramphenicol and ceftriaxone.

#### ***Influence on diagnostic tests***

A false positive Coomb's test result has been rarely observed in patients treated with ceftriaxone. Ceftriaxone, like other antibiotics, may result in false-positive tests for galactosemia. Likewise, nonenzymatic methods for the glucose determination in urine may give false-positive results. Select enzymatic reagents for urinary glucose determination during ceftriaxone therapy.

#### **Additional information on special populations**

Data is not available.

#### **Pediatric population**

The information given above is also applicable for the pediatric population.

#### **4.6 Fertility, pregnancy and lactation**

##### **General Recommendation**

Pregnancy category is B

##### **Pregnancy**

Studies in animals have not shown evidence of an increased occurrence of fetal damage. Reproductive toxicity studies have been performed in mice and rats at doses up to 20 times the human dose of 2 g/d (586

mg/kg/d in rats), and have not shown evidence of embryotoxicity, fetotoxicity, teratogenicity or adverse effects on male or female fertility, birth or peri- and postnatal development. In primates, no embryotoxicity or teratogenicity was demonstrated at a dose approximately 3 times the human dose (84 mg/kg/d in monkeys).

Safety in human pregnancy has not been established. Ceftriaxone crosses the placental barrier.

#### **Lactation**

Low concentrations of ceftriaxone are secreted in human milk. Exercise caution when administering ceftriaxone to a nursing woman.

#### **Fertility**

Reproductive studies have shown no evidence of adverse effects on male or female fertility.

#### **4.7 Effects on ability to drive and use machines**

This medicine is presumed to be safe or unlikely to produce an effect.

#### **4.8 Undesirable effects**

Ceftriaxone is generally well tolerated. During ceftriaxone treatment the following side effects, which were reversible either spontaneously or after withdrawal of the medicine, have been observed:

##### **Common (not less than 1%)**

*Gastrointestinal complaints (about 2% of the cases):* loose stools or diarrhea, nausea, vomiting, stomatitis and glossitis.

*Hematological changes (about 2%):* eosinophilia, leucopenia, granulocytopenia, hemolytic anemia, thrombocytopenia. Isolated cases of agranulocytosis (below 500/mm<sup>3</sup>) have been reported, most of them after 10 days of treatment and following total doses of 20 g or more.

##### **Uncommon (less than 1% but not less than 0.1%)**

*Skin reactions (about 1%):* exanthema, allergic dermatitis, pruritus, urticaria, edema. Isolated cases of severe cutaneous adverse reactions (erythema multiforme, Stevens Johnson syndrome or Lyell's Syndrome/toxic epidermal necrolysis) have been reported.

##### **Rare (less than 0.1%)**

These include headache and dizziness, symptomatic precipitation of ceftriaxone calcium salt in the gallbladder, increase in liver enzymes, oliguria, increase in serum creatinine, genital mycosis, fever, shivering and anaphylactic or anaphylactoid reactions.

In rare cases, phlebotic reactions occurred after intravenous administration. These may be minimized by slow injection over 2 to 4 minutes. Intramuscular injection without lidocaine solution is painful.

Pseudomembranous enterocolitis and coagulation disorders have been reported as very rare side effects.

Very rare cases of renal precipitation have been reported, mostly in children older than 3 years and who have been treated with either high daily doses (e.g. NLT 80 mg/kg/day) or total doses exceeding 10 grams and presenting other risk factors (e.g. fluid restrictions, confinement to bed, etc.). This event may be symptomatic or asymptomatic, may lead to renal insufficiency, and is reversible upon discontinuation of ceftriaxone.

##### **Very Rare (less than 0.01%)**

Pancreatitis, Stevens Johnson syndrome.

#### **Reporting of suspected adverse reactions**

Reporting suspected adverse reactions after authorization of the medicine is important. It allows continued monitoring of the benefit/risk balance of the medicine. Healthcare professionals are asked to report any suspected adverse reactions <https://nzphvc.otago.ac.nz/reporting/>.

## 4.9 Overdose

In the case of overdosage, ceftriaxone concentration would not be reduced by hemodialysis or peritoneal dialysis. There is no specific antidote. Treatment of overdosage should be symptomatic.

For further advice on management of overdose please contact the National Poisons Information Centre (0800 POISON or 0800 764 766).

**Drug abuse and dependence:** Drug dependency, addiction and recreational abuse have not been reported as a problem with this compound.

