Drug Design, Development and Therapy

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Health Technology Assessment: Evaluation of 8 CGRP-Targeted Therapy Drugs for the Treatment of Migraine

Mengyi Li, Siyong Huang, Jiabao Li, Xiao Hu, Jisheng Chen

Key Specialty of Clinical Pharmacy, the First Affiliated Hospital of Guangdong Pharmaceutical University, Guangzhou, People's Republic of China

Correspondence: Jisheng Chen, Key Specialty of Clinical Pharmacy, the First Affiliated Hospital of Guangdong Pharmaceutical University, Guangdong, 510080, People's Republic of China, Tel +86 20-87622305, Fax +86 20-61321967, Email cjslym@163.com

Purpose: In order to scientifically evaluate the clinical value of the comprehensive attributes of Calcitonin gene-related peptide (CGRP) inhibitor drugs, a comprehensive literature-based clinical evaluation of CGRP-targeted therapy drugs was conducted using the drug evaluation method modified by expert discussion in the Rapid Guide for Drug Evaluation and Selection in Chinese Medical Institutions (Second Edition).

Methods: Based on evidence-based data and the relevant elements and weighting in the "Selection Guidelines" quantification record form for drug evaluation and selection in medical institutions, adjustments were made according to the characteristics of CGRP-targeted therapy drugs. We systematically evaluated erenumab, galcanezumab, fremanezumab, eptinezumab, rimegepant, ubrogepant, atogepant, zavegepant for safety, efficacy, economy, and pharmacological properties.

Results: The final assessment result scores from highest to lowest were rimegepant (84.5 points), erenumab (75.78 points), galcanezumab (74.02 points), fremanezumab (73.93 points), atogepant (72.64 points), eptinezumab (71.69 points), ubrogepant (70.37 points), zavegepant (56.44 points).

Conclusion: Rimegepant, erenumab, fremanezumab, atogepant, galcanezumab, eptinezumab, ubrogepant can be entered into the medication list of medical institutions as strongly recommended drugs.

Keywords: calcitonin gene related peptide, CGRP, migraine, CGRP-targeted therapy drugs, rimegepant

Introduction

Migraine is a common neurological disorder characterized by recurrent, mostly unilateral, moderate-to-severe throbbing headaches, often accompanied by nausea, vomiting, photophobia, and phonophobia,[1] and has become one of the major public health problems worldwide. Migraine causes the second highest number of life years lost due to disability among all human diseases and the highest number of disability-adjusted life years among females aged 15–49 years, with a very negative impact on patients, their families, and society. About 1.04 billion people worldwide suffer from migraine.[2] In China, the annual prevalence of migraine is 9%, and the yearly cost of treatment for migraine sufferers exceeds $299.4 billion.[3,4] The annual cost of treating migraineurs diagnosed with migraine exceeds 299.4 billion dollars.

Drugs previously used in the acute treatment of migraine include non-migraine-specific therapeutic drugs such as nonsteroidal anti-inflammatory drugs (NSAIDs) and other analgesics, in addition to migraine-specific therapeutic drugs such as the Triptans class.[5,6] However, about 1/3 of patients have an inadequate response to treatment with Triptans, and 20% or more of migraine patients have contraindications to the use of Triptans due to co-morbid cardiovascular disease that precludes the use of such medications. In addition, there are few patients with medication-overuse headache (MOH) due to the unregulated use of NSAIDS and Triptans.[7–9] Calcitonin gene-related peptide (CGRP) is a novel therapeutic target for the treatment of migraine, for which therapeutic options are increasingly being updated. CGRP and its receptors are widely distributed in the trigeminal vascular and central nervous systems, and play an important role in the

Received: 3 November 2024
Accepted: 10 February 2025
Published: 19 February 2025

© 2025 Li et al. This work is published and licensed by Dove Medical Press Limited. The full terms of this license are available at https://www.dovepress.com/terms.php and incorporate the Creative Commons Attribution – Non Commercial (unported, v3.0) License (http://creativecommons.org/licenses/by-nc/3.0/). By accessing the work you hereby accept the Terms. Non-commercial uses of the work are permitted without any further permission from Dove Medical Press Limited, provided the work is properly attributed. For permission for commercial use of this work, please see paragraphs 4.2 and 5 of our Terms (https://www.dovepress.com/terms.php).

pathogenesis of migraine. Novel drugs targeting CGRP have been a hot research topic in recent years, and have been recommended by national and international migraine guidelines for acute and/or prophylactic treatment of migraine.

Rapid health technology assessment (rHTA) as an evidence synthesis methodology can provide evidence support to decision makers by rapidly assessing the efficacy, safety, and economy of drugs through simplified health technology assessment methods and processes. Many health authorities and hospitals in the world have applied rHTA in the decision-making of drug access and payment.[10,11] To scientifically evaluate the clinical value of the comprehensive attributes of CGRP-targeted therapy drugs, a comprehensive literature-based clinical evaluation of CGRP-targeted therapy drugs was conducted using the drug evaluation method modified by expert discussion in the Rapid Guide for Drug Evaluation and Selection in Chinese Medical Institutions (Second Edition) (hereinafter referred to as the Selection Guidelines)[12] to provide reference and a basis for the rational use of drugs in clinics as well as the provision of individualized treatment protocols for different patients. To provide a reference and basis for rational clinical use of drugs and individualized treatment plans for different patients.

Materials and Methods

Evaluation Basis

Based on the "Selection guide" published in 2023, and applying the Mini-health technology assessment (Mini-HTA) combined with the system of objectified judgment analysis(SOJA) to evaluate 8 CGRP-targeted therapy drugs. The evaluation dimensions and weights were determined by the guideline guidance group and the expert group through the Delphi method. The pharmaceutical properties, effectiveness, safety, economy and other properties of CGRP-targeted therapies were evaluated.

Evaluation of Drugs

New migraine-specific preventive therapies targeting the CGRP pathway have been recently introduced. These novel treatments are injectable monoclonal antibodies targeting the CGRP ligand (fremanezumab, galcanezumab, eptinezumab) or its receptor (erenumab), and the orally administrated small molecule CGRP receptor antagonists, the so called gepants (ubrogepant, atogepant, rimegepant and zavegepant). The final drugs included in the evaluation and drug information are shown in Table 1.

