

## HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use FETROJA® safely and effectively. See full prescribing information for FETROJA.

**FETROJA (cefiderocol) for injection, for intravenous use**  
**Initial U.S. Approval: 2019**

### INDICATIONS AND USAGE

FETROJA is a cephalosporin antibacterial indicated in patients 18 years of age or older who have limited or no alternative treatment options, for the treatment of complicated urinary tract infections (cUTI), including pyelonephritis caused by susceptible Gram-negative microorganisms. (1.1)  
Approval of this indication is based on limited clinical safety and efficacy data for FETROJA. (1.1, 14)

To reduce the development of drug-resistant bacteria and maintain the effectiveness of FETROJA and other antibacterial drugs, FETROJA should be used only to treat or prevent infections that are proven or strongly suspected to be caused by bacteria. (1.2)

### DOSAGE AND ADMINISTRATION

- Administer 2 grams of FETROJA for injection every 8 hours by intravenous (IV) infusion over 3 hours in patients with creatinine clearance (CLcr) 60 to 119 mL/min. (2.1)
- Dose adjustments are required for patients with CLcr less than 60 mL/min and for patients with CLcr 120 mL/min or greater. (2.2)
- See full prescribing information for instructions on preparation of FETROJA doses. (2.3)
- See full prescribing information for drug compatibilities. (2.4)

### DOSAGE FORMS AND STRENGTHS

For injection: 1 gram of cefiderocol as a lyophilized powder for reconstitution in single-dose vials. (3)

### CONTRAINDICATIONS

FETROJA is contraindicated in patients with a known history of severe hypersensitivity to cefiderocol and other beta-lactam antibacterial drugs or other components of FETROJA. (4)

### WARNINGS AND PRECAUTIONS

- Increase in All-Cause Mortality in Patients With Carbapenem-Resistant Gram-Negative Bacterial Infections: An increase in all-cause mortality was observed in FETROJA-treated patients compared to those treated with best available therapy (BAT). Reserve FETROJA for use in patients who have limited or no alternative treatment options for the treatment of cUTI. Closely monitor the clinical response to therapy in patients with cUTI. (5.1)
- Hypersensitivity Reactions: Serious and occasionally fatal hypersensitivity (anaphylactic) reactions have been reported in patients receiving beta-lactam antibacterial drugs. Hypersensitivity was observed with FETROJA. Cross-hypersensitivity may occur in patients with a history of penicillin allergy. If an allergic reaction occurs, discontinue FETROJA. (5.2)
- Clostridioides difficile*-Associated Diarrhea (CDAD): CDAD has been reported with nearly all systemic antibacterial agents, including FETROJA. Evaluate if diarrhea occurs. (5.3)
- Seizures and Other Central Nervous System (CNS) Adverse Reactions: CNS adverse reactions such as seizures have been reported with FETROJA. If focal tremors, myoclonus, or seizures occur, evaluate patients to determine whether FETROJA should be discontinued. (5.4)

### ADVERSE REACTIONS

The most frequently occurring adverse reactions in greater than or equal to 2% of patients treated with FETROJA were diarrhea, infusion site reactions, constipation, rash, candidiasis, cough, elevations in liver tests, headache, hypokalemia, nausea, and vomiting. (6.1)

To report SUSPECTED ADVERSE REACTIONS, contact Shionogi Inc. at 1-800-849-9707 or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch).

### DRUG INTERACTIONS

Use alternate testing methods to confirm positive results of dipstick tests (urine protein, ketones, or occult blood). (7.1)

See 17 for PATIENT COUNSELING INFORMATION.

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## FULL PRESCRIBING INFORMATION

### 1 INDICATIONS AND USAGE

#### 1.1 Complicated Urinary Tract Infections (cUTI), Including Pyelonephritis

FETROJA<sup>®</sup> is indicated in patients 18 years of age or older who have limited or no alternative treatment options for the treatment of complicated urinary tract infections (cUTIs), including pyelonephritis caused by the following susceptible Gram-negative microorganisms: *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, and *Enterobacter cloacae* complex.

Approval of this indication is based on limited clinical safety and efficacy data for FETROJA [see *Clinical Studies (14.1)*].

#### 1.2 Usage

To reduce the development of drug-resistant bacteria and maintain the effectiveness of FETROJA and other antibacterial drugs, FETROJA 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.

### 2 DOSAGE AND ADMINISTRATION

#### 2.1 Recommended Dosage

The recommended dosage of FETROJA is 2 grams administered every 8 hours by intravenous (IV) infusion over 3 hours in adults with a creatinine clearance (CLcr) of 60 to 119 mL/min.

Dosage adjustment is recommended for patients with CLcr less than 60 mL/min or for patients with CLcr 120 mL/min or greater [see *Dosage and Administration (2.2)*].

The recommended duration of treatment with FETROJA is 7 to 14 days. The duration of therapy should be guided by the severity of infection and the patient's clinical status for up to 14 days.

#### 2.2 Dosage Adjustments In Patients With Renal Impairment (CLcr Less Than 60 mL/min and CLcr 120 mL/min or Greater)

##### Dosage Adjustments in Patients with CLcr Less Than 60 mL/min

Dosage adjustment of FETROJA is recommended in patients with CLcr less than 60 mL/min (Table 1). For patients with fluctuating renal function, monitor CLcr and adjust dosage accordingly.

**Table 1 Recommended Dosage of FETROJA for Patients with CLcr less than 60 mL/min**

Estimated Creatinine Clearance (CLcr) <sup>a</sup>	Dose	Frequency	Infusion Time
Patients with CLcr 30 to 59 mL/min	1.5 grams	Every 8 hours	3 hours
Patients with CLcr 15 to 29 mL/min	1 gram	Every 8 hours	3 hours
ESRD Patients (CLcr less than 15 mL/min) with or without intermittent HD <sup>b</sup>	0.75 gram	Every 12 hours	3 hours

<sup>a</sup>CLcr = creatinine clearance estimated by Cockcroft-Gault equation.

