

Linaclootide Capsules 72 mcg and 145 mcg

LINTIDE™

1. GENERIC NAME

Linaclootide Capsules 72 mcg and 145 mcg

2. QUALITATIVE AND QUANTITATIVE COMPOSITION

Linaclootide Capsules 72 mcg
Each Capsule Contains: 72 mcg

Linaclootide Capsules 145 mcg
Each Capsule Contains: 145 mcg

3. DOSAGE FORM AND STRENGTH

Capsules, 72 mcg and 145 mcg

4. CLINICAL PARTICULARS

4.1 Therapeutic indications

Linaclootide is indicated in adults for the treatment of

- Chronic idiopathic constipation

4.2 Posology and method of administration

Chronic Idiopathic Constipation (CIC)

The recommended dosage of Linaclootide is 72 mcg orally once daily or 145 mcg orally once daily based on individual presentation or tolerability.

Method of administration

Oral use. The capsule should be taken on an empty stomach, at least 30 minutes prior to the meal at approximately the same time each day.

4.3 Contraindications

- Hypersensitivity to linaclootide or to any of the excipients.
- Patients with known or suspected mechanical gastrointestinal obstruction.
- Linaclootide is contraindicated in patients less than 2 years of age

4.4 Special warnings and precautions for use

Risk of Serious Dehydration in Pediatric Patients Less Than 2 Years of Age

Linaclootide is contraindicated in patients less than 2 years of age. In neonatal mice (human age equivalent of approximately 0 to 28 days), linaclootide increased fluid secretion as a consequence of age-dependent elevated GC-C agonism which was associated with increased mortality within the first 24 hours due to dehydration. There was no age-dependent trend in GC-C intestinal expression in a clinical study of children 2 to less than 18 years of age; however, there are insufficient data available on GC-C intestinal expression in children less than 2 years of age to assess the risk of developing diarrhea and its potentially serious consequences in these patients. The safety and effectiveness of Linaclootide in patients less than 18 years of age have not been established.

Diarrhea

In adults diarrhea was the most common adverse reaction of Linaclootide -treated patients in the pooled IBS-C (Irritable Bowel Syndrome with Constipation) and CIC double-blind placebo-controlled trials. The incidence of diarrhea was similar between the IBS-C and CIC populations. Severe diarrhea was reported in 2% of 145 mcg and 290 mcg Linaclootide -treated patients, and in <1% of 72 mcg Linaclootide-treated CIC patients.

In post-marketing experience, severe diarrhea associated with dizziness, syncope, hypotension and electrolyte abnormalities (hypokalemia and hyponatremia) requiring hospitalization or intravenous fluid administration have been reported in patients treated with Linaclootide.

Severe diarrhea occurs, suspend dosing and rehydrate the patient.

Others

Linaclootide should be used after organic diseases have been ruled out

Patients should be aware of the possible occurrence of diarrhea and lower gastrointestinal bleeding during treatment. They should be instructed to inform their physician if severe or prolonged diarrhea or lower gastrointestinal bleeding occurs.

Should prolonged (e.g. more than 1 week) or severe diarrhoea occur, medical advice should be sought and temporary discontinuation of linaclootide until diarrhoea episode is resolved may be considered. Additional caution should be exercised in patients who are prone to a disturbance of water or electrolyte balance (e.g. elderly, patients with cardiovascular (CV) diseases, diabetes, hypertension), and electrolyte control should be considered.

Cases of intestinal perforation have been reported after use of linaclootide in patients with conditions that may be associated with localized or diffuse weakness of the intestinal wall. Patients should be advised to seek immediate medical care in case of severe, persistent, or worsening abdominal pain; linaclootide should be discontinued if these symptoms occur.

Linaclootide has not been studied in patients with chronic inflammatory conditions of the intestinal tract, such as Crohn's disease and ulcerative colitis; therefore it is not recommended to use Linaclootide in these patients.

Elderly patients

There are limited data in elderly patients. Because of the higher risk of diarrhoea seen in the clinical trials, special attention should be given to these patients and the treatment benefit/risk ratio should be carefully and periodically assessed.