Table 1 CGRP-Targeted Therapies Drugs Information

Type of medication and target	Generic name/ Trade name	Dosage form (Route of administration)	Approved Regions (Year)	Manufacturer
Antibody against CGRP receptor	Erenumab/ Aimovig	Injections (Subcutaneous)	China (2023), Europe (2018), United States (2018), Japan (2021)	Novartis Pharmaceuticals Corp.
Antibody against CGRP	Fremanezumab/ AJOVY	Injections (Subcutaneous)	Europe (2019), United States (2018), Japan (2021)	Teva Pharmaceutical Industries Ltd.
	Galcanezumab/ Emgality	Injections (Subcutaneous)	China (2024), Europe (2018), United States (2018), Japan (2021)	Eli Lilly & Co.
	Eptinezumab/ Vyepti	Injections (Intravenous)	Europe (2011), United States (2020), Japan (2021)	HLundbeck A/S
Small-molecule CGRP receptor antagonists	Ubrogepant/ Ubrelvy	Tablets (Oral)	Europe (2022), United States (2021), Japan (2023)	Merck Sharp &Dohme Corp.
	Rimegepant/ NURTEC ODT, Vydura	Tablets (Oral)	China (2022), Europe (2020), United States (2020), Japan (2021)	Pfizer, Inc.
	Atogepant/ AQUIPTA	Orally Disintegrating Tablet	Europe (2023), United States (2022), Japan (2023)	AbbVie
	Zavegepant/ ZAVZPRET	Nasal spray	United States (2023)	Bristol Myers Squibb Co.

Relevant Evidence Retrieval and Evaluation Contents

Based on drug labels, drug registration information, some government websites (eg, American Food and Drug Administration (FDA) provide safety information. We searched English databases PubMed, Embase, and Cochrane Library, as well as Chinese databases Chinese Biomedical Sciences (CBM) and China National Knowledge Infrastructure (CNKI). The goal is to score the 8 CGRP-targeted therapy drugs on five dimensions, the total score is 100 points, including an assessment of their pharmacologic properties (28 points), efficacy (27 points), safety (25 points), economy (10 points), and other attributes (10 points).

Analysis and Evaluation

Based on evidence-based data and the relevant elements and weighting in the "Drug Selection Guidelines" quantification record form for drug evaluation and selection in medical institutions, adjustments were made according to the characteristics of CGRP-targeted therapies. Ultimately, a quantitative evaluation record form was developed, which includes scoring across five dimensions based on specific project indicators. The evaluation was conducted independently by two clinical pharmacists. When there was a significant discrepancy between their scores in any dimension (greater than 3 points), a third expert from the relevant field was invited to discuss and make a final determination. This process aimed to minimize subjective error and reduce bias. The comprehensive score system recommends strong support for scores above 70 points; for scores between 60 and 70, depending on the availability of alternative treatments, the recommendation is either weak or negative. Scores below 60 are advised as non-recommendations.

Results

Pharmacological Properties (28 Points)

Pharmacological Effects

8 CGRP-targeted therapy drugs with definite clinical efficacy, precise mechanism of action, and innovative mechanism of action or target point of action, all scored 5 points.

In vivo Processes

At the same time, pharmacokinetic parameters are complete, scored 5 points.

Pharmacy and Method of Use

8 CGRP-targeted therapies drugs main ingredients and auxiliary materials are clear, scored 2 points; Specifications and packaging are suitable for clinical and dose adjustment, scored 2 points.

Dosage forms: among them, erenumab, fremanezumab and galcanezumab are subcutaneous injections, scored 1.5 points; eptinezumab is the intravenous injection, scored 1 point. Ubrogepant, rimegepant and atogepant are oral tablets, scored 2 points. Zavegepant is a nasal spray,scored 2 points.

The dose administered: in addition to zavegepant, which uses a fixed dose each time, scored 2 points, the other 7 kinds need to adjust the dose according to the course of treatment and the degree of disease, scored 1.5 points.

The eight CGRP-targeted therapies all have a dosing frequency of ≤1 time per day, though there are significant differences in actual dosing intervals. To enhance the evaluation and make the scoring more meaningful, we adjusted the scoring criteria based on the real-world dosing frequency of these drugs. Eptinezumab, which is administered once every three months, scored 2 points. Erenumab, fremanezumab, and galcanezumab, which are administered monthly, scored 1.5 points. Ubrogepant, rimegepant, and zavegepant require multiple doses per month, and dosing frequency should be confirmed with a physician. Therapies administered more than once per month are scored 1 point. Atogepant, which is taken once daily, scored 0.5 points.

Ease of use: patients treated with erenumab, fremanezumab, galcanezumab need to be trained by a healthcare provider, scored 1.5 points. Patients treated with eptinezumab need to be administered by medical personnel,scored 1 point. The rest of the drugs can be self administered, scored 2 points.

Storage Conditions

Erenumab, fremanezumab, galcanezumab, eptinezumab need to be stored in refrigerated storage,scored 1 point; ubrogepant, rimegepant, atogepant, zavegepant need to be stored in the shade, scored 2 points.

Expiry Date

The expiry date of rimegepant is 48 months, and the expiry date of erenumab is 36 months, scored 1.5 points; Other drugs have 24 months, scored 1 point.

The results of the pharmaceutical properties scoring are presented in Table 2.

Efficacy (27 Points)

Indications

All 8 CGRP-targeted therapy drugs have been approved for the treatment of migraines. Among them, erenumab, fremanezumab, galcanezumab, eptinezumab and atogepant are used for the preventive treatment of migraines. Ubrogepant and zavegepant are specifically indicated for the acute treatment of migraine attacks. Rimegepant is currently the only drug approved for both the acute treatment and preventive therapy of migraines, and it has gradually become the first-choice drug in clinical practice, scored 5 points. Erenumab, fremanezumab, galcanezumab, eptinezumab, ubrogepant and atogepant are considered secondary recommendations in clinical practice,scored 3 points. Zavegepant, as a newly marketed drug with limited research on its safety and efficacy, is less frequently used in clinical practice, and given the availability of multiple alternatives, scored 1 point.

Guideline Recommendations

Erenumab, fremanezumab, galcanezumab, eptinezumab, rimegepant, atogepant were recommended in several guidelines. All highest recommendation grade was IA, and they scored a guideline recommendation score of 12. The highest recommendation grade of ubrogepant was IIA, scored 9 points. Zavegepant did not have a high recommendation grade due to its late introduction to the market,scored 2 points.

Domestic and international guidelines or consensus recommendations are shown in Table 3.

Clinical Efficacy

The trial endpoint is mean monthly migraine days. Responder rates have emerged as an important secondary efficacy endpoint that indicates the magnitude of efficacy in individual patients. Other key secondary endpoints of the trials include reduced acute medication use and multiple patient-reported outcomes.

