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PHARMFACTS BULLETIN

The latest news and updates from The Christ Hospital Pharmacy Department

IN THIS ISSUE

P&T Updates *Nabhag Patel, PharmD, MBA, PGY1 Pharmacy Resident*

Formulary Updates as of May 31st, 2025

- **IV Minocycline** was added to formulary.
- **Linezolid** Criteria for Use was revised to now include treatment of necrotizing soft tissue infection.
- **Fondaparinux** restriction was updated to patients with HIT, suspected HIT, non-HIT heparin/LMWH allergy, pork allergy/religious restrictions.
- New **Pharmacy to Dose Vancomycin Policy** was approved. Under this policy, all vancomycin doses ordered will automatically be converted to consults and pharmacy will manage therapy for the duration of inpatient stay.
- IV to PO conversion policy was updated to include **Levetiracetam.**
- **Soliris (eculizumab)** biosimilars, Epysqli and Bkemv, were added to formulary as preferred product for atypical hemolytic uremic syndrome and restricted for outpatient use only. Inpatient use will be reviewed case-by-case.
- **Truxima** was added to formulary as the preferred product for non-oncology indications

*****Attention Providers*****

Reading the PharmFacts Bulletin can be used to earn CME! Just complete the CME quiz on the last page of the issue, submit the quiz as directed, and score a passing grade to earn CME.

Spotlight: Finerenone – A New Generation of Mineralocorticoid Receptor Antagonist

Cardiology: Finerenone – A New Generation of Mineralocorticoid Receptor Antagonist

Rebecca Dudley, PharmD, BCCP, CACP

While mineralocorticoid receptor antagonists (MRAs) like spironolactone and eplerenone have been utilized for a variety of indications spanning several decades, their use is often limited by adverse effects such as hyperkalemia, gynecomastia, and hormonal imbalances. Finerenone (Kerendia) is a nonsteroidal MRA that selectively binds to the mineralocorticoid receptor with high affinity, potentially reducing the incidence of adverse effects seen with earlier generation MRAs, while exhibiting more potent anti-inflammatory and antifibrotic effects in preclinical models.[1,2]

Clinical trials have demonstrated a reduction in various cardiovascular (CV) and renal outcomes in adult patients with chronic kidney disease (CKD) associated with type 2 diabetes (T2DM) with the use of finerenone, leading to an FDA-approved indication for the management of CKD associated with T2DM and a place in the 2024 Kidney Disease: Improving Global Outcomes (KDIGO) Clinical Practice Guideline.[3,4] Two such trials included FIDELIO-DKD and FIGARO-DKD. These were randomized, double-blind, placebo-controlled trials that evaluated finerenone compared to placebo in patients with T2DM and varying degrees of CKD. The renal composite outcome of kidney failure, a sustained decrease of at least 40% in eGFR from baseline, or death from renal causes was found to be significantly lower in the finerenone group in both trials, as was the key CV composite outcome of death from CV causes, nonfatal MI, nonfatal stroke, or HF hospitalization.[2,5] Of note, in the FIDELITY pooled analysis, benefits in CV and renal outcomes were observed irrespective of sodium-glucose cotransporter 2 (SGLT2) inhibitor use.[6] Similar frequency of adverse events was seen with finerenone versus placebo, though hyperkalemia and discontinuation related to hyperkalemia were higher with finerenone.[2,5]

Finerenone has also shown promise as an alternative in the management of HF, such as in the FINEARTS-HF trial published in 2024 that included patients with HF and a left ventricular ejection fraction (EF) of ≥40%. Over a median follow-up of 32 months, the primary composite outcome of total worsening HF events and death from CV causes was significantly lower with finerenone 20 to 40 mg daily compared to placebo.[7] Similar to other finerenone trials, adverse events were comparable between groups except for an increased risk of hyperkalemia and a decreased risk of hypokalemia with finerenone.[7]