<sup>b</sup>Cefiderocol is removed by hemodialysis (HD); thus, complete hemodialysis (HD) at the latest possible time before the start of cefiderocol dosing. ESRD = end-stage renal disease; HD = hemodialysis.

## Dosage Adjustments in Patients with CLcr 120 mL/min or Greater

For patients with CLcr greater than or equal to 120 mL/min, FETROJA 2 grams administered every 6 hours by IV infusion over 3 hours is recommended.

### **2.3 Preparation of FETROJA Solution for Administration**

FETROJA is supplied as a sterile, lyophilized powder that must be reconstituted and subsequently diluted using aseptic technique prior to intravenous infusion.

#### Preparation of Doses

Reconstitute the powder for injection in the FETROJA vial with 10 mL of either 0.9% sodium chloride injection, USP or 5% dextrose injection, USP and gently shake to dissolve. Allow the vial(s) to stand until the foaming generated on the surface has disappeared (typically within 2 minutes). The final volume of the reconstituted solution will be approximately 11.2 mL. The reconstituted solution is for intravenous infusion only after dilution in an appropriate infusion solution.

To prepare the required doses, withdraw the appropriate volume of reconstituted solution from the vial according to Table 2 below. Add the withdrawn volume to an infusion bag containing 100 mL of 0.9% sodium chloride injection, USP or 5% dextrose injection, USP [see *Dosage and Administration (2.4)*].

Parenteral drug products should be inspected visually for particulate matter and discoloration prior to administration, whenever solution and container permit. FETROJA infusions are clear, colorless solutions. Discard any unused FETROJA solution in the vial (see Table2).

**Table 2 Preparation of FETROJA Doses**

<b>FETROJA Dose</b>	<b>Number of 1-gram FETROJA Vials to be Reconstituted</b>	<b>Volume to Withdraw from Reconstituted Vial(s)</b>	<b>Total Volume of FETROJA Reconstituted Solution for Further Dilution into at Least 100 mL</b>
2 grams	2 vials	11.2 mL (entire contents) of each vial	22.4 mL
1.5 grams	2 vials	11.2 mL (entire contents) of first vial AND 5.6 mL from second vial	16.8 mL
1 gram	1 vial	11.2 mL (entire contents)	11.2 mL
0.75 gram	1 vial	8.4 mL	8.4 mL

### **2.4 Drug Compatibility**

FETROJA solution for administration is compatible with:

- 0.9% sodium chloride injection, USP
- 5% dextrose injection, USP

The compatibility of FETROJA solution for administration with solutions containing other drugs or other diluents has not been established.

### **2.5 Storage of Reconstituted Solutions**

#### Reconstituted FETROJA

Upon reconstitution with the appropriate diluent, the reconstituted FETROJA solution in the vial should be immediately transferred and diluted into the infusion bag. Reconstituted FETROJA can be stored for up to 1 hour at room temperature. Discard any unused reconstituted solution.

## Diluted FETROJA Infusion Solution

The diluted FETROJA infusion solution in the infusion bags is stable for up to 4 hours at room temperature.

### **3 DOSAGE FORMS AND STRENGTHS**

FETROJA 1 gram is supplied as a white to off-white, sterile, lyophilized powder for reconstitution in single-dose, clear glass vials; each vial contains 1 gram of cefiderocol.

### **4 CONTRAINDICATIONS**

FETROJA is contraindicated in patients with a known history of severe hypersensitivity to cefiderocol or other beta-lactam antibacterial drugs, or any other component of FETROJA [*see Warnings and Precautions (5.2) and Adverse Reactions (6.1)*].

### **5 WARNINGS AND PRECAUTIONS**

#### **5.1 Increase in All-Cause Mortality in Patients With Carbapenem-Resistant Gram-Negative Bacterial Infections**

An increase in all-cause mortality was observed in patients treated with FETROJA as compared to best available therapy (BAT) in a multinational, randomized, open-label trial in critically-ill patients with carbapenem-resistant Gram-negative bacterial infections (NCT02714595). Patients with nosocomial pneumonia, bloodstream infections, sepsis, or cUTI were included in the trial. BAT regimens varied according to local practices and consisted of 1 to 3 antibacterial drugs with activity against Gram-negative bacteria. Most of the BAT regimens contained colistin.

The increase in all-cause mortality occurred in patients treated for nosocomial pneumonia, bloodstream infections, or sepsis. The 28-Day all-cause mortality was higher in patients treated with FETROJA than in patients treated with BAT [25/101 (24.8%) vs. 9/49 (18.4%), treatment difference 6.4%, 95% CI (-8.6, 19.2)]. All-cause mortality remained higher in patients treated with FETROJA than in patients treated with BAT through Day 49 [34/101 (33.7%) vs. 10/49 (20.4%), treatment difference 13.3%, 95% CI (-2.5, 26.9)]. Generally, deaths were in patients with infections caused by Gram-negative organisms, including non-fermenters such as *Acinetobacter baumannii*, *Stenotrophomonas maltophilia*, and *Pseudomonas aeruginosa*, and were the result of worsening or complications of infection, or underlying comorbidities. The cause of the increase in mortality has not been established. The safety and efficacy of FETROJA has not been established for the treatment of nosocomial pneumonia, bloodstream infections, or sepsis.

Reserve FETROJA for use in patients who have limited or no alternative treatment options for the treatment of cUTI [*see Indications and Usage (1.1)*]. Closely monitor the clinical response to therapy in patients with cUTI.