## 5. PHARMACOLOGICAL PROPERTIES

### 5.1 Pharmacodynamic properties

**Pharmacotherapeutic group:** Antibacterials for systemic use, Third-generation cephalosporins

**ATC code:** J01DD04

Ceftriaxone sodium is almost white to yellowish crystalline powder.

The chemical name of Ceftriaxone sodium is:

Disodium (6R,7R)-7-[[[(2Z)-(2-Aminothiazol-4-yl)(methoxyimino)acetyl]amino]-3-[[[(2-methyl-6-oxido-5-oxo-2,5-dihydro-1,2,4-triazin-3-yl)sulphonyl]methyl]-8-oxo-5-thia-1-azabicyclo[4.2.0]oct-2-ene-2-carboxylate 3.5 hydrate (Sterile Ceftriaxone Sodium)

Ceftriaxone sodium is very soluble in water, sparingly soluble in methanol, very slightly soluble in ethanol, and has a molecular weight of 661.61.

#### Pharmacodynamic properties

Ceftriaxone is a long acting, broad-spectrum cephalosporin antibiotic for parenteral use. Ceftriaxone inhibits the bacterial cell wall synthesis leading to lysis of bacteria.

#### Mechanism of action:

Ceftriaxone is a long acting, broad-spectrum cephalosporin antibiotic for parenteral use. The bactericidal activity of ceftriaxone results from inhibition of bacterial cell wall synthesis.

Ceftriaxone exerts *in vitro* activity against a wide range of Gram-negative and Gram-positive microorganisms. Ceftriaxone is highly stable to most  $\beta$ -lactamases, both penicillinases and cephalosporinases, of gram-positive and gram-negative bacteria.

Ceftriaxone is usually active against the following micro-organisms *in vitro* and in clinical infections (see Section 4.1):

#### **Gram-positive Aerobes:**

*Staphylococcus aureus* (methicillin-sensitive),

*Staphylococci* coagulase-negative,

*Streptococcus pyogenes* ( $\beta$ -hemolytic, group A),

*Streptococcus agalactiae* ( $\beta$ -hemolytic, group B),

*Streptococci*  $\beta$ -hemolytic (non-group A or B),

*Streptococcus viridans*,

*Streptococcus pneumoniae*.

*Note:* Methicillin-resistant *Staphylococcus* spp. are resistant to cephalosporins, including ceftriaxone. In general, *Enterococcus faecalis*, *Enterococcus faecium* and *Listeria monocytogenes* are resistant.

#### **Gram-negative Aerobes:**

*Acinetobacter lwoffii*,

*Acinetobacter anitratus* (mostly *A. baumannii*)\*,

*Aeromonas hydrophila*,

*Alcaligenes faecalis*,  
*Alcaligenes odorans*,  
*Alcaligenes* -like bacteria,  
*Capnocytophaga* spp.,  
*Citrobacter diversus* (including *C. amalonaticus*),  
*Citrobacter freundii*\*,  
*Escherichia coli*,  
*Enterobacter aerogenes* \*,  
*Enterobacter cloacae* \*,  
*Enterobacter* spp. (other),  
*Haemophilus ducreyi*,  
*Haemophilus influenzae*,  
*Haemophilus parainfluenzae*,  
*Hafnia alvei*,  
*Klebsiella oxytoca*,  
*Klebsiella pneumoniae*\*\*,  
*Moraxella catarrhalis* (former *Branhamella catarrhalis*),  
*Moraxella osloensis*,  
*Moraxella* spp. (other),  
*Morganella morganii*,  
*Neisseria gonorrhoea*,  
*Neisseria meningitidis*,  
*Pasteurella multocida*,  
*Plesiomonas shigelloides*,  
*Proteus penneri* \*,  
*Proteus mirabilis*,  
*Proteus vulgaris* ,  
*Pseudomonas cepacia*  
*Pseudomonas fluorescens* \*,  
*Pseudomonas* spp. (other)\*,  
*Providentia rettgeri*,  
*Providentia* spp. (other),  
*Salmonella typhi*,  
*Salmonella* spp. (non-typhoid),  
*Serratia marcescens* ,  
*Serratia* spp. (other),  
*Shigella* spp.,  
*Vibrio* spp.,  
*Yersinia enterocolitica*,  
*Yersinia* spp. (other)

\* Some isolates of these species are resistant to ceftriaxone, mainly due to the production of the chromosomally encoded  $\beta$ -lactamase.