Though dosing in clinical trials has varied widely, the initial dose of finerenone for CKD associated with T2DM is dependent on eGFR, ranging from 10 mg to 20 mg once daily, and is titrated based on serum potassium measured four weeks after therapy initiation (Table 1).[3] Finerenone is not recommended in patients with an eGFR <25 mL/min/1.73m^2 or in patients with a baseline potassium level of >5 mEq/L.[3] It is also contraindicated in patients with adrenal insufficiency and patients receiving concomitant strong CYP3A4 inhibitors and should be used cautiously with consideration for more frequent monitoring in patients at risk for hyperkalemia.[3]

Table 1 – *Dosing of finerenone*[3]

		Finerenone Dose	
		10 mg daily	20 mg daily
Serum Potassium (mEq/L)	≤4.8	Increase to 20 mg daily Maintain 10 mg daily if eGFR has decreased by >30%	Continue 20 mg daily
	>4.8-5.5	Continue 10 mg daily	Continue 20 mg daily
	>5.5	Hold finerenone Consider restarting at 10 mg daily when K ≤5 mEq/L	Hold finerenone Consider restarting at 10 mg daily when K ≤5 mEq/L

Though nonformulary for inpatient use at TCH, finerenone is increasingly being used in the outpatient setting due to benefits seen in the management of CKD with T2DM and enhanced safety profile secondary to its receptor selectivity. While more randomized controlled trials are needed evaluating finerenone in HF and across the EF spectrum, many of which are ongoing, it holds promise for future use in this patient population as well.

References: 1. Sabina M, Trube J, Shah S, et al. Finerenone: a third-generation MRA and its impact on cardiovascular health – insights from randomized controlled trials. J Clin Med. 2024;13:6398. 2. Bakris GL, Agarwal R, Anker SD, et al. Effects of finerenone on chronic kidney disease outcomes in type 2 diabetes. N Engl J Med. 2020;383:2219-29. 3. Kerendia (finerenone) [prescribing information]. Whippany, NJ: Bayer HealthCare Pharmaceuticals Inc; September 2022. 4. KDIGO Executive Committee. Kidney Disease: Improving Global Outcomes 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney International. 2024;105(Suppl 4S):S117-314. 5. Pitt B, Filippatos G, Agarwal R, et al. Cardiovascular events with finerenone in kidney disease and type 2 diabetes. N Engl J Med. 2021;385(24):2252-63. 6. Rossing P, Anker SD, Filippatos G, et al. Finerenone in patients with chronic kidney disease and type 2 diabetes by sodium-glucose cotransporter 2 inhibitor treatment: the FIDELITY analysis. Diabetes Care. 2022;45(12):2991-8. 7. Solomon SD, McMurray JJV, Vaduganathan M, et al. Finerenone in heart failure with mildly reduced or preserved ejection fraction. N Engl J Med. 2024;391:1475-85.

CME

Internal Medicine: Antidiabetic Medication and Asthma Attacks

Emma Finger, PharmD; Bryce Mortera, PharmD Candidate 2025, Natalie Delozier, PharmD

Asthma affects approximately 28 million individuals in the United States. In 2021, almost 40% of adults with asthma reported having at least one asthma attack in the past year.[1] Risk factors for poor asthma control and asthma attacks include type 2 diabetes mellitus (T2DM), insulin resistance, and metabolic disorders. Recent studies have shown that metformin's anti-inflammatory effect can also reduce airway inflammation, leading to the investigation of using metformin for asthma control in patients with both T2DM and asthma.[2]

Metformin is a biguanide that works by decreasing both the production and absorption of glucose, as well as improving sensitivity to insulin.[3] It's an oral antidiabetic medication recommended as a first-line treatment for patients with type 2 diabetes. Metformin is also believed to have anti-airway remodeling effects through adenosine monophosphate activated protein kinase (AMPK) activation. AMPK is a sensor of cellular energy status and oxidative stress and has roles in tissue remodeling.[4] When AMPK is activated, it can inhibit inflammatory processes associated with conditions such as colitis, cystic fibrosis, and autoimmune encephalopathy.[2]