#### **5.2 Hypersensitivity Reactions**

Serious and occasionally fatal hypersensitivity (anaphylactic) reactions and serious skin reactions have been reported in patients receiving beta-lactam antibacterial drugs. Hypersensitivity was observed in FETROJA clinical trials [*see Adverse Reactions (6.1)*]. These reactions are more likely to occur in individuals with a history of beta-lactam hypersensitivity and/or a history of sensitivity to multiple allergens. There have been reports of individuals with a history of penicillin hypersensitivity who have experienced severe reactions when treated with cephalosporins. Before therapy with FETROJA is instituted, inquire about previous hypersensitivity reactions to cephalosporins, penicillins, or other beta-lactam antibacterial drugs. Discontinue FETROJA if an allergic reaction occurs.

### 5.3 *Clostridioides difficile*-Associated Diarrhea (CDAD)

*Clostridioides difficile*-Associated diarrhea (CDAD) has been reported for nearly all systemic antibacterial agents, including FETROJA. CDAD may range in severity from mild diarrhea to fatal colitis. Treatment with antibacterial agents alters the normal flora of the colon and may permit 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 antibacterial use. Careful medical history is necessary because CDAD has been reported to occur more than 2 months after the administration of antibacterial agents.

If CDAD is suspected or confirmed, antibacterial drugs not directed against *C. difficile* may need to be discontinued. Manage fluid and electrolyte levels as appropriate, supplement protein intake, monitor antibacterial treatment of *C. difficile*, and institute surgical evaluation as clinically indicated.

### 5.4 Seizures and Other Central Nervous System (CNS) Adverse Reactions

Cephalosporins, including FETROJA, have been implicated in triggering seizures [see *Adverse Reactions (6.1)*]. Nonconvulsive status epilepticus (NCSE), encephalopathy, coma, asterixis, neuromuscular excitability, and myoclonia have been reported with cephalosporins particularly in patients with a history of epilepsy and/or when recommended dosages of cephalosporins were exceeded due to renal impairment. Adjust FETROJA dosing based on creatinine clearance [see *Dosage and Administration (2.2)*]. Anticonvulsant therapy should be continued in patients with known seizure disorders. If CNS adverse reactions including seizures occur, patients should undergo a neurological evaluation to determine whether FETROJA should be discontinued.

### 5.5 Development of Drug-Resistant Bacteria

Prescribing FETROJA in the absence of a proven or strongly suspected bacterial infection or a prophylactic indication is unlikely to provide benefit to the patient and may increase the risk for development of drug-resistant bacteria [see *Indications and Usage (1.2)*].

## 6 ADVERSE REACTIONS

The following serious adverse reactions are described in greater detail in the Warnings and Precautions section:

- Increase in All-Cause Mortality in Patients With Carbapenem-Resistant Gram-Negative Bacterial Infections [see *Warnings and Precautions (5.1)*]
- Hypersensitivity Reactions [see *Warnings and Precautions (5.2)*]
- *Clostridioides difficile*-Associated Diarrhea (CDAD) [see *Warnings and Precautions (5.3)*]
- Seizures and Other Central Nervous System Adverse Reactions [see *Warnings and Precautions (5.4)*]

### 6.1 Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

#### Clinical Trial Experience in cUTI, including Pyelonephritis

FETROJA was evaluated in an active-controlled clinical trial in patients with cUTI, including pyelonephritis (Trial 1). In this trial, 300 patients received FETROJA 2 grams every 8 hours infused over 1 hour (or a renally-adjusted dose) and 148 patients were treated with imipenem/cilastatin 1 gram/1 gram every 8 hours infused over 1 hour (or a renally-adjusted dose). The median age of treated patients across treatment arms was 65 years (range 18 to 93 years), with approximately 53% of patients aged greater than or equal to 65. Approximately

96% of patients were white, most were from Europe, and 55% were female. Patients across treatment arms received treatment for a median duration of 9 days.

### Serious Adverse Reactions and Adverse Reactions Leading to Discontinuation

In Trial 1, a total of 14/300 (4.7%) patients treated with FETROJA and 12/148 (8.1%) of patients treated with imipenem/cilastatin experienced serious adverse reactions. One death (0.3%) occurred in 300 patients treated with FETROJA as compared to none treated with imipenem/cilastatin. Discontinuation of treatment due to any adverse reaction occurred in 5/300 (1.7%) of patients treated with FETROJA and 3/148 (2.0%) of patients treated with imipenem/cilastatin. Specific adverse reactions leading to treatment discontinuation in patients who received FETROJA included diarrhea (0.3%), drug hypersensitivity (0.3%), and increased hepatic enzymes (0.3%).

### Common Adverse Reactions

Table 3 lists the most common selected adverse reactions occurring in  $\geq 2\%$  of patients receiving FETROJA in the cUTI trial.

<b>Table 3 Selected Adverse Reactions Occurring in <math>\geq 2\%</math> of Patients Receiving FETROJA in the cUTI Trial</b>		
<b>Adverse Reaction</b>	<b>FETROJA<sup>a</sup> (N = 300)</b>	<b>Imipenem/Cilastatin<sup>b</sup> (N = 148)</b>
Diarrhea	4%	6%
Infusion site reactions <sup>c</sup>	4%	5%
Constipation	3%	4%
Rash <sup>d</sup>	3%	<1%
Candidiasis <sup>e</sup>	2%	3%
Cough	2%	<1%
Elevations in liver tests <sup>f</sup>	2%	<1%
Headache	2%	5%
Hypokalemia <sup>g</sup>	2%	3%
Nausea	2%	4%
Vomiting	2%	1%

cUTI = complicated urinary tract infections  
<sup>a</sup> 2 grams IV over 1 hour every 8 hours (with dosing adjustment based on renal function)  
<sup>b</sup> 1 gram IV over 1 hour every 8 hours (with dosing adjustment based on renal function and body weight)  
<sup>c</sup> Infusion site reactions include infusion site erythema, inflammation, pain, pruritis, injection site pain, and phlebitis.  
<sup>d</sup> Rash includes rash macular, rash maculopapular, erythema, skin irritation.  
<sup>e</sup> Candidiasis includes oral or vulvovaginal candidiasis, candiduria.  
<sup>f</sup> Elevations in liver tests include alanine aminotransferase, aspartate aminotransferase, gamma-glutamyl transferase, blood alkaline phosphatase, hepatic enzyme increased.  
<sup>g</sup> Hypokalemia includes blood potassium decreased.