Paediatric population

Linaclootide should not be used in children and adolescents as it has not been studied in this population. As GC-C receptor is known to be overexpressed at early ages, children younger than 2 years may be particularly sensitive to linaclootide effects.

4.5 Drug Interactions

No interaction studies have been performed. Linaclootide is rarely detectable in plasma following administration of the recommended clinical doses and in vitro studies have shown that linaclootide is neither a substrate nor an inhibitor/inducer of the cytochrome P450 enzyme system and does not interact with a series of common efflux and uptake transporters.

A food interaction clinical study in healthy subjects showed that linaclootide was not detectable in plasma either in fed or in fasted conditions at the therapeutic doses. Taking Linaclootide in the fed condition produced more frequent and looser stools, as well as more gastrointestinal adverse events, than when taking it under fasting conditions. The capsule should be taken 30 minutes before a meal.

Concomitant treatment with proton pump inhibitors, laxatives or NSAIDs may increase the risk of diarrhoea. Caution should be used when co-administering Linaclootide with such medications.

In cases of severe or prolonged diarrhoea, absorption of other oral medicinal products may be affected. The efficacy of oral contraceptives may be reduced and the use of an additional contraceptive method is recommended to prevent possible failure of oral contraception (see the prescribing information of the oral contraceptive). Caution should be exercised when prescribing medicinal products absorbed in the intestinal tract with a narrow therapeutic index such as levofloxacin as their efficacy may be reduced.

4.6 Use in special populations (such as pregnant women, lactating women, paediatric patients, geriatric patients etc.)

Pregnancy

Risk Summary

Linaclootide and its active metabolite are negligibly absorbed systemically following oral administration, and maternal use is not expected to result in fetal exposure to the drug. The available data on Linaclootide use in pregnant women are not sufficient to inform any drug-associated risk for major birth defects and miscarriage. In animal developmental studies, no effects on embryo-fetal development were observed with oral administration of linaclootide in rats and rabbits during organogenesis at doses much higher than the maximum recommended human dosage. Severe maternal toxicity associated with effects on fetal morphology were observed in mice (see Data). 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 United States 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

Animal Data
The potential for linaclootide to cause harm to embryo-fetal development was studied in rats, rabbits and mice. In pregnant mice, oral dose levels of at least 40,000 mcg/kg/day given during organogenesis produced severe maternal toxicity including death, reduction of gravid uterine and fetal weights, and effects on fetal morphology. Oral doses of 5,000 mcg/kg/day did not produce maternal toxicity or any adverse effects on embryo-fetal development in mice. Oral administration of up to 100,000 mcg/kg/day in rats and 40,000 mcg/kg/day in rabbits during organogenesis produced no maternal toxicity and no effects on embryo-fetal development. Additionally, oral administration of up to 100,000 mcg/kg/day in rats during organogenesis through lactation produced no developmental abnormalities or effects on growth, learning and memory, or fertility in the offspring through maturation.

The maximum recommended human dose is approximately 5 mcg/kg/day, based on a 60-kg body weight. Limited systemic exposure to linaclootide was achieved in animals during organogenesis (AUC = 40, 940, and 25 ng/ml in rats, rabbits, and mice, respectively, at the highest dose levels). Linaclootide and its active metabolite are not measurable in human plasma following administration of the recommended clinical dosages. Therefore, animal and human doses should not be compared directly for evaluating relative exposure.

Lactation

Risk Summary

Linaclootide and its active metabolite were not detected in the milk of lactating women (see Data). In adults, concentrations of linaclootide and its active metabolite were below the limit of quantitation in plasma following multiple doses of Linaclootide. Maternal use of Linaclootide is not expected to result in exposure to linaclootide or its active metabolite in breastfed infants. There is no information on the effects of linaclootide or its active metabolite on milk production. The developmental and health benefits of breastfeeding should be considered along with the mother's clinical need for Linaclootide and any potential adverse effects on the breastfed infant from Linaclootide or from the underlying maternal condition.

Data

Following oral administration of 72 mcg, 145 mcg, or 290 mcg of Linaclootide once daily for 3 days to breastfeeding mothers taking linaclootide therapeutically, the concentrations of linaclootide and its metabolite were below the limits of quantitation (<0.25 ng/mL and <1 ng/mL, respectively) in all breast milk samples collected over 24 hours.