Recent studies have observed that metformin was associated with improved asthma control and a reduction in asthma attacks in patients with concurrent asthma and diabetes. One study found a 30% decrease in asthma attacks in patients taking metformin compared to those who did not. This study also observed a further 40% reduction in asthma attacks in patients who were also treated with a glucagon-like peptide-1 receptor agonist (GLP-1RA).[5] Additionally, another study found that patients who received metformin had a lower risk of asthma-related hospitalizations and asthma exacerbations compared to metformin non-users.[2] Lastly, one study in diabetic patients observed metformin use was associated with a lower hazard of asthma-related hospitalizations and continued to be associated with a lower hazard of ED visits for asthma.[6] All three of these studies suggest that metformin may have a role in improving asthma control and reducing asthma attacks in adults with asthma and diabetes.

References: 1. James JM. Asthma Facts and Figures. *Asthma and Allergy Foundation of America*. 2024. AAFA Asthma Facts and Figures Updated September 2024 2. Li CY, Erickson SR, Wu CH. Metformin use and asthma outcomes among patients with concurrent asthma and diabetes. *Respirology*. 2016;21(7):1210-1218. doi:10.1111/resp.12818 3. Metformin. Lexi-Drug. UpToDate Lexidrug. UpToDate Inc. Accessed February 28, 2025. http://online.lexi.com 4. Park CS, Bang BR, Kwon HS, Moon KA, Kim TB, Lee KY, Moon HB, Cho YS. Metformin reduces airway inflammation and remodeling via activation of AMP-activated protein kinase. *Biochemical Pharmacology*. 2012;84(12):1660-1670 5.Lee B, Man KKC, Wong E, Tan T, Sheikh A, Bloom CI. Antidiabetic Medication and Asthma Attacks. *JAMA Intern Med*. 2025;185(1):16-25. doi:10.1001/jamainternmed.2024.5982 6. Wu TD, Fawzy A, Akenroye A, Keet C, Hansel NN, McCormack MC. Metformin Use and Risk of Asthma Exacerbation Among Asthma Patients with Glycemic Dysfunction. *J Allergy Clin Immunol Pract*. 2021;9(11):4014-4020.e4. doi:10.1016/j.jaip.2021.07.007

POP QUIZ

Which of the following is not a risk factor for asthma control or asthma attacks?

A. Type 2 Diabetes
B. Heart failure
C. Insulin resistance
D. Metabolic disorders

Answer: B

Ambulatory Care: GLP-1 Agonists Bioequivalence

Emily Pierson, PharmD, BCPS, BCGP

Oral semaglutide, approved in 2019, was the first orally available glucagon-like-peptide-1 (GLP-1) receptor agonist available in the United States for the treatment of diabetes mellitus type 2. This novel product comes at a once-daily dose of 3mg, 7mg, and 14mg. The oral bioavailability of GLP-1s remains a significant challenge, making the dosing of oral semaglutide complicated. It must be taken on an empty stomach with no more than 4 ounces of plain water and at least 30 minutes before consuming any other food, drink, or medications.

In an attempt to solve the bioavailability problem of oral semaglutide, a second generation oral semaglutide was developed. While the second generation is bioequivalent, with similar safety and efficacy, it is important to note the dosing difference. Second generation oral semaglutide is dosed as 1.5mg, 4mg, and 9mg. When comparing or adjusting doses, low doses correspond to low doses, and high doses to high doses (e.g., 1.5 mg of the second-generation formulation is equivalent to 3 mg of the first-generation version). Both generations of oral semaglutide retain the complex dosing as detailed above.