## Other Adverse Reactions of FETROJA in the cUTI Trial

The following selected adverse reactions were reported in FETROJA-treated patients at a rate of less than 2% in the cUTI trial:

*Blood and lymphatic disorders:* thrombocytosis

*Cardiac disorders:* congestive heart failure, bradycardia, atrial fibrillation

*Gastrointestinal disorders:* abdominal pain, dry mouth, stomatitis

*General system disorders:* pyrexia, peripheral edema

*Hepatobiliary disorders:* cholelithiasis, cholecystitis, gallbladder pain

*Immune system disorders:* drug hypersensitivity

*Infections and infestations:* *Clostridioides difficile* infection

*Laboratory Investigations:* prolonged prothrombin time (PT) and prothrombin time international normalized ratio (PT-INR), red blood cells urine positive, creatine phosphokinase increase

*Metabolism and nutrition disorders:* decreased appetite, hypocalcemia, fluid overload

*Nervous system disorders:* dysgeusia, seizure

*Respiratory, thoracic, and mediastinal disorders:* dyspnea, pleural effusion

*Skin and subcutaneous tissue disorders:* pruritis

*Psychiatric disorders:* insomnia, restlessness

## **7 DRUG INTERACTIONS**

### **7.1 Drug/Laboratory Test Interactions**

Cefiderocol may result in false-positive results in dipstick tests (urine protein, ketones, or occult blood). Use alternate clinical laboratory methods of testing to confirm positive tests.

## **8 USE IN SPECIFIC POPULATIONS**

### **8.1 Pregnancy**

#### Risk Summary

There are no available data on FETROJA use in pregnant women to evaluate for a drug-associated risk of major birth defects, miscarriage or adverse maternal or fetal outcomes.

Available data from published prospective cohort studies, case series, and case reports over several decades with cephalosporin use in pregnant women have not established drug-associated risks of major birth defects, miscarriage, or adverse maternal or fetal outcomes (*see Data*).

Developmental toxicity studies with cefiderocol administered during organogenesis to rats and mice showed no evidence of embryo-fetal toxicity, including drug-induced fetal malformations, at doses providing exposure levels 1.4 times (rats) or 2 times (mice) higher than the average observed in cUTI patients receiving the maximum recommended daily dose.

The estimated background risk of major birth defects and miscarriage for the indicated population is unknown. All pregnancies have a background risk of birth defect, loss, or other adverse outcomes. In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2% to 4% and 15% to 20%, respectively.

## Data

### *Human Data*

While available studies cannot definitively establish the absence of risk, published data from prospective cohort studies, case series, and case reports over several decades have not identified an association with cephalosporin use during pregnancy, and major birth defects, miscarriage, or other adverse maternal or fetal outcomes.

Available studies have methodologic limitations, including small sample size, retrospective data collection, and inconsistent comparator groups.

### *Animal Data*

Developmental toxicity was not observed in rats at intravenous doses of up to 1000 mg/kg/day or mice at subcutaneous doses of up to 2000 mg/kg/day given during the period of organogenesis (gestation days 6-17 in rats and 6-15 in mice). No treatment-related malformations or reductions in fetal viability were observed. Mean plasma exposure (AUC) at these doses was approximately 1.4 times (rats) and 2 times (mice) the daily mean plasma exposure in cUTI patients that received 2 grams of cefiderocol infused intravenously every 8 hours.

In a pre- and postnatal development study, cefiderocol was administered intravenously at doses up to 1000 mg/kg/day to rats from day 6 of pregnancy until weaning. No adverse effects on parturition, maternal function, or pre- and postnatal development and viability of the pups were observed.

In pregnant rats, cefiderocol-derived radioactivity was shown to cross the placenta, but the amount detected in fetuses was a small percentage (<0.5%) of the dose.

## **8.2 Lactation**

### Risk Summary

It is not known whether cefiderocol is excreted into human milk; however, cefiderocol-derived radioactivity was detected in the milk of lactating rats that received the drug intravenously. When a drug is present in animal milk, it is likely that the drug will be present in human milk. No information is available on the effects of FETROJA on the breastfed infant or on milk production.

The developmental and health benefits of breastfeeding should be considered along with the mother's clinical need for FETROJA and any potential adverse effects on the breastfed child from FETROJA or from the underlying maternal condition.

### Data

Cefiderocol-derived radioactivity was detected in milk following intravenous administration to lactating rats. The peak level in rat milk was approximately 6% of the peak plasma level.

## **8.4 Pediatric Use**

Safety and efficacy of FETROJA in pediatric patients younger than 18 years of age have not been established.

## **8.5 Geriatric Use**

Of the 300 subjects treated with FETROJA in the cUTI trial, 158 (52.7%) were 65 years of age and older, and 67 (22.3%) were 75 years of age and older. No overall differences in safety or efficacy were observed between these subjects and younger subjects.

FETROJA is known to be substantially excreted by the kidney, and the risk of adverse reactions to this drug may be greater in patients with impaired renal function. Because elderly patients are more likely to have decreased renal function, care should be taken in dose selection, and it may be useful to monitor renal function. No dosage adjustment is required based on age. Dosage adjustment for elderly patients should be based on renal function [*see Dosage and Administration (2.2), Use in Specific Populations (8.6), and Clinical Pharmacology (12.3)*].