Fertility

Animal studies indicate that there is no effect on male or female fertility.

Geriatric Use

Of 2498 CIC patients in the placebo-controlled clinical studies of Linaclootide, 273 (11%) were 65 years of age and over, while 56 (2%) were 75 years and over. Clinical studies of Linaclootide did not include sufficient numbers of patients aged 65 and over to determine whether they respond differently from younger patients. In general, dose selection for an elderly patient should be cautious reflecting the greater frequency of decreased hepatic, renal or cardiac function and of concomitant disease or other drug therapy.

Patients with renal or hepatic impairment

No dose adjustments are required for patients with hepatic or renal impairment.

Elderly patients

For elderly patients, although no dose adjustment is required, the treatment should be carefully monitored and periodically re-assessed.

Paediatric population

The safety and efficacy of Linaclootide in children and adolescents under the age of 18 years have not yet been established. No data are available. This medicinal product should not be used in children and adolescents.

4.7 Effects on ability to drive and use machines

Linaclootide has no or negligible influence on the ability to drive and use machines.

4.8 Undesirable effects

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 with rates in the clinical trials of another drug and may not reflect the rates observed in practice.

Exposure in clinical development included approximately 2570, 2040, and 1220 patients with either IBS-C or CIC treated with Linaclootide for 6 months or longer, 1 year or longer, and 18 months or longer, respectively (not mutually exclusive). Demographic characteristics were comparable between treatment groups in all studies.

Chronic Idiopathic Constipation (CIC)

Most Common Adverse Reactions

The data described below reflect exposure to Linaclootide in the two double-blind placebo controlled clinical trials of 1275 adult patients with CIC. Patients were randomized to receive placebo or 145 mcg Linaclootide or 290 mcg Linaclootide once daily on an empty stomach, for at least 12 weeks. Table below provides the incidence of adverse reactions reported in at least 2% of CIC patients in the 145 mcg Linaclootide treatment group and at an incidence that was greater than in the placebo treatment group.

Table 1: Most Common Adverse Reactions* in the Two Placebo-controlled Trials in Patients with CIC

Adverse Reactions	Linaclootide 145 mcg N=430) %	Placebo (N=423) %
Gastrointestinal		
Diarrhea	16	5
Abdominal pain	7	6
Flatulence	6	5
Abdominal distension	3	2
Infections and infections		
Upper respiratory tract infection Sinusitis	5	4
	3	2

*: Reported in at least 2% of Linaclootide-treated patients and at an incidence greater than placebo by: "Abdominal pain" term includes abdominal pain, upper abdominal pain, and lower abdominal pain

The safety of a 72 mcg dose was evaluated in an additional placebo-controlled trial in which 1223 patients were randomized to Linaclootide 72 mcg, 145 mcg, or placebo once daily for 12 weeks.

Adverse reactions that occurred at a frequency of ≥2% in Linaclootide -treated patients (n=411 in each Linaclootide 72 mcg and 145 mcg group) and at a higher rate than placebo (n=401) were:

- Diarrhea (Linaclootide 72 mcg 19%; Linaclootide 145 mcg 22%; placebo 7%)
- Abdominal distension (Linaclootide 72 mcg 2%; Linaclootide 145 mcg 1%; placebo <1%)

Diarrhea was the most commonly reported adverse reaction in Linaclootide -treated patients in the CIC placebo-controlled studies. In all trials, the majority of reported cases of diarrhea started within the first 2 weeks of Linaclootide treatment. Severe diarrhea was reported in less than 1% of the 72 mcg Linaclootide -treated patients, in 2% of the 145 mcg Linaclootide -treated patients, and less than 1% of the placebo-treated patients.

Adverse Reactions Leading to Discontinuation

In placebo-controlled trials in patients with CIC, 3% of patients treated with 72 mcg and between 5% and 8% of patients treated with 145 mcg of Linaclootide discontinued prematurely due to adverse reactions compared to between less than 1% and 4% of patients treated with placebo. In patients treated with 72 mcg Linaclootide, the most common reason for discontinuation due to adverse reactions were diarrhea and abdominal pain. In comparison, less than 1% of patients in the placebo group withdrew due to diarrhea or abdominal pain.