\*\* Some isolates of these species are resistant due to production of extended spectrum, plasmid-mediated  $\beta$ -lactamase.

*Note:* Many strains of the above micro-organisms that are multiple resistant to other antibiotics, e.g. aminopenicillins and ureido-penicillins, older cephalosporins and aminoglycosides, are susceptible to ceftriaxone. *Treponema pallidum* is sensitive in vitro and in animal experiments. Clinical investigations indicate that primary and secondary syphilis respond well to ceftriaxone therapy. *Borrelia burgdorferi* can also be classified as highly sensitive to ceftriaxone, according to the available *in vitro* and *in vivo* data. With a few exceptions clinical *P. aeruginosa* isolates are resistant to ceftriaxone.

#### **Anaerobic organisms**

*Bacteroides* spp. (bile-sensitive)\*,  
*Clostridium* spp. (excluding *C. perfringens* group),



*Fusobacterium nucleatum*,  
*Fusobacterium* spp. (other),  
*Gaffkia anaerobica* (formerly *Peptococcus*),  
*Peptostreptococcus* spp.

\* Some isolates of these species are resistant to ceftriaxone due to  $\beta$ -lactamase-production.

Note: Many strains of  $\beta$ -lactamase-producing *Bacteroides* spp. (notably *B. fragilis*) are resistant.

*Clostridium difficile* is resistant.

Susceptibility to ceftriaxone can be determined by the disk diffusion test or by the agar or broth dilution test using standardized techniques for susceptibility testing such as those recommended by the National Committee for Clinical Laboratory Standards (NCCLS).

The NCCLS issued the following interpretative breakpoints for ceftriaxone:

	<b>Susceptible</b>	<b>Moderately susceptible</b>	<b>Resistant</b>
Dilution test inhibitory concentrations in mg/L	$\leq 8$	16-32	$\geq 64$
Diffusion test (disk with 30 $\mu$ g ceftriaxone), inhibition zone diameter in mm	$\geq 21$	20-14	$\leq 13$

Micro-organisms should be tested with the ceftriaxone disk since it has been shown by *in vitro* tests to be active against certain strains resistant to cephalosporin class disks.

Where NCCLS recommendations are not in daily use, alternative, well standardized, susceptibility-interpretative guidelines such as those issued by DIN, ICS and others may be substituted.

## 5.2 Pharmacokinetic properties

### General properties

The pharmacokinetics of ceftriaxone are non-linear and all basic pharmacokinetic parameters, except the elimination half-life, are dose dependent if based on total drug concentrations. An overall mean and the range of means from studies have been presented for the primary pharmacokinetic parameters of ceftriaxone administered in the dose range 0.15-3 g.

#### Absorption:

The maximum plasma concentration after a single IM dose of 1 g is about 81 mg/L and is reached in 2-3 hours after administration. The area under the plasma concentration-time curve after IM administration is equivalent to that after IV administration of an equivalent dose, indicating 100% bioavailability of intramuscularly administered ceftriaxone.

#### Distribution:

The volume of distribution of ceftriaxone is 7-12 L. Ceftriaxone has shown excellent tissue and body fluid penetration after a dose of 1-2 g; concentrations well above the minimal inhibitory concentrations of most pathogens responsible for infection are detectable for more than 24 hours in over 60 tissues or body fluids including lung, heart, biliary tract/liver, tonsil, middle ear and nasal mucosa, bone as well as cerebrospinal, pleural, prostatic and synovial fluids.

Following intravenous administration, ceftriaxone diffuses rapidly into the interstitial fluid, sustaining bactericidal concentrations against susceptible organisms for 24 hours.

#### *Protein binding*

Ceftriaxone is reversibly bound to albumin, and the binding decreases with the increase in concentration, e.g. from 95% binding at plasma concentrations of <100 mg/L to 85% binding at 300 mg/L. Owing to the lower albumin content, the proportion of free ceftriaxone in interstitial fluid is correspondingly higher than in plasma.

#### *Penetration into particular tissues*

Ceftriaxone penetrates the inflamed meninges of neonates, infants and children: Ceftriaxone concentrations exceed 1.4 mg/L in the Cerebrospinal Fluid (CSF) 24 hours after IV injection of ceftriaxone in doses of 50-100 mg/kg (neonates and infants respectively). Peak concentration in CSF is reached about 4 hours after IV injection and gives an average value of 18 mg/L. The average extent of diffusion into the cerebrospinal fluid during bacterial meningitis is 17% of plasma concentrations and 4% in patients with aseptic meningitis.