## 8.6 Renal Impairment

### Patients with CLCr 60 to 89 mL/min

No dosage adjustment of FETROJA is recommended in patients with CLCr 60 to 89 mL/min.

### Patients with CLCr Less Than 60 mL/min

Dose adjustment is required in patients with CLCr 15 to 59 mL/min, and in patients with end-stage renal disease or who are receiving hemodialysis (HD). In patients requiring HD, complete HD at the latest possible time before the start of cefiderocol dosing [see *Dosage and Administration (2.2) and Clinical Pharmacology (12.3)*]. Monitor renal function regularly and adjust the dosage of FETROJA accordingly as renal function may change during the course of therapy.

### Patients with CLCr 120 mL/min or greater

CLCr 120 mL/min or greater may be seen in seriously ill patients, who are receiving intravenous fluid resuscitation. Dosage adjustment of FETROJA is required in patients with CLCr 120 mL/min or greater [see *Dosage and Administration (2.2) and Clinical Pharmacology (12.3)*]. Monitor renal function regularly and adjust the dosage of FETROJA accordingly as renal function may change during the course of therapy.

## 8.7 Hepatic Impairment

The effects of hepatic impairment on the pharmacokinetics of cefiderocol have not been evaluated. Hepatic impairment is not expected to alter the elimination of cefiderocol as hepatic metabolism/excretion represents a minor pathway of elimination for cefiderocol. Dosage adjustments are not necessary in patients with impaired hepatic function.

## 10 OVERDOSAGE

There is no information on clinical signs and symptoms associated with an overdose of FETROJA. Patients who receive doses greater than the recommended dose regimen and have unexpected adverse reactions possibly associated with FETROJA should be carefully observed and given supportive treatment, and discontinuation or interruption of treatment should be considered.

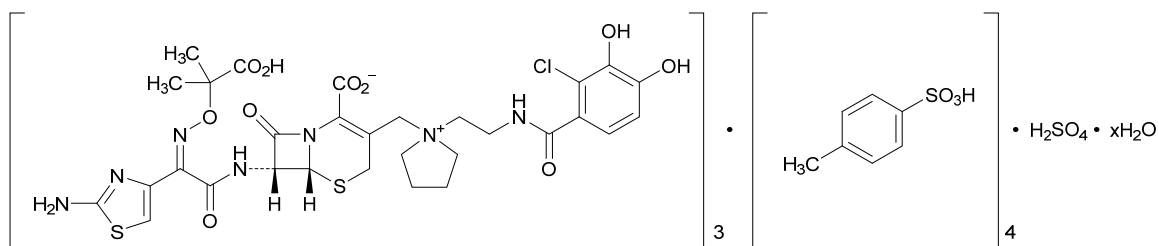
Approximately 60% of cefiderocol is removed by a 3- to 4-hour hemodialysis session [see *Clinical Pharmacology (12.3)*].

## 11 DESCRIPTION

FETROJA is a cephalosporin antibacterial drug product consisting of cefiderocol sulfate tosylate for intravenous infusion. Cefiderocol functions as a siderophore [see *Microbiology (12.4)*].

The chemical name of cefiderocol sulfate tosylate is Tris[(6*R*,7*R*)-7-[(*ZZ*)-2-(2-amino-1,3-thiazol-4-yl)-2-[(2-carboxypropan-2-yl)oxy]imino}acetamido]-3-(1-[2-(2-chloro-3,4-dihydroxybenzamido)ethyl]pyrrolidin-1-ium-1-yl)methyl]-8-oxo-5-thia-1-azabicyclo[4.2.0]oct-2-ene-2-carboxylate] tetrakis(4-methylbenzenesulfonate) monosulfate hydrate, and the molecular weight is 3043.50 (anhydrous). The molecular formula is  $3C_{30}H_{34}ClN_7O_{10}S_2 \cdot 4C_7H_8O_3S \cdot H_2SO_4 \cdot xH_2O$ .

**Figure 1** Chemical Structure of Cefiderocol Sulfate Tosylate



FETROJA for injection is a white to off-white, sterile, lyophilized powder formulated with 1 gram of cefiderocol (equivalent to 1.6 grams of cefiderocol sulfate tosylate), sucrose (900 mg), sodium chloride (216 mg), and sodium hydroxide to adjust pH. The sodium content is approximately 176 mg/vial. The pH of the reconstituted solution of 1 gram cefiderocol (1 vial) dissolved in 10 mL water is 5.2 to 5.8.

## 12 CLINICAL PHARMACOLOGY

### 12.1 Mechanism of Action

FETROJA is an antibacterial drug [see *Microbiology (12.4)*].

### 12.2 Pharmacodynamics

The percent time of dosing interval that unbound plasma concentrations of cefiderocol exceed the minimum inhibitory concentration (MIC) against the infecting organism best correlates with antibacterial activity in neutropenic murine thigh and lung infection models with Enterobacteriaceae, *P. aeruginosa*, *A. baumannii*, and *S. maltophilia*. Compared to a 1-hour infusion, a 3-hour infusion increased the percent time of dosing interval that unbound plasma concentrations of cefiderocol exceed the MIC. The in vivo animal pneumonia studies showed that the antibacterial activity of cefiderocol was greater at the human equivalent dosing regimen of 3-hour infusion compared to that of 1-hour infusion.

#### Cardiac Electrophysiology

At doses 1 and 2 times the maximum recommended dosage, FETROJA does not prolong the QT interval to any clinically relevant extent.

### 12.3 Pharmacokinetics

In cUTI patients with CL<sub>cr</sub> 60 mL/min or greater, the mean cefiderocol C<sub>max</sub> was 138 mg/L and AUC was 394.7 mg·hr/L (as 1184 mg·hr/L of daily AUC) after multiple (every 8 hours) FETROJA 2-gram doses infused over 1 hour (1/3 of the recommended infusion duration).