Adverse Reactions Leading to Dose Reductions

In the open-label, long-term trials, 1129 patients with CIC received 290 mcg of Linaclootide daily for up to 18 months. In these trials, 27% of patients had their dose reduced or suspended secondary to adverse reactions, the majority of which were diarrhea or other GI adverse reactions.

Less Common Adverse Reactions

Defecation urgency, fecal incontinence, dyspepsia, and viral gastroenteritis were reported in less than 2% of patients in the Linaclootide treatment group and at an incidence greater than placebo treatment group.

A randomized, multicentre, double blind, placebo controlled, parallel-group, study was conducted to evaluate the efficacy and safety of Linaclootide once daily of Dr. Reddy's laboratories limited in Indian patients with chronic constipation.

The following table is showing summary of frequency of all adverse events by system organ class and preferred term (safety population) from the phase 3 study conducted in Indian patients with Chronic constipation.

Table 2: Summary of Frequency of All Adverse Events by System Organ Class and Preferred Term (Safety Population)

System Organ Class and Preferred Term	Linaclootide (N=158) n(%)E	Placebo (N=158) n(%)E
Subjects with any TEAE	26 (16.5)53	32 (20.3)59
Ear and labyrinth disorders	1 (0.6)1	0 (0.0)
Vertigo	1 (0.6)1	0 (0.0)
Gastrointestinal disorders	14 (8.9)20	13 (8.2)14
Abdominal distension	1 (0.6)1	0 (0.0)
Abdominal pain	5 (3.2)5	8 (5.1)9
Abdominal pain upper	5 (3.2)5	1 (0.6)1
Diarrhoea	1 (0.6)2	0 (0.0)
Gastritis	1 (0.6)1	0 (0.0)
Hyperchlorhydria	0 (0.0)	2 (1.3)2
Nausea	1 (0.6)1	1 (0.6)1
Vomiting	2 (1.3)2	1 (0.6)1
General disorders and administration site conditions	8 (5.1)14	10 (6.3)18
Asthenia	4 (2.5)5	5 (3.2)7
Pain	2 (1.3)2	2 (1.3)2
Pyrexia	5 (3.2)7	9 (5.7)9
Infections and infestations	2 (1.3)2	2 (1.3)2
Nasopharyngitis	2 (1.3)2	2 (1.3)2
Injury, poisoning and procedural complications	1 (0.6)1	0 (0.0)
Animal bite	1 (0.6)1	0 (0.0)
Metabolism and nutrition disorders	0 (0.0)	1 (0.6)1
Diabetes mellitus	0 (0.0)	1 (0.6)1
Musculoskeletal and connective tissue disorders	2 (1.3)2	0 (0.0)
Back pain	1 (0.6)1	0 (0.0)
Wrist fracture	1 (0.6)1	0 (0.0)
Nervous system disorders	7 (4.4)11	15 (9.5)22
Headache	7 (4.4)11	15 (9.5)22
Reproductive system and breast disorders	1 (0.6)1	0 (0.0)
Amenorrhoea	1 (0.6)1	0 (0.0)
Respiratory, thoracic and mediastinal disorders	1 (0.6)1	1 (0.6)2
Cough	1 (0.6)1	1 (0.6)1
Productive cough	0 (0.0)	1 (0.6)1

Postmarketing Experience

The following adverse reactions have been identified during post approval use of Linaclootide. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

Hypersensitivity reactions: Anaphylaxis, angioedema, rash (including hives or urticaria) Gastrointestinal reactions: Hematochezia, nausea, rectal haemorrhage.

Reporting of adverse reactions

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Report suspected adverse reactions via any point of contact available at www.torrenthpharma.com.

4.9 Overdose

An overdose may result in symptoms resulting from an exaggeration of the known pharmacodynamic effects of the medicinal product, mainly diarrhoea. In a study in healthy volunteers receiving a single dose of 2,897 micrograms (up to 10-fold the recommended therapeutic dose) the safety profile in these subjects was consistent with that in the overall population, with diarrhoea being the most commonly reported adverse event.

Should an overdose occur, the patient should be treated symptomatically and supportive measures instituted as required.