References: 1. Nielsen MS, Brondsted L, Kankam M, Morelli G, Nguyen D, Vang, T, et al. A Bioequivalence Study of Two Formulations of Oral Semaglutide in Healthy Participants. Diabetes Ther. 2024 Dec 21;16(2):269-287. Doi: 10.1007/s13300-024-01674-8

CME

Infectious Disease: Guideline and Treatment Update: *H. pylori*

Angella Haskell, PharmD, BCPS, BCIDP

This year the American College of Gastroenterology (ACG) released an updated clinical practice guideline for the treatment of *Helicobacter pylori* (*H. pylori*)[1]. *H. pylori* can cause dyspepsia, peptic ulcer disease, and is the leading cause of gastric cancer world wide[2]. The update was developed to address increasing resistance to previous treatment regimens, which included clarithromycin and levofloxacin, which has led to reduced effectiveness of treatment. New antibiotics and more potent, next generation gastric acid-suppressing agents for the treatment of *H. pylori* are introduced in this update. The guideline also discusses recommendations for testing determination and when to begin treatment, but this update will highlight treatment recommendations.

The recommended first-line treatment for treatment-naïve patients is to give a 14-day course of optimized bismuth quadruple therapy (BQT), which includes a proton pump inhibitor (PPI) twice daily given 30-60 minutes before a meal, bismuth 300mg four times a day, metronidazole 500mg three to four times a day, and tetracycline 500mg four times a day. Due to increasing resistance, the guideline does not recommend doxycycline to replace tetracycline in this combination. Additional treatment naïve regimens include a rifabutin triple therapy and two separate potassium based-competitive acid block regimens. These regimens include proprietary FDA approved products. These products are not available on the TCHHN inpatient formulary and there may be insurance limitations for use in outpatient prescriptions therefore, it is recommended to trial BQT first. This regimen is ideal for most patients, including those with a penicillin allergy.

For treatment-experienced patients, the guidelines emphasize the importance of not repeating previously failed regimens and tailoring therapy based on prior treatment history and susceptibility data. Treatment regimens for treatment-experienced patients include optimized BQT, rifabutin-based triple therapy who have already received BQT, and levofloxacin-based salvage regimen but only if susceptibility testing can be done. More information on specific products and dosing can be found in the infographic linked below. Susceptibility testing is becoming more accessible in the U.S., but its use in guiding therapy is still under evaluation. ACG recommends considering susceptibility testing in cases where treatment choices are unclear, especially in cases of therapy failures or when considering regimens containing clarithromycin or levofloxacin. TCHHN does not routinely perform susceptibility testing for *H. pylori* and is a send out test with an expected turnaround of 7 days or longer. Contact customer service for the lab if testing is requested. For more information on the updated recommendations, the full guidelines is referenced below or you can access a summary infographic here: ACG-Hpylori-Guidelines-Highlights-2024-FINAL.pdf.pdf.

References: 1. Chey, William D. et al. ACG Clinical Guideline: Treatment of Helicobacter pylori Infection. The American Journal of Gastroenterology 119(9):p 1730-1753, September 2024. **2.** Hooi JKY, Lai WY, Ng WK, et al. Global prevalence of Helicobacter pylori infection: Systematic review and meta-analysis. Gastroenterology 2017;153(2):420–9