A prospective randomized head-to-head study of galcanezumab and rimegepant showed that both were effective, safe, and well tolerated. Galcanezumab was not superior to rimegepant for the primary endpoint.[19] In another head-to-head experiment comparing the effectiveness of atogepant and rimegepant, oral atogepant once daily demonstrated a significantly greater reduction.[20,21] A study of erenumab vs topiramate found that adherence to erenumab was significantly better than adherence to topiramate (primary endpoint), and found as a secondary endpoint that the efficacy of erenumab was statistically superior to that of topiramate.[22] Multiple meta-analyses have been performed to evaluate the CGRP-targeting migraine preventive therapies.[23–28] All confirm their efficacy, and some also confirm their safety and tolerability.

Overall, on the primary outcome endpoint erenumab, fremanezumab, galcanezumab, eptinezumab, ubrogepant, rimegepant, atogepant and zavegepant scored 5, 4, 5, 4, 4,6,5, and 4, respectively. At the secondary outcome endpoint, the scores for erenumab, fremanezumab, galcanezumab, eptinezumab, ubrogepant, rimegepant, atogepant and zavegepant were 3, 3, 3, 3, 4, 4.4 and 2, respectively.

The efficacy score results are shown in Table 4.

Safety (25 Points)

Adverse Events

The severity of adverse events was graded according to the "Common Terminology Criteria for Adverse Events".[29] Erenumab: most adverse drug reactions (ADRs) were mild or moderate. The most common ADRs were injection site

Table 2 Pharmaceutical Properties Score Results

Pharmaceutical properties (28 points)		Grading Criteria	Erenumab	Fremanezumab	Galcanezumab	Eptinezumab	Ubrogepant	Rimegepant	Atogepant	Zavegepant
Pharmacological effects (5)	Definite clinical efficacy, precise mechanism of action, and innovative mechanism of action or target point of action	5	5	5	5	5	5	5	5	5
	Definite clinical efficacy and precise mechanism of action	4								
	Fair clinical efficacy and mechanism of action are unclear	2								
	General clinical efficacy and unclear mechanism of action	1								
In vivo processes (5)	Well-defined in vivo process with complete pharmacokinetic parameters	5	5	5	5	5	5	5	5	5
	Well-defined in vivo process with incomplete pharmacokinetic parameters	3								
	In vivo processes are unclear, or no pharmacokinetic studies are available	1								
Pharmacy and methods of use (multiple choice) (12)	Main ingredients and excipients (all specify 2; one specify 1)	2	2	2	2	2	2	2	2	2
	Specification and packaging (all appropriate for clinical use/dose adjustment 2; one appropriate 1)	2	2	2	2	2	2	2	2	2

(*Continued*)

https://doi.org/10.2147/DDDT.S499848

https://doi.org/10.2147/DDDT.S499848

Table 2 (Continued).

Pharmaceutical properties (28 points)		Grading Criteria	Erenumab	Fremanezumab	Galcanezumab	Eptinezumab	Ubrogepant	Rimegepant	Atogepant	Zavegepant
	Dosage forms (oral/inhalation/topical formulations 2; subcutaneous/intramuscular injections 1.5; intravenous drip/intravenous injections 1)	2	1.5	1.5	1.5	1	2	2	2	2
	The dose administered (fixed dose 2; dose to be adjusted during use 1.5; dose based on body mass or body surface area 1)	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2
	Frequency of administration (<1 dose/d 2; 2 doses/d 1.5; ≥3 doses/d 1)	2	1.5	1.5	1.5	2	1	1	0.5	1
	Ease of use (self-administration without assistance 2; with help or training 1.5; administered by medical personnel 1)	2	1.5	1.5	1.5	1	2	2	2	2
Storage conditions (multiple choice) (4)	Storage at room temperature	3								
	Storage in the shade	2					2	2	2	2
	Refrigerated/frozen storage	1	1	1	1	1				
	No need for shade/light protection	1								
Expiry date (2)	>60 months	2								
	≥36 months, <60 months	1.5	1.5					1.5		
	≥24 months, <36 months	1		1	1	1	1		1	1
	≥12 person-months, <24 months	0.5								
	<12 months	0.25								
Pharmaceutical Properties Score			22.5	22	22	21.5	23.5	24	23	24

Note: The frequency of administration of the evaluated drugs were all ≤1 times·d^{-1}, and to make the scoring more meaningful, we made different scores according to the size ranking of the frequency of administration.

Table 3 Recommendations From National and International Guidelines/Consensus

Name of the Guidelines	Guide Developers and Sources	Name of Drug	Recommended Content	Level of Evidence
European Headache Federation guideline on the use of monoclonal antibodies targeting the calcitonin gene related peptide pathway for migraine prevention - 2022 update[13]	European Headache Federation (EHF)	Erenumab FremanezumabGalcanezumab Eptinezumab	In individuals with episodic migraine, we recommend Eptinezumab, erenumab, Fremanezumab and Galcanezumab as preventive treatment	IA
Calcitonin gene-related peptide-targeting therapies are a first-line option for the prevention of migraine: An American Headache Society position statement update[14]	The American Headache Society	Erenumab FremanezumabGalcanezumab Eptinezumab Rimegepant Atogepant	The evidence for the efficacy, tolerability, and safety of CGRP-targeting migraine preventive therapies (the monoclonal antibodies: erenumab, Fremanezumab, Galcanezumab, and Eptinezumab, and the gepants: Rimegepant and atogepant) is substantial, and vastly exceeds that for any other preventive treatment approach. The evidence remains consistent across different individual CGRP-targeting treatments and is corroborated by extensive "real-world" clinical experience. The data indicates that the efficacy and tolerability of CGRP-targeting therapies are equal to or greater than those of previous first-line therapies and that serious adverse events associated with CGRP-targeting therapies are rare.	/
Pharmacological management of migraine: A national clinical guideline[15]	Healthcare Improvement Scotland	Erenumab Fremanezumab Galcanezumab Eptinezumab,	Erenumab, Fremanezumab, Galcanezumab and Eptinezumab are recommended for the prophylactic treatment of patients with chronic migraine where medication overuse has been addressed and patients have not benefitted from appropriate trials of three or more oral migraine prophylactic treatments. Fremanezumab, Galcenezumab and Eptinezumab can be considered for the prophylactic treatment of patients with episodic migraine where medication overuse has been addressed and patients have not benefitted from appropriate trials of three or more oral migraine prophylactic treatments.	IA
Diagnosis and management of migraine in ten steps[16]	Nature Reviews Neurology	Erenumab Fremanezumab Galcanezumab Eptinezumab Rimegepant Ubrogepant	If all available triptans fail after an adequate trial period (no or insufficient therapeutic response in at least three consecutive attacks) or their use is contraindicated, alternatives are currently limited. Ditans or gepants could be used, but their availability is currently very limited. Lasmiditan is the only ditan approved for acute treatment of migraine, and Ubrogepant and Rimegepant are the only gepants approved. Third-line medications are the four CGRP monoclonal antibodies erenumab, Fremanezumab, Galcanezumab and Eptinezumab.	/
Guidelines for diagnosis and treatment of migraine in China (2022)[17]	The Neurologist Branch of the Chinese Medical Doctor Association Headache and Sensory Disorders Professional Committee of Chinese Research Hospital Society	Erenumab Fremanezumab Galcanezumab Eptinezumab Rimegepant Atogepant Ubrogepant	Multiple studies have shown that Rimegepant and Atogepant are safe, effective, and well-tolerated for the acute treatment of migraines. These two medications are suitable for patients who have contraindications to the use of nonsteroidal anti-inflammatory drugs (NSAIDs) or triptans, or for those who have not responded to these treatments. erenumab, Fremanezumab, Galcanezumab, and Eptinezumab have all been proven effective and well-tolerated in randomized trials for the prevention of episodic and chronic migraines.	IA