5. PHARMACOLOGICAL PROPERTIES

5.1 Pharmacodynamic properties

Pharmacotherapeutic group: Drugs for constipation, other drugs for constipation, ATC Code: A04AX04

Mechanism of action

Linaclootide is a Guanylate Cyclase-C receptor agonist (GCCA) with visceral analgesic and secretory activities. Linaclootide is a 14-amino acid synthetic peptide structurally related to the endogenous guanylin peptide family. Both linaclootide and its active metabolite bind to the GC-C

receptor, on the luminal surface of the intestinal epithelium. Through its action at GC-C, linaclootide has been shown to reduce visceral pain and increase GI transit in animal models and increase colonic transit in humans. Activation of GC-C results in an increase in concentrations of cyclic guanosine monophosphate (cGMP), both intracellularly and intracellularly. Extracellular cGMP decreases pain-fiber activity, resulting in reduced visceral pain in animal models.

Intracellular cGMP causes secretion of chloride and bicarbonate into the intestinal lumen, through activation of the cystic fibrosis transmembrane conductance regulator (CFTR), which results in increased intestinal fluid and accelerated transit.

Pharmacodynamic effects

In a cross-over food interaction study, 18 healthy subjects were administered Linaclootide 290 micrograms for 7 days both in the fasting and fed state. Taking Linaclootide immediately after a high fat breakfast resulted in more frequent and looser stools, as well as more gastrointestinal adverse events, compared with taking it in the fasted state.

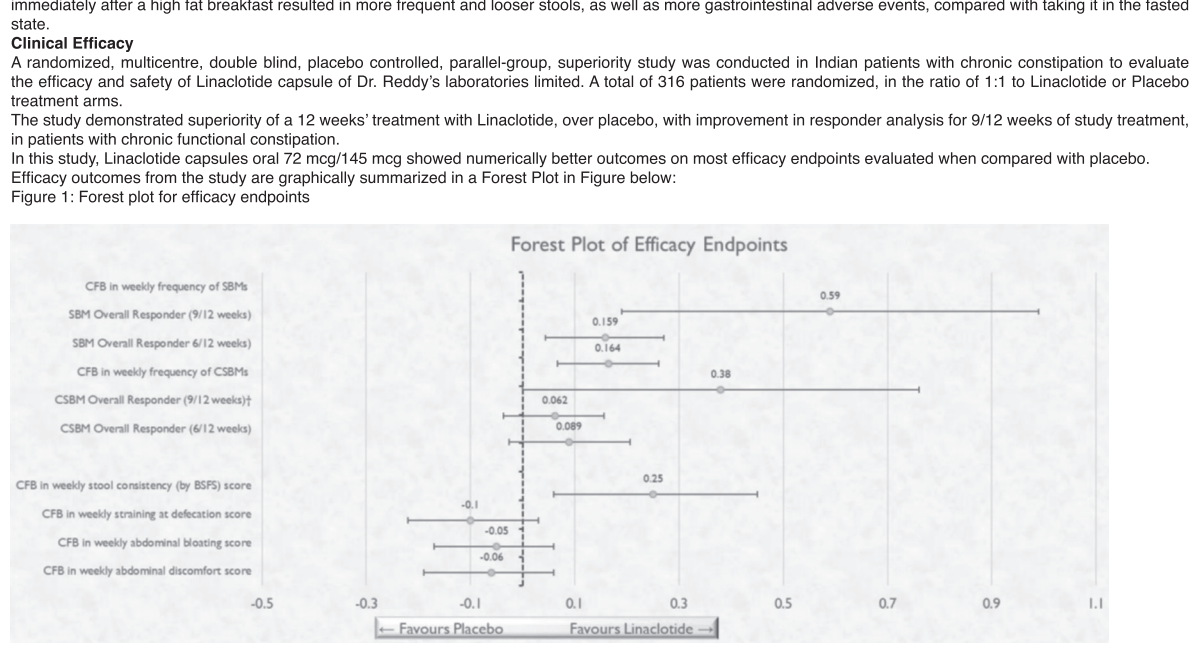
Clinical Efficacy

A randomized, multicentre, double blind, placebo controlled, parallel-group, superiority study was conducted in Indian patients with chronic constipation to evaluate the efficacy and safety of Linaclootide capsule of Dr. Reddy's laboratories limited. A total of 316 patients were randomized, in the ratio of 1:1 to Linaclootide or Placebo treatment arms.