In healthy volunteers, the mean cefiderocol C<sub>max</sub> and AUC was 89.7 mg/L and 386 mg·hr/L, respectively, after a single FETROJA 2-gram dose was infused over 3 hours. Cefiderocol C<sub>max</sub> and AUC increased proportionally with dose.

#### Distribution

The geometric mean (±SD) cefiderocol volume of distribution was 18.0 (±3.36) L. Plasma protein binding, primarily to albumin, of cefiderocol is 40% to 60%.

#### Elimination

Cefiderocol terminal elimination half-life is 2 to 3 hours. The geometric mean (±SD) cefiderocol clearance is estimated to be 5.18 (±0.89) L/hr.

## Metabolism

Cefiderocol is minimally metabolized [less than 10% of a single radiolabeled cefiderocol dose of 1 gram (0.5 times the approved recommended dosage) infused over 1 hour].

## Excretion

Cefiderocol is primarily excreted by the kidneys. After a single radiolabeled cefiderocol 1-gram (0.5 times the approved recommended dosage) dose infused over 1 hour, 98.6% of the total radioactivity was excreted in urine (90.6% unchanged) and 2.8% in feces.

## Specific Populations

No clinically significant differences in the pharmacokinetics of cefiderocol were observed based on age (18 to 93 years of age), sex, or race. The effect of hepatic impairment on the pharmacokinetics of cefiderocol was not evaluated.

## Patients with Renal Impairment

Approximately 60% of cefiderocol was removed by a 3- to 4-hour hemodialysis session.

Cefiderocol AUC fold changes in subjects with renal impairment compared to subjects with CLcr 90 to 119 mL/min are summarized in Table 4.

CLcr (mL/min)	Cefiderocol AUC Geometric Mean Ratios (90% CI) <sup>b</sup>
60 to 89 (N=6)	1.37 (1.15, 1.62)
30 to 59 (N=7)	2.35 (2.00, 2.77)
15 to 29 (N=4)	3.21 (2.64, 3.91)
<15 (N=6)	4.69 (3.95, 5.56)

<sup>a</sup>After a single FETROJA 1-gram dose (0.5 times the approved recommended dosage)  
<sup>b</sup>Compared to AUC in subjects with CLcr 90 to 119 mL/min (N=12)  
CI=confidence interval

## Patients with CLcr 120 mL/min or Greater

Increased cefiderocol clearance has been observed in patients with CLcr 120 mL/min or greater. A FETROJA 2-gram dose every 6 hours infused over 3 hours is predicted to provide cefiderocol exposures comparable to those in patients with CLcr 90 to 119 mL/min [see *Dosage and Administration* (2.2)].

## Drug Interaction Studies

### Clinical Studies

No clinically significant differences in the pharmacokinetics of furosemide (an organic anion transporter [OAT]1 and OAT3 substrate), metformin (an organic cation transporter [OCT]1, OCT2, and multi-drug and toxin extrusion [MATE]2-K substrate), and rosuvastatin (an organic anion transporting polypeptide [OATP]1B3 substrate) were observed when co-administered with cefiderocol.

### In Vitro Studies Where Drug Interaction Potential Was Not Further Evaluated Clinically

**Cytochrome P450 (CYP) Enzymes:** Cefiderocol is not an inhibitor of CYP1A2, CYP2B6, CYP2C8, CYP2C9, CYP2C19, CYP2D6, CYP2E1, or CYP3A4. Cefiderocol is not an inducer of CYP1A2, CYP2B6, or CYP3A4.

*Transporter Systems*: Cefiderocol is not an inhibitor of OATP1B1, MATE1, P-glycoprotein (P-gp), breast cancer resistance protein (BCRP), or bile salt export pump transporters. Cefiderocol is not a substrate of OAT1, OAT3, OCT2, MATE1, MATE2-K, P-gp, or BCRP.

## 12.4 Microbiology

### Mechanism of Action

FETROJA is a cephalosporin antibacterial with activity against Gram-negative aerobic bacteria. Cefiderocol functions as a siderophore and binds to extracellular free ferric iron. In addition to passive diffusion via porin channels, cefiderocol is actively transported across the outer cell membrane of bacteria into the periplasmic space using a siderophore iron uptake mechanism. Cefiderocol exerts bactericidal action by inhibiting cell wall biosynthesis through binding to penicillin-binding proteins (PBPs).

Cefiderocol has no clinically relevant *in vitro* activity against most Gram-positive bacteria and anaerobic bacteria. Cefiderocol has shown *in vitro* activity against some isolates of *S. maltophilia*, and meropenem-resistant Enterobacteriaceae, *P. aeruginosa*, and *A. baumannii*. Cefiderocol is active against some *P. aeruginosa* and *A. baumannii* isolates resistant to meropenem, ciprofloxacin, and amikacin. Cefiderocol is active against some *E. coli* isolates containing *mcr-1*.

Cefiderocol demonstrated *in vitro* activity against certain Enterobacteriaceae genetically confirmed to contain the following: ESBLs (TEM, SHV, CTX-M, oxacillinase [OXA]), AmpC, AmpC-type ESBL (CMY), serine-carbapenemases (such as KPC, OXA-48), and metallo-carbapenemases (such as NDM and VIM). Cefiderocol demonstrated *in vitro* activity against certain *P. aeruginosa* genetically confirmed to contain VIM, GES, AmpC and certain *A. baumannii* containing OXA-23, OXA-24/40, OXA-51, OXA-58. Cefiderocol has demonstrated *in vitro* activity against some *K. pneumoniae* isolates with OmpK35/36 porin deletion and some isolates of *P. aeruginosa* with OprD porin deletion.

### Resistance

Cross-resistance with other classes of antibacterial drugs has not been identified; therefore, isolates resistant to other antibacterial drugs may be susceptible to cefiderocol.