Oh, the places there's info!!—Antimicrobial Stewardship Guidance

MyTCH WELL CONNECTED → Clinical Resources → Pharmacy Services →

Antimicrobial Stewardship

Adult Antimicrobial Dosing Reference

INPATIENT Antibiogram 2024

OUTPATIENT Antibiogram 2024

NETWORK Antibiogram 2024

Antimicrobial Criteria for Use

Guidance Document: Gram Negative Pathogens

Guidance Document: Blood Cultures

BIOFIRE Panels Guidance Document

CME

Critical Care: Systemic Alteplase Dosing Considerations in High-Risk PE

Hilary Raidt, PharmD, BCCCP

High-risk (massive) pulmonary embolism (PE) is characterized by hemodynamic instability and is associated with a high mortality rate (approximately 30-60%).[1] Systemic thrombolysis is suggested as the primary reperfusion therapy in high-risk PE by six clinical practice guidelines[2-8], only three of which discuss dosing.[3,4,6] The FDA approved dosing, alteplase 100 mg IV over 2 hours, is based on a randomized trial (n=45) in which patients experienced moderate to marked lysis of pulmonary emboli and improvement in pulmonary perfusion and pulmonary hypertension (p=0.002 and p=0.003, respectively) with alteplase administration.[9] While all applicable guidelines cite the FDA approved "full" dose alteplase 100 mg in their treatment algorithms, the Pulmonary Embolism Response Teams (PERT) consortium does additionally suggest considering "reduced" dose systemic thrombolysis in those with *relative* contraindications to thrombolysis (Table 1). Despite there being a general dosing consensus in the guidelines, a variety of dosing regimens have been studied in the literature resulting in a heterogeneity of institutional protocols. For instance, in those with greater degrees of hemodynamic instability, bolus dosing has been utilized (e.g., bolus 10 or 20 mg IV over 1 min with the remaining 90 or 80 mg IV over 2 hours or in the setting of extreme hemodynamic instability 0.6 mg/kg (max 50 mg) IV over 15 min[10*], etc.). Conversely, reduced dose regimens have also been investigated to mitigate bleeding risk, as systemic thrombolytic therapy has been associated with a 9.9% incidence of major bleeding and a 1.7% incidence of intracranial or fatal bleeding.[11] In a prospective RCT of 118 patients with hemodynamically unstable or massive pulmonary artery obstruction, patients were randomized to receive 100 mg or 50 mg alteplase. Similar efficacy was demonstrated but the 50 mg dose resulted in less bleeding, particularly those with a body weight <65 kg (p=0.049).[12] Of note, catheter-directed alteplase therapy can be considered in hemodynamically unstable patients in whom systemic thrombolysis has failed or is contraindicated.[2]

Take-home: Clinical status as well as underlying bleed risk should be carefully evaluated when considering the dose of systemic thrombolysis, as it may not be a one-size-fits-all approach.

Table 1. *Alteplase dosing*

	AHA 2011[6]	PERT 2019[4]	ESC 2019[3]
High-risk (massive) PE	100 mg IV over 2 h	100 mg IV over 2 h	100 mg IV over 2 h
		Reduced dose regimen: 50 mg IV over 2 h**	

*Alteplase dosing in active cardiac arrest is out of the scope of this letter, generally alteplase 50 mg IV over 2 min, may be repeated once in 15 min if ROSC is not achieved is utilized
**In high-risk patients with relative contraindications to systemic thrombolysis
FDA, Food and Drug Administration; PERT, pulmonary embolism response team; IV, intravenous; ROSC, return of spontaneous circulation; RCT, randomized controlled trial; h, hours