(*Continued*)

https://doi.org/10.2147/DDDT.S499848

Table 3 (Continued).

Name of the Guidelines	Guide Developers and Sources	Name of Drug	Recommended Content	Level of Evidence
Guidelines for diagnosis and treatment of migraine in China (Chinese Medical Association Neurology Branch 1st Edition)[18]	Chinese Medical Association Branch of Neurology Headache Cooperation Group of Neurology Branch of Chinese Medical Association	Erenumab, Fremanezumab Galcanezumab Eptinezumab Rimegepant Atogepant Ubrogepant	Rimegepant: The recommended dose is 75 mg per dose, with a maximum daily dose of 75 mg. Ubrogepant: The recommended dose is 50–100 mg per dose, with a maximum daily dose of 200 mg. Eptinezumab: The recommended dose is 100 mg per quarter. Fremanezumab: The recommended dose is 225 mg subcutaneously per month or 675 mg per quarter. Injection sites include the abdomen, thighs, or upper arms. Galcanezumab: The initial loading dose is 240 mg, followed by 120 mg monthly, administered subcutaneously. erenumab: The recommended dose is 70 mg subcutaneously once a month, with the option to increase the dose to 140 mg per month if needed.	IIA

https://doi.org/10.2147/DDDT.S499848

Table 4 Efficacy Score Results

Efficacy (27 points)		Grading Criteria	Erenumab	Fremanezumab	Galcanezumab	Eptinezumab	Ubrogepan	Rimegepant	Atogepant	Zavegepant
Indications (5)	Clinically necessary, preferred	5						5		
	Clinical need, second choice	3	3	3	3	3	3		3	
	More medicines available	1								1
Recommended Guidelines (12)	Diagnosis and treatment norms/clinical pathways, consensus issued by national health administrative agencies/management methods, etc., guideline level I recommendation (Level A evidence 12; Level B evidence 11; Level C evidence, and others 10)	12	12	12	12	12		12	12	
	Guidelines Level II and below (Level A Evidence 9; Level B Evidence 8; Level C Evidence and Others 7)	9					9			
	Expert Consensus Recommendations (the consensus published by the society organizations based on systematic evaluation 6; the consensus published by the society organization others 4)	6								
	Systematic evaluation/Meta-analysis (large sample, high-quality systematic evaluation/Meta-analysis 3; small sample, low-quality systematic evaluation/ Meta-analysis 2; systematic evaluation/Meta-analysis of non-RCT studies 1).	3								2
Clinical efficacy (10)	The primary efficacy endpoint indicators (6)	6	5	4	5	4	4	6	5	4
	The secondary efficacy endpoint indicators (4)	4	3	3	3	3	4	4	4	2
Effectiveness Score			23	22	23	22	20	32	24	9

https://doi.org/10.2147/DDDT.S499848

reactions and constipation, with an incidence of 1% to <10%, scored 2 points. Fremanezumab: the most common ADR was injection site reactions (1%), scored 3 points.Galcanezumab (120 mg): the ADRs included injection site pain (10.1%), injection site reactions (9.9%), dizziness (0.7%), constipation (1.0%), itching (0.7%), and hives (0.3%). Most reactions were mild or moderate in severity, with an average incidence of 1% to <10%,scored 2 points. Eptinezumab: the most common ADRs were nasopharyngitis and allergic reactions, with an incidence of 1% to <10%, scored 2 points.Ubrogepant: common ADRs included nausea (2%), somnolence (2%), and dry mouth (2%), with an incidence of 1% to <10%, scored 2 points. Rimegepant: the most common ADR was nausea (1.2%), with most reactions being mild to moderate, scored 2 points. Atogepant: common ADRs included constipation (6%), nausea (5%), decreased appetite (1%), and fatigue/somnolence (4%), with an average incidence of 1% to <10%, scored 2 points.Zavegepant: common ADRs included taste disorders (18%), nausea (4%), nasal discomfort (3%), and vomiting (2%), with an average incidence of 1% to <10% scored 2 points.

Both rimegepant and zavegepant had rare severe allergic reactions, with an incidence of less than 1%, scored 3 points. All other therapies had no severe ADRs or an incidence of less than 0.01%, scored 5 points.

Special Populations

All 8 CGRP-targeted therapy drugs were not suitable for children.For elderly, erenumab, galcanezumab, ubrogepant, atogepant and zavegepant should be used with caution, scored 0.5 points. Fremanezumab, eptinezumab and rimegepant did not determine whether they responded differently from younger subjects, scored 0 points. All 8 CGRP-targeted therapy drugs should be avoided during pregnancy, with each receiving a score of 0 points. For breastfeeding women, it is recommended to consult a physician and use the medications with caution, each receiving a score of 0.5 points. Patients with liver impairment can take erenumab, fremanezumab, galcanezumab, eptinezumab and ubrogepant, with each receiving a score of 3 points. However, patients with severe liver impairment should avoid using rimegepant, atogepant and zavegepant, scored 2 points.Patients with renal impairment can use all eight CGRP-targeted therapies, with each receiving a score of 3 points.