The study demonstrated superiority of a 12 weeks' treatment with Linaclootide, over placebo, with improvement in responder analysis for 9/12 weeks of study treatment, in patients with chronic functional constipation.

In this study, Linaclootide capsules oral 72 mcg/145 mcg showed numerically better outcomes on most efficacy endpoints evaluated when compared with placebo. Efficacy outcomes from the study are graphically summarized in a Forest Plot in Figure below:

Figure 1: Forest plot for efficacy endpoints



This phase III study in Indian patient population with chronic constipation has shown superior outcomes for Linaclootide compared to Placebo on the endpoints of change from baseline in average weekly frequency of SBMs and CSBMs, SBM and CSBM overall responder proportions, and change from baseline in weekly stool consistency (by Bristol Stool Form Score) at end of 12 wks.

5.2 Pharmacokinetic properties

Absorption

In general, linaclootide is minimally detectable in plasma following therapeutic oral doses and therefore standard pharmacokinetic parameters cannot be calculated. Following single doses of up to 966 micrograms and multiple doses up to 290 micrograms of linaclootide, there were no detectable plasma levels of parent compound or the active metabolite (des-tyrosine). When 2,897 micrograms was administered on day 8, following a 7-day course of 290 micrograms/day, linaclootide was detectable in only 2 of 18 subjects at concentrations just above the lower limit of quantification of 0.2 ng/ml (concentrations ranged from 0.212 to 0.735 ng/ml). In the two pivotal phase 3 studies in which patients were dosed with 290 micrograms of linaclootide once daily, linaclootide was only detected in 2 out of 162 patients approximately 2 h following the initial linaclootide dose (concentrations were 0.241 ng/ml to 0.239 ng/ml) and in none of the 162 patients after 4 weeks of treatment. The active metabolite was not detected in any of the 162 patients at any time point.

Distribution

As linaclootide is rarely detectable in plasma following therapeutic doses, standard distribution studies have not been conducted. It is expected that linaclootide is negligibly or not systemically distributed.

Biotransformation

Linaclootide is metabolised locally within the gastrointestinal tract to its active primary metabolite, des-tyrosine. Both linaclootide and des-tyrosine active metabolite are reduced and enzymatically proteolyzed within the gastrointestinal tract to smaller peptides and naturally occurring amino acids.

The potential inhibitory activity of linaclootide and its active primary metabolite MM-419447 on the human efflux transporters BCRP, MRP2, MRP3, and MRP4 and the human uptake transporters OATP1B1, OATP1B3, OATP2B1, PEPT1 and OCTN1 was investigated in vitro. Results of this study showed that neither peptide is an inhibitor of the common efflux and uptake transporters studied at clinically relevant concentrations.

The effect of linaclootide and its metabolites to inhibit the common intestinal enzymes (CYP2C9 and CYP3A4) and liver enzymes (CYP1A2, 2B6, 2C8, 2C9, 2C19, 2D6, 2E1 and 3A4) or to induce liver enzymes (CYP1A2, 2B6, and 3A4/5) was investigated in vitro. Results of these studies showed that linaclootide and des-tyrosine metabolite are not inhibitors or inducers of the cytochrome P450 enzyme system.

Elimination

Following a single oral dose of 2,897 micrograms linaclootide on day 8, after a 7-day course of 290 micrograms/day in 18 healthy volunteers, approximately 3 to 5% of the dose was recovered in the faeces, virtually all of it as the des-tyrosine active metabolite.

Age and gender

Clinical studies to determine the impact of age and gender on the clinical pharmacokinetics of linaclootide have not been conducted because it is rarely detectable in plasma. Gender is not expected to have any impact on dosing.

Renal impairment

Linaclootide has not been studied in patients who have renal impairment. Linaclootide is rarely detectable in plasma, therefore, renal impairment would not be expected to affect clearance of the parent compound or its metabolite.

Hepatic impairment