In adult meningitis patients, administration of 50 mg/kg leads within 2-24 hours to CSF concentrations several times higher than the minimum inhibitory concentrations required for the most common causative organisms of meningitis.

Ceftriaxone crosses the placental barrier and is secreted in the breast milk at low concentrations.

#### Metabolism

Ceftriaxone is not metabolized systemically; but is converted to inactive metabolites by the intestinal flora.

#### Elimination

Total plasma clearance is 10-22 ml/min.

Renal clearance is 5-12 ml/min.

50-60% of ceftriaxone is excreted unchanged in the urine, while 40-50% is excreted unchanged in the bile. The elimination half-life in adults is about 8 hours.

### **Characteristics in patients**

#### Neonates and elderly patients

In neonates, urinary recovery accounts for about 70% of the dose. In infants aged less than 8 days and in elderly persons aged over 75 years the average elimination half-life is usually two to three times that in young adults.

#### Renal or hepatic dysfunction

In patients with renal or hepatic dysfunction, the pharmacokinetics of ceftriaxone are only minimally altered and the elimination half-life is only slightly increased. If kidney function alone is impaired, biliary elimination of ceftriaxone is increased; if liver function alone is impaired, renal elimination is increased.

### **5.3 Preclinical safety data**

Repeated dose administrations in animals revealed the known and reversible side effect of parenterally administered 3rd-generation cephalosporins at high doses (e.g. alteration of laboratory parameters, enteric disturbances and a certain degree of nephrotoxicity). A specific side effect of ceftriaxone is the formation of biliary calculi in the gallbladder of dogs, and to a minor extent, also in monkeys. Ceftriaxone had no effect on reproductive parameters, and was found to have neither mutagenic nor antigenic activity.

## **6. PHARMACEUTICAL PARTICULARS**

### **6.1 List of Excipients**

None

### **6.2 Incompatibilities**

Ceftriaxone should not be added to solutions containing calcium such as Hartmann's solution and Ringer's solution. Based on literature reports ceftriaxone is incompatible with amsacrine, vancomycin and fluconazole and aminoglycosides.

### **6.3 Shelf life**

36 months

#### 6.4 Special precautions for storage

Ceftriaxone powder must be reconstituted prior to use (see Section 4.2).

Dry Powder: Store below 25 °C. Keep vial in the outer carton in order to protect from light.

Reconstituted Solution: Store at 25 °C for 24 hours and at 2-8 °C (refrigerate, do not freeze) for 3 days.

#### 6.5 Nature and contents of container

CEFTRIAXONE 0.5 g Powder For Injection

Sterile, non-pyrogenic, almost white or yellowish, crystalline powder in 8 cc molded Type- III clear glass vial with rubber stopper (Coating B2-42) sealed with aluminum cap.

CEFTRIAXONE 1 g Powder For Injection

Sterile, non-pyrogenic, almost white or yellowish, crystalline powder in 15 cc molded Type- III clear glass vial with rubber stopper (Coating B2-42) sealed with aluminum cap.

CEFTRIAXONE 2 g Powder For Infusion

Sterile, non-pyrogenic, almost white or yellowish, crystalline powder in 50 cc molded Type- II clear glass vial with rubber stopper (Coating B2-42) sealed with aluminum flip-off cap.

All presented in 1 vial, 5 vial and 10 vial packs. Not all pack sizes may be currently marketed.

#### 6.6 Special precautions for disposal and other handling

Any unused material should be disposed according to local disposal regulations.

### 7. MEDICINE SCHEDULE

Prescription Medicine

### 8. SPONSOR

DEVATIS LIMITED

45 Yarrow Street, Invercargill, 9810

New Zealand

Tel: +64 3 211 0080

Fax: +64 3 211 0079

[www.devatis.nz](http://www.devatis.nz)

### 9. DATE OF FIRST APPROVAL

**CEFTRIAXONE 0.5 g & 1 g Powder For Injection:**

Date of first authorization: 21/08/2014

**CEFTRIAXONE 2 g Powder For Infusion**

Date of first authorization: 11/08/2016

### 10. DATE OF REVISION OF THE TEXT

August 2021