Drug Interactions

Erenumab, fremanezumab, galcanezumab and eptinezumab are not metabolized by cytochrome P450 enzymes, so taking them with other drugs does not affect absorption efficiency, and they each receive a score of 3 points. Atogepant requires a dose adjustment when administered concomitantly with CYP3A4 inhibitors, scored 2 points. Ubrogepant should be avoided when taken concomitantly with strong CYP3A4 inhibitors, scored 1 point. Rimegepant should be avoided when taken concomitantly with strong CYP3A4 inhibitors, strong CYP3A4 inducers, and moderately potent CYP3A4 inducers, scored 1 point. Zavegepant should be avoided when taken concomitantly with inhibit OATP1B3 or NTCP transporters,scored 1 point.

Other

All adverse reactions of the drugs included in the study were reversible and scored 1 point. The instructions for all drugs have no special medication warning, and all scored 1 point. Fremanezumab and eptinezumab have not undergone carcinogenicity or teratogenicity studies, scored 0 points. Erenumab, galcanezumab, ubrogepant and atogepant have no known carcinogenicity but may cause harm to the fetus, scored 0.5 points. Rimegepant and zavegepant show no evidence of carcinogenicity or teratogenicity, scored 1 point.

The safety score results are shown in Table 5.

Economy (27 Points)

The specifications, dosages, and prices of all 8 CGRP-targeted therapy drugs were sourced from the US FDA Drugs Database, Pharmacy Checker, PharmStore, and GoodRx websites.

All information counted as of September 20, 2024. 8 CGRP-targeted therapy drugs do not have the same generic name. The drug with the lowest average daily treatment cost of the same kind of drug is scored 7 points, and the evaluation drug score = the lowest average daily treatment cost/the average daily treatment cost of the evaluated drug * 7. Among the 8 CGRP-targeted therapies drugs, the drug with the lowest average daily treatment cost is rimegepant, with an average daily cost of 69.11 yuan; the corresponding scores were calculated according to the evaluation method, and the score of the erenumab, fremanezumab, galcanezumab, eptinezumab, ubrogepant,

Table 5 Safety Score Results

Safety (25 points)		Grading Criteria	Erenumab	Fremanezumab	Galcanezumab	Eptinezumab	Ubrogepant	Rimegepant	Atogepant	Zavegepant
Moderate adverse reactions (3)	Incidence <1%	3		3						
	Incidence 1% to <10%	2	2		2	2	2	2	2	2
	Incidence ≥10%	1								
	ADR occurrence data not available	0								
Severe adverse reactions (5)	Incidence < 0.01%	5	5	5	5	5	5		5	
	Incidence 0.01%~<0.1%	4								
	Incidence 0.1%~<1%	3						3		3
	Incidence 1% to <10%	2								
	Incidence ≥10%	1								
	ADR occurrence data not available	0								
Special populations (multiple choice) (11)	Available for children (both 2; 1.9 for 3 months+; 1.8 for 6 months+; 1.7 for 9 months+; 1.6 for ages 1+; 1.5 for ages 2+; 1.4 for ages 3+; 1.3 for ages 4+; 1.2 for ages 5+; 1.1 for ages 6+; 1.0 for ages 7+; 0.9 for ages 8+; 0.8 for ages 9+ 0.7 for ages 10+; 0.6 for ages 11+; 0.5 for ages 12+.	2	0	0	0	0	0	0	0	0
	The elderly (available 1; use with caution 0.5)	1	0.5	0	0.5	0	0.5	0	0.5	0.5
	Pregnant women (early pregnancy 1; during the first trimester 0.8; during the second trimester 0.5).	1	0	0	0	0	0	0	0	0
	Lactating women (available 1; use with caution 0.5)	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Hepatic dysfunction (severe available 3, moderate available 2. Lightly available 1)	3	3	3	3	3	3	2	2	2
	Renal dysfunction (severe available 3, moderate available 2. Lightly available 1)	3	3	3	3	3	3	3	3	3
Adverse reactions due to drug interactions (3)	No dosage adjustment is required	3	3	3	3	3				
	Dosage adjustment required	2							2	
	Prohibited to use at the same time	1					1	1		1
Other (multiple choice) (3)	Reversibility of adverse reactions	1	1	1	1	1	1	1	1	1
	Non-teratogenic/ non-carcinogenic	1	0.5	0	0.5	0	0.5	1	0.5	1
	No special medication warnings	1	1	1	1	1	1	1	1	1
Total Safety Score			19.5	19.5	19.5	18.5	17.5	14.5	17	15

https://doi.org/10.2147/DDDT.S499848

rimegepant, atogepant, and zavegepant were scored as5.78, 6.22, 5.34, 6.19, 5.57, 10, 4.93, and 4.44 respectively. See Tables 6 and 7 for details. See Tables 6 and 7 for details.

Other Attributes (10 Points)

National Health Insurance and National Essential Drug Characteristics

All 8 CGRP-targeted therapies drugs are not included in the National Health Insurance and National Essential Drug Catalog.

National Centralized Drug Procurement and Original Research Drugs

All 8 CGRP-targeted therapy drugs are originator drugs, all scored 1 point. In addition, none of the CGRP-targeted therapies drugs are national centralized drug procurement drugs, scoring 0 points.

Status of producers

Table 1 shows the manufacturer of all 8 CGRP-targeted therapies drugs. The manufacturers of erenumab, rimegepant, atogepant and zavegepant are among the top 50 pharmaceutical companies in terms of global sales and are ranked 4th, 1st, 2nd, and 7th, respectively (2023 rankings). Fremanezumab, galcanezumab and ubrogepant are among the top 50 pharmaceutical companies in terms of global sales and are ranked 21 st,24th, and 13th.Eptinezumab is not on the list of the top 100 pharmaceutical industry in China and the World's top 50 pharmaceutical companies.