Cefiderocol does not cause induction of AmpC beta-lactamase in *P. aeruginosa* and *E. cloacae*. The frequency of resistance development in Gram-negative bacteria including carbapenemase producers exposed to cefiderocol at 10x minimum inhibitory concentration (MIC) ranged from  $10^{-6}$  to  $10^{-8}$ .

*In vitro*, MIC increases that may result in resistance to cefiderocol in Gram-negative bacteria, have been associated with the presence of beta-lactamases including AmpC beta-lactamase overproduction, modifications of penicillin binding proteins, and mutations of transcriptional regulators that impact siderophore or efflux pump expression.

*In vitro*, the addition of the beta-lactamase inhibitors (such as avibactam, clavulanic acid, and dipicolinic acid) results in the lowering of MICs of some isolates with relatively high MICs (range 2 to 256) to cefiderocol.

### Interaction with Other Antimicrobials

*In vitro* studies showed no antagonism between cefiderocol and amikacin, ceftazidime/avibactam, ceftolozane/tazobactam, ciprofloxacin, clindamycin, colistin, daptomycin, linezolid, meropenem, metronidazole, tigecycline, or vancomycin against strains of Enterobacteriaceae, *P. aeruginosa*, and *A. baumannii*.

### Activity against Bacteria in Animal Infection Models

In a neutropenic murine thigh infection model using a humanized dose (2 grams every 8 hours), cefiderocol demonstrated  $1 \log_{10}$  reduction in bacterial burden against most Enterobacteriaceae *A. baumannii*, and *P. aeruginosa* including some carbapenemase-producing isolates with MICs of  $\leq 4$  mcg/mL.

In an immunocompetent rat pneumonia model, reduction in bacterial counts in the lungs of animals infected with *K. pneumoniae* with MICs  $\leq 8$  mcg/mL and *P. aeruginosa* with MICs  $\leq 1$  mcg/mL was observed using humanized cefiderocol dose.

In an immunocompetent murine urinary tract infection model, cefiderocol reduced bacterial counts in the kidneys of mice infected with Enterobacteriaceae, and *P. aeruginosa* isolates with MICs  $\leq 1$  mcg/mL. In an immunocompromised murine systemic infection model, cefiderocol increased survival in mice infected with *E. cloacae*, *S. maltophilia*, and *Burkholderia cepacia* isolates with MICs  $\leq 0.5$  mcg/mL compared to untreated mice. In an immunocompetent murine systemic infection model, cefiderocol increased survival in mice infected with *S. marcescens* and *P. aeruginosa* isolates with MICs  $\leq 1$  mcg/mL compared to untreated mice. The clinical significance of the above findings is not known.

### Antimicrobial Activity

FETROJA has been shown to be active against the following bacteria, both *in vitro* and in clinical infections [see *Indications and Usage (1.1)*]:

#### Gram-negative

*Escherichia coli*

*Enterobacter cloacae* complex

*Klebsiella pneumoniae*

*Proteus mirabilis*

*Pseudomonas aeruginosa*

Cefiderocol demonstrated *in vitro* activity against the following bacteria, but the clinical significance is unknown. At least 90% of the following bacteria exhibit an *in vitro* minimum inhibitory concentration (MIC) less than or equal to the susceptible breakpoint for cefiderocol. However, the efficacy of cefiderocol in treating clinical infections due to these bacteria has not been established in adequate and well-controlled clinical trials.

#### Gram-negative

*Acinetobacter baumannii*

*Citrobacter freundii* complex

*Citrobacter koseri*

*Klebsiella aerogenes*

*Klebsiella oxytoca*

*Morganella morganii*

*Proteus vulgaris*

*Providencia rettgeri*

*Serratia marcescens*

*Stenotrophomonas maltophilia*

#### Susceptibility Testing

For specific information regarding susceptibility test interpretive criteria and associated test methods and quality control standards recognized by FDA for this drug, please see <https://www.fda.gov/STIC>.

## 13 NONCLINICAL TOXICOLOGY

### 13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

#### Carcinogenesis

Carcinogenicity studies in animals have not been conducted with cefiderocol.

#### Mutagenesis

Cefiderocol was negative for genotoxicity in a reverse mutation test with *S. typhimurium* and *E. coli* and did not induce mutations in V79 Chinese hamster lung cells. Cefiderocol was positive in a chromosomal aberration test in cultured TK6 human lymphoblasts and increased mutation frequency in L5178Y mouse lymphoma cells. Cefiderocol was negative in an *in vivo* rat micronucleus test and a rat comet assay at the highest doses of 2000 and 1500 mg/kg/day, respectively.

#### Impairment of Fertility

Cefiderocol did not affect fertility in adult male or female rats when administered intravenously at doses up to 1000 mg/kg/day. The AUC at this dose is approximately 1.4 times the mean daily cefiderocol exposure in cUTI patients who received the maximum recommended clinical dose of 2 grams every 8 hours.

## 14 CLINICAL STUDIES

### 14.1 Complicated Urinary Tract Infections, Including Pyelonephritis

A total of 448 adults hospitalized with cUTI (including pyelonephritis) were randomized in a 2:1 ratio and received study medications in a multinational, double-blind trial (Trial 1) (NCT02321800) comparing FETROJA 2 grams intravenously (IV) every 8 hours (infused over 1 hour) to imipenem/cilastatin 1g/1g IV every 8 hours (infused over 1 hour) for 7 to 14 days. No switch from IV to oral antibacterial therapy was permitted.

Efficacy was assessed as a composite of microbiological eradication and clinical cure in the microbiological intent-to-treat (Micro-ITT) population, which included all patients who received at least a single-dose of study medication and had at least one baseline Gram-negative uropathogen. Other efficacy endpoints included the microbiological eradication rate and the clinical response rate at the Test of Cure (TOC) visit in the Micro-ITT population.