Table 6 Basic Economy Information

	Erenumab	Fremanezumab	Galcanezumab	Eptinezumab	Ubrogepant	Rimegepant	Atogepant	Zavegepant
Specification	1mL/piece (70 mg/mL)	225 mg/1.5 mL	1mL/piece (120 mg/mL)	100 mg/mL	50mg*10 100mg*10	75mg*1	10mg, 30mg, 60mg*30	10mg
Dosage	70mg monthly	225 mg monthly	240mg for 1 first month; 120mg for every following month	100mg every 3 months	50 mg or 100 mg every time	75mg every time	10/30/60mg every time	10mg every time
Average daily cost of treatment (¥)	174.11	150.45	206.42	151.57	188.07	69.11	250.08	335.95

Table 7 Economy Score Results

Economy (10 points)		Grading Criteria	Erenumab	Fremanezumab	Galcanezumab	Eptinezumab	Ubrogepant	Rimegepant	Atogepant	Zavegepant
Drugs with the same generic name (3)	The score for the evaluated drug = lowest average daily cost of treatment/average daily cost of treatment for the evaluated drug * 3	3	3	3	3	3	3	3	3	3
Substitutable medicines for main indications (7)	The score for the evaluated drug = lowest average daily cost of treatment / average daily cost of treatment of the evaluated drug * 7.	7	2.78	3.22	2.34	3.19	2.57	7	1.93	1.41
Economy Score			5.78	6.22	5.34	6.19	5.57	10	4.93	4.44

Notes: In the prescribing information for Gepant-class medications, they are indicated for use as needed, and both the dosage and frequency should be determined by a physician based on the severity of the migraine. The instructions for ubrogepant, rimegepant and zavegepant indicate that the safety of treating more than 8 or 18 migraines within 30 days has not been established. For this evaluation, we have calculated the dosage frequency based on 8 treatments per month. Atogepant is calculated based on once-daily dosing.

Global Utilization

Erenumab, galcanezumab, rimegepant are available in China, USA, Europe, Japan.

Fremanezumab, eptinezumab are available in the United States, Europe, and Japan. They are used regularly in some parts of China. Fremanezumab is used in hospitals within the Guangdong-Hong Kong-Macao Greater Bay Area under the "Hong Kong and Macao Drug and Device Access" policy. Eptinezumab is utilized at Hainan Ruijin Hospital under the "Pioneer Pilot" policy. Ubrogepant, atogepant, zavegepant are not available in China.

The other attributes' score results are shown in Table 8.

Table 8 Other Attribute Score Results

Other Attributes (10 points)		Grading Criteria	Erenumab	Fremanezumab	Galcanezumab	Eptinezumab	Ubrogepant	Rimegepant	Atogepant	Zavegepant
National Medical Insurance (3)	National medical insurance category A, no payment restrictions	3								
	National medical insurance category A with payment restrictions	2.5								
	National medical insurance category B, no payment limitations	2								
	National medical insurance category B with payment restrictions.	1.5								
	Not on the national medical insurance list	1	1	1	1	1	1	1	1	1
National essential drugs (3)	National essential drugs without Δ requirement.	3								
	National essential drugs with Δ Requirements	2								
	Not on the national essential drugs list	1	1	1	1	1	1	1	1	1
National centralized procurement of medicines (1)	Selected drugs for centralized national procurement	1	0	0	0	0	0	0	0	0
Original/ reference/ consistency evaluation (1)	Drug of origin/reference drug	1	1	1	1	1	1	1	1	1
	Generic drugs through consistency evaluation	0.5								
Status of producers (1)	The world's top 50 pharmaceutical manufacturers in terms of sales volume (1 for top 1-10; 0.8 for top 11-20; 0.6 for top 21-30; 0.4 for top 31-40; 0.2 for top 41-50) / Top 100 Pharmaceutical Industry published by MIIT (1for top 1-20; 0.8 for top 21-40; 0.6 for top 41-60; 0.4 for top 61-80; 0.2 for top 81-100).	1	1	0.8	0.8	0	0.8	1	1	1
Global utilization (1)	Available in China, USA, Europe, Japan	1	1		1			1		
	Domestic and international sales	0.5		0.5		0.5				
Other Attributes Score			5	4.3	4.8	3.5	3.8	5	4	4

Note: The "Δ" sign indicates that the drug should be used by a physician with corresponding prescription qualifications or under the guidance of a specialist physician, and use monitoring and evaluation should be strengthened.

https://doi.org/10.2147/DDDT.S499848

Discussion

CGRP analogs are currently used clinically as an important option for migraine treatment, but their clinical efficacy and drug costs vary widely.[16,30,31] According to the "Selection Guidelines", the clinical comprehensive evaluation of CGRP-targeted therapy drugs marketed globally is carried out from five dimensions, which evaluates the core attributes of drugs (pharmacological properties, safety, efficacy and economy), policy attributes (inclusion in the National Health Insurance, inclusion in the National Essential Drugs), and the basic attributes of drugs (storage conditions, the expiration date of the drugs, use, status of the manufacturing enterprises, etc.) to evaluate the comprehensive clinical value of CGRP-targeted therapy drugs can effectively measure the difference in clinical utility between different drugs, and provide a reference basis for the selection of drugs by medical institutions and the rational selection of clinical drugs.

As shown in Table 9, the drugs included in this study in descending order of final quantitative scores were: rimegepant, erenumab, fremanezumab, atogepant, galcanezumab, eptinezumab, ubrogepant and zavegepant. Final scores were 84.5, 75.78, 74.02, 73.93, 72.64, 71.69, 70.37, 56.44. Among them, rimegepant, erenumab, fremanezumab, atogepant, galcanezumab, eptinezumab, and ubrogepant scored higher than 70 and made strong recommendations for the treatment of migraine in clinical use. Other drugs (zavegepant) scored between 60 ~ 70, which is a weak recommendation, and medical institutions can choose according to the actual situation.

According to the evaluation results, rimegepant has the best overall evaluation results. Rimegepant is a second-generation gepant drug. Rimegepant has been marketed in China, the United States, Europe, Japan and other countries, and is currently the only drug approved for dual indications of acute phase treatment and prophylactic treatment of migraine. The drug dosage form is orally disintegrating tablets, which has the advantages of easy to take, fast onset of action.Rimegepant also has high bioavailability, and provides migraine sufferers with a more convenient and novel choice. Erenumab, galcanezumab and fremanezumab are monoclonal antibodies.The monoclonal antibodies have a higher binding specificity and longer half-life than the gepant, so the safety is higher. They are administered by subcutaneous injection, and the frequency of administration is $\leq 1 \cdot d^{-1}$, which will greatly improve the compliance of migraine patients.Atogepant is an oral tablet, indicative for the preventive treatment of episodic migraine in adults. Its clinical effectiveness is better. The course of administration is long, the dose needs to be adjusted according to the condition, and it is expensive.

Eptinezumab is an intravenous monoclonal antibody that requires specialized administration by a health care provider. Ubrogepant had lower efficacy and safety scores. The lowest scoring zavegepant is the only nasal spray that specifically treats migraine, has limited clinical data, and is recommended less frequently by guidelines.Side effects of the currently marketed CGRP antagonists are all relatively rare, with common side effects including injection site reactions, constipation, mild joint pain, nausea, fatigue, and nasal irritation (nasal preparations).

In recent years, with the increasing research on the mechanism of migraine occurrence, the role of CGRP in the trigeminal vascular system in the pathogenesis of migraine has attracted much attention and has become a new target for migraine treatment and prevention.[32–34] Compared to the current mainstay of migraine treatment, the CGRP drug is well tolerated and opens up new possibilities with an additional option for patients who cannot tolerate triptan or who have not had an effect with other preventive medications.There are two types of CGRP-targeted therapy drugs: monoclonal antibodies and small molecule antagonists (gepants). These drugs are available as injections, nasal sprays, oral medications and so on.

Clinical trials on the safety and efficacy of CGRP-targeted therapy drugs are currently underway. Some clinical trials are developing indications for different CGRP-targeted therapy drugs for different types of migraine attacks, and the safety of the dosage of CGRP-targeted therapy drugs needs to be verified in subsequent clinical trials, as well as pediatric data, carcinogenicity, etc. The extent to which CGRP controls neurotransmission associated with migraine and its independence from other neurotransmitters remains to be examined.[35] At this stage, CGRP-targeted therapy drugs are expensive and long-term use requires a certain degree of affordability.This study also has some limitations: (1) The clinical trial data referenced for the evaluation are small, and further real-world based clinical synthesis is still needed. (2) As each drug is marketed differently, some drug attributes, such as economics, cannot be compared under the same conditions. (3) CGRP-targeted therapy drugs are listed late in China, with a short clinical use time, and there are many

Table 9 Final Total Score Results

Evaluation Dimension	Erenumab	Fremanezumab	Galcanezumab	Eptinezumab	Ubrogepant	Rimegepant	Atogepant	Zavegepant
Pharmaceutical Properties	22.5	22	22	21.5	23.5	24	23	24
Efficacy	23	22	21	22	20	31	25	9
Safety	19.5	19.5	19.5	18.5	17.5	14.5	17	15
Economy	5.78	6.22	5.34	6.19	5.57	10	4.93	4.44
Other Attributes	5	4.3	4.8	3.5	3.8	5	4	4
Total Score	75.78	74.02	72.64	71.69	70.37	84.5	73.93	56.44

https://doi.org/10.2147/DDDT.S499848

deficiencies in indications, guideline recommendations, and health insurance reimbursement, etc. There is an urgent need for further dynamic evaluations of CGRP-targeted therapy drugs on the basis of new evidence-based bases, new health insurance policies, and pricing information.

Conclusion

Rimegepant, erenumab, fremanezumab, atogepant, galcanezumab, eptinezumab, ubrogepant can be entered into the medication list of medical institutions as strongly recommended drugs. The evaluation results can provide a reference for medical institutions to select CGRP-targeted therapies drugs.

Acknowledgment

We would like to thank all of the author that participated in the present study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This study was supported by the National Key Specialty Construction Project (Clinical Pharmacy) and the High-level Clinical Key Specialty of Guangdong Province, and the funders were the central finance subsidy fund for the improvement of medical services and guarantee capacity, code Z155080000004; the Guangzhou Minsheng Science and Technology Research Program Project, code 201803010096.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Cephalalgia. Headache classification committee of the Inter national Headache Society (IHS). *Int Classification of Headache Disord, 3rd Edition*. 2018;38(1):1–211.
2. Steiner TJ, Stovner LJ, Jensen R, Uluduz D, Katsarava Z. Migraine remains second among the world's causes of disability, and first among young women: findings from GBD2019. *J Headache Pain*. 2020;21(1):137. doi:10.1186/s10194-020-01208-0
3. Ashina M, Katsarava Z, Do TP, et al. Migraine: epidemiology and systems of care. *Lancet*. 2021;397(10283):1485–1495. doi:10.1016/s0140-6736(20)32160-7
4. Yao C, Wang Y, Wang L, et al. Burden of headache disorders in China, 1990-2017: findings from the Global Burden of Disease Study 2017. *J Headache Pain*. 2019;20(1):102. doi:10.1186/s10194-019-1048-2
5. Baraldi C, Beier D, Martelletti P, Pellesi L. The preclinical discovery and development of atogepant for migraine prophylaxis. *Expert Opin Drug Discov*. 2024;19(7):783–788. doi:10.1080/17460441.2024.2365379
6. Pellesi L, Do TP, Hougaard A. Pharmacological management of migraine: current strategies and future directions. *Expert Opin Pharmacother*. 2024;25(6):673–683. doi:10.1080/14656566.2024.2349791
7. Liu H, Dong M, Liu K, et al. Status of diagnosis and preventative treatment for primary headache disorders: real-world data of unmet needs in China. *J Headache Pain*. 2023;24(1):119. doi:10.1186/s10194-023-01654-6
8. Takeshima T, Wan Q, Zhang Y, et al. Prevalence, burden, and clinical management of migraine in China, Japan, and South Korea: a comprehensive review of the literature. *J Headache Pain*. 2019;20(1):111. doi:10.1186/s10194-019-1062-4
9. Zobdeh F, Ben Kraiem A, Attwood MM, et al. Pharmacological treatment of migraine: drug classes, mechanisms of action, clinical trials and new treatments. *Br J Pharmacol*. 2021;178(23):4588–4607. doi:10.1111/bph.15657
10. Huang S, Li J, Hu X, Chen J. A health technology assessment based on Chinese guideline: active Vitamin D and its analogs in the treatment of osteoporosis. *Drug Des Devel Ther*. 2024;18:2593–2608. doi:10.2147/dddt.S465960
11. Xie Z, Hu J, Li M, Hu X, Chen J. Health technology assessment: evaluation of 7 Glucagon-like peptide-1 receptor agonists for the treatment of type 2 diabetes mellitus. *Risk Manag Healthc Policy*. 2024;17:1053–1067. doi:10.2147/rmhp.S455897
12. Dz Z, Liu J. A quick guideline for drug evaluation and selection in Chinese medical institutions(the Second Edition). *Herald Meddoi*. 2023;04:447–456. doi:10.3870/j.issn.1004-0781.2023.04.001
13. Sacco S, Amin FM, Ashina M, et al. European Headache Federation guideline on the use of monoclonal antibodies targeting the calcitonin gene related peptide pathway for migraine prevention - 2022 update. *J Headache Pain*. 2022;23(1):67. doi:10.1186/s10194-022-01431-x