The Micro-ITT population consisted of 371 patients of whom 25% had cUTI with pyelonephritis, 48% had cUTI without pyelonephritis, and 27% had acute uncomplicated pyelonephritis. Complicating conditions included obstructive uropathy, catheterization, and renal stones. The median age was 66 years, with 24% of patients over the age of 75 years, and 55% of the population was female. The median duration of therapy in both treatment groups was 9 days (range: 1-14 days). Of the 371 patients, 32% had CLcr >50-80 mL/min, 17% had CLcr 30-50 mL/min, and 3% had CLcr <30 mL/min at baseline. Concomitant Gram-negative bacteremia was identified in 7% of patients. In the Micro-ITT population, the most common baseline pathogens were *E. coli* and *K. pneumoniae*.

Table 5 provides the results of a composite of microbiological eradication (all Gram-negative uropathogens found at baseline at  $\geq 10^5$  CFU/mL reduced to  $< 10^4$  CFU/mL) and clinical response (resolution or improvement of cUTI symptoms and no new symptoms assessed by the investigator) at the TOC visit 7 +/- 2 days after the last dose of study drug. The response rates for the composite endpoint of microbiological eradication and clinical response at the TOC visit were higher in the FETROJA arm compared with imipenem/cilastatin as shown in Table 5. Clinical response rates at the TOC visit were similar between FETROJA and imipenem/cilastatin. Most patients with microbiological failure at the TOC visit in either treatment arm did not require further antibacterial drug treatment. Subgroup analyses examining composite outcomes by baseline pathogen are shown in Table 6 and demonstrated responses consistent with the overall population. Subgroup

analyses examining outcomes by age, gender, and/or outcomes in patients with renal impairment, concomitant bacteremia, complicated UTI with or without pyelonephritis, or acute uncomplicated pyelonephritis demonstrated responses were consistent with the overall population.

**Table 5 Composite, Microbiological, and Clinical Response Rates at the TOC Visit – Micro ITT Population**

Study Endpoint	FETROJA n/N (%)	Imipenem/Cilastatin n/N (%)	Treatment Difference (95% CI) <sup>a</sup>
Composite response at TOC	183/252 (72.6%)	65/119 (54.6%)	18.6 (8.2, 28.9)
Microbiologic response TOC	184/252 (73.0%)	67/119 (56.3%)	17.3 (6.9, 27.6)
Clinical response TOC	226/252 (89.7%)	104/119 (87.4%)	2.4 (-4.7, 9.4)

CI = confidence interval; Micro-ITT = microbiological intent-to-treat; TOC = Test of Cure

<sup>a</sup>The treatment difference and 95% CI were based on the Cochran-Mantel-Haenszel method.

**Table 6 Composite Endpoint of Microbiological Eradication and Clinical Response at the TOC Visits in the Micro-ITT by Baseline Pathogen<sup>a</sup> Subgroups**

Baseline Pathogen Subgroup	FETROJA n/N (%)	Imipenem/Cilastatin n/N (%)
<i>Escherichia coli</i>	113/152 (74.3)	45/79 (57.0)
<i>Klebsiella pneumoniae</i>	36/48 (75.0)	12/25 (48.0)
<i>Proteus mirabilis</i>	13/17 (76.5)	0/2 (0.0)
<i>Pseudomonas aeruginosa</i>	8/18 (44.4)	3/5 (60.0)
<i>Enterobacter cloacae</i> complex	8/13 (61.5)	3/3 (100.0)

<sup>a</sup>Patients may have been infected with more than one pathogen in the baseline urine culture.

In the FETROJA treatment group, 61 (24.2%) bacterial isolates were ESBL producers compared with 32 (26.9%) in the imipenem/cilastatin group. The composite response rate of patients with these ESBL isolates at the TOC visit was consistent with the overall results.

## 16 HOW SUPPLIED/STORAGE AND HANDLING

### 16.1 How Supplied

FETROJA 1 gram (cefiderocol) for injection is supplied as a white to off-white sterile lyophilized powder for reconstitution in single-dose, clear glass vials (NDC 59630-266-01) sealed with a rubber stopper (not made with natural rubber latex) and an aluminum seal with flip-off cap. Each vial is supplied in cartons containing 10 single-dose vials.

NDC 59630-266-10 FETROJA (cefiderocol) 1 gram/vial, 10 vials/carton

### 16.2 Storage and Handling

FETROJA vials should be stored refrigerated at 2°C to 8°C (36°F to 46°F). Protect from light. Store in the carton until time of use. Reconstituted and diluted solutions of FETROJA can be stored at room temperature [see Dosage and Administration (2.5)]

## 17 PATIENT COUNSELING INFORMATION

### Serious Allergic Reactions

Advise patients and their families that allergic reactions, including serious allergic reactions, could occur with FETROJA and that serious reactions require immediate treatment. Ask patients about any previous hypersensitivity reactions to FETROJA, other beta-lactams (including cephalosporins), or other allergens [*see Warnings and Precautions (5.2)*].

### Potentially Serious Diarrhea

Advise patients and their families that diarrhea is a common problem caused by antibacterial drugs, including FETROJA. Sometimes, frequent watery or bloody diarrhea may occur and may be a sign of a more serious intestinal infection. If severe watery or bloody diarrhea develops, tell patient to contact his or her healthcare provider [*see Warnings and Precautions (5.3)*].

### Seizures

Counsel patients on the implication of cephalosporins in triggering seizures, particularly in patients with renal impairment when the dosage was not reduced and in patients with a history of epilepsy [*see Warnings and Precautions (5.4)*].

### Antibacterial Resistance

Patients should be counseled that antibacterial drugs including FETROJA should only be used to treat bacterial infections. They do not treat viral infections (e.g., influenza, common cold). When FETROJA is 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 FETROJA or other antibacterial drugs in the future [*see Warnings and Precautions (5.5)*].

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