14. Charles AC, Digre KB, Goadsby PJ, Robbins MS, Hershey A. Calcitonin gene-related peptide-targeting therapies are a first-line option for the prevention of migraine: an American Headache Society position statement update. *Headache*. 2024;64(4):333–341. doi:10.1111/head.14692
15. Scotland HI. Pharmacological management of migraine:A national clinical guideline. 2024.
16. Eigenbrodt AK, Ashina H, Khan S, et al. Diagnosis and management of migraine in ten steps. *Nat Rev Neurol*. 2021;17(8):501–514. doi:10.1038/s41582-021-00509-5
17. Headache and Sensory Disorders Professional Committee of Chinese Research Hospital Society BoN, Chinese Medical Doctor Association. Chinese guidelines for diagnosis and treatment of migraine (2022 edition). *J Pain Med*. 2022;28(12):881–898. doi:10.3969/j.issn.1006-9852.2022.12.001.
18. Neurology CMABo, Association HCGoNBoCM. Guidelines for diagnosis and treatment of migraine in China (Chinese Medical Association Neurology Branch 1st Edition). *J of Neurol*. 2023;56(6):591–613. doi:10.3760/cma.j.cn113694-20230222-00118.
19. Schwedt TJ, Myers Oakes TM, Martinez JM, et al. Comparing the efficacy and safety of galcanezumab versus rimegepant for prevention of episodic migraine: results from a randomized, controlled clinical trial. *Neurol Ther*. 2024;13(1):85–105. doi:10.1007/s40120-023-00562-w
20. Wells-Gatnik WD, Pellesi L, Martelletti P. Rimegepant and atogepant: novel drugs providing innovative opportunities in the management of migraine. *Expert Rev Neurother*. 2024;1–11. doi:10.1080/14737175.2024.2401558
21. Tassorelli C, Onishchenko K, Halker Singh RB, et al. Comparative efficacy, quality of life, safety, and tolerability of atogepant and rimegepant in migraine prevention: a matching-adjusted indirect comparison analysis. *Cephalalgia*. 2024;44(2):3331024241235156. doi:10.1177/03331024241235156
22. Reuter U, Ehrlich M, Gendolla A, et al. erenumab versus topiramate for the prevention of migraine - a randomised, double-blind, active-controlled Phase 4 trial. *Cephalalgia*. 2022;42(2):108–118. doi:10.1177/03331024211053571
23. Goadsby PJ, Dodick DW, Ailani J, et al. Safety, tolerability, and efficacy of orally administered atogepant for the prevention of episodic migraine in adults: a double-blind, randomised phase 2b/3 trial. *Lancet Neurol*. 2020;19(9):727–737. doi:10.1016/s1474-4422(20)30234-9
24. Lipton RB, Dodick DW, Ailani J, et al. Effect of Ubrogepant vs Placebo on pain and the most bothersome associated symptom in the acute treatment of migraine: the ACHIEVE II randomized clinical trial. *JAMA*. 2019;322(19):1887–1898. doi:10.1001/jama.2019.16711
25. Lipton RB, Goadsby PJ, Smith J, et al. Efficacy and safety of eptinezumab in patients with chronic migraine: PROMISE-2. *Neurology*. 2020;94(13):e1365–e1377. doi:10.1212/wnl.0000000000009169
26. Mulleners WM, Kim BK, Láinez MJA, et al. Safety and efficacy of galcanezumab in patients for whom previous migraine preventive medication from two to four categories had failed (CONQUER): a multicentre, randomised, double-blind, placebo-controlled, phase 3b trial. *Lancet Neurol*. 2020;19(10):814–825. doi:10.1016/s1474-4422(20)30279-9
27. Tepper SJ, Ashina M, Reuter U, et al. Long-term safety and efficacy of erenumab in patients with chronic migraine: results from a 52-week, open-label extension study. *Cephalalgia*. 2020;40(6):543–553. doi:10.1177/0333102420912726
28. Ferrari MD, Diener HC, Ning X, et al. Fremanezumab versus placebo for migraine prevention in patients with documented failure to up to four migraine preventive medication classes (FOCUS): a randomised, double-blind, placebo-controlled, phase 3b trial. *Lancet*. 2019;394(10203):1030–1040. doi:10.1016/s0140-6736(19)31946-4
29. Common Terminology Criteria for Adverse Events (CTCAE). Version 5. Published: november 27. US Department of Health and Human Services, National Institutes of Health, National Cancer Institute.
30. Ailani J, Burch RC, Robbins MS. The American headache society consensus statement: update on integrating new migraine treatments into clinical practice. *Headache*. 2021;61(7):1021–1039. doi:10.1111/head.14153
31. Fullerton T, Pixton G. Long-term use of rimegepant 75 mg for the acute treatment of migraine is associated with a reduction in the utilization of select analgesics and antiemetics. *J Pain Res*. 2024;17:1751–1760. doi:10.2147/jpr.S456006
32. Chiang CC, Schwedt TJ. Calcitonin gene-related peptide (CGRP)-targeted therapies as preventive and acute treatments for migraine-The monoclonal antibodies and gepants. *Prog Brain Res*. 2020;255:143–170. doi:10.1016/bs.pbr.2020.06.019
33. Rissardo JP, Caprara ALF. Gepants for acute and preventive migraine treatment: a narrative review. *Brain Sci*. 2022;12(12):1612. doi:10.3390/brainsci12121612
34. Raffaelli B, De Icco R, Corrado M, Terhart M, Ailani J. Open-label trials for CGRP-targeted drugs in migraine prevention: a narrative review. *Cephalalgia*. 2023;43(2):3331024221137091. doi:10.1177/03331024221137091
35. Wattiez AS, Sowers LP, Russo AF. Calcitonin gene-related peptide (CGRP): role in migraine pathophysiology and therapeutic targeting. *Expert Opin Ther Targets*. 2020;24(2):91–100. doi:10.1080/14728222.2020.1724285

Drug Design, Development and Therapy

Dovepress
Taylor & Francis Group

Publish your work in this journal

Drug Design, Development and Therapy is an international, peer-reviewed open-access journal that spans the spectrum of drug design and development through to clinical applications. Clinical outcomes, patient safety, and programs for the development and effective, safe, and sustained use of medicines are a feature of the journal, which has also been accepted for indexing on PubMed Central. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit http://www.dovepress.com/testimonials.php to read real quotes from published authors.

Submit your manuscript here: https://www.dovepress.com/drug-design-development-and-therapy-journal