References: 1. Franchin L, Iannaccone M, et al. Limitations and future perspectives on pulmonary embolism. *Interventional Cardiology.* 2025;20:e11., 2. Zuin M, Bikdeli B, Ballard-Hernandex J, et al. International clinical practice guideline recommendations for acute pulmonary embolism. *JACC.* 2024;84:1561-77., 3. Konstantinides SV, Meyer G, Becattini C, et al. 2019 ESC guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). *Eur Heart J.* 2020;41:543–603., 4. Rivera-Lebron B, McDaniel M, Ahrar K, et al. Diagnosis, treatment and follow up of acute pulmonary embolism: consensus practice from the PERT consortium. *Clin Appl Thromb Hemost*. 019;25:1076029619853037., 5. Stevens SM, Woller SC, Kreuziger LB, et al. Antithrombotic therapy for VTE disease: second update of the chest guideline and expert panel report. *Chest*. 2021;160:e545–e608., 6. Jaff MR, McMurtry MS, Archer SL, et al. Management of massive and submassive pulmonary embolism, iliofemoral deep vein thrombosis, and chronic thromboembolic pulmonary hypertension: a scientific statement from the American Heart Association. *Circulation*. 2011;123:1788–1830., 7. Ortel TL, Neumann I, Ageno W, et al. American Society of Hematology 2020 guidelines for management of venous thromboembolism: treatment of deep vein thrombosis and pulmonary embolism. *Blood Adv*. 2020;4:4693–4738., 8. National Institute for Health and Care Excellence (NICE). Venous Thromboembolic Diseases: Diagnosis, Management and Thrombophilia Testing. NICE Clinical Guidelines [NG158]. 2023., 9. FDA labeling for ACTIVASE (alteplase) for injection. https://www.fda.gov/drugsatfda, Accessed: May 15, 2025., 10. Sors H, Pacouret G, Azarian R, Meyer G, Charbonnier B, Simonneau G. Hemodynamic effects of bolus vs 2-h infusion of alteplase in acute massive pulmonary embolism: A randomized controlled multicenter trial. *Chest*. 1994;106(3):712-717. doi:10. 1378/chest.106.3.712., 11. Marti C, John G, Konstantinides S, et al. Systemic thrombolytic therapy for acute pulmonary embolism: a systematic review and meta-analysis. *Eur Heart Journal.* 2015;36:605-14., 12. Wang C, Zhai Z, Yang Y, et al. Efficacy and safety of low dose tissue-type plasminogen activator for the treatment of acute pulmonary embolism. *CHEST*. 2010;137(2):254-61.

POP QUIZ

What is the FDA approved alteplase dosing for a massive pulmonary embolism (PE)?

A. 100mg IV over 2 hours
B. 10mg IV bolus over 1 minute and 90mg IV over
C. 0.6mg/kg (max 50mg) over 15 minutes
D. 50mg IV over 2 hours

Answer: B

CME

Name (Required): Date:

Email:

Submit quiz to Alissa Lee by email (Alissa.Lee@thechristhospital.com) or fax (513-585-3438). Receipt of completed quiz will be confirmed by email. To receive CME credit, one must score at least 80%. Submissions are due by June 15, 2026. If a participant received a score below the minimum requirement, he/she will be contacted and asked to resubmit. Two attempts are the maximum each participant is allowed. Each question is worth 1 point and the quiz is worth a total of 10 points.

1. What is one adverse effect that is associated with all MRA's including Finerenone?
    a. Gynecomastia
    b. Hormonal imbalance
    c. Hyperkalemia
    d. Hypercalcemia
2. Which trial demonstrated positive heart failure and cardiovascular outcomes?
    a. FINEARTS-HF
    b. FIDELITY
    c. FIDELIO-DKD
    d. FIGARO-DKD
3. Which of the following is not a risk factor for asthma control or asthma attacks?
    a. Type 2 Diabetes
    b. Heart failure
    c. Insulin resistance
    d. Metabolic disorders
4. What is the proposed mechanism of metformin associated anti-remodeling effects?
    a. Antibody inhibition
    b. Interleukin inhibition
    c. Mast cell proliferation
    d. Adenosine monophosphate protein kinase activation
5. Select all the dosage forms that the novel oral semaglutide is available in?
    a. 3mg
    b. 5mg
    c. 7mg
    d. 14mg
6. Which of the following is the correct paired dose equivalency (1st generation oral semaglutide: 2nd generation oral semaglutide)?
    a. 3mg: 2mg
    b. 5mg: 3mg
    c. 7mg: 4mg
    d. 14mg: 10mg
7. What is the first-line recommended treatment for *H. pylori* infections?
    a. Bismuth triple therapy (BTT)
    b. Bismuth quadruple therapy (BQT)
    c. Doxycycline monotherapy
    d. Tetracycline triple therapy (TTT)
8. What is the expected turn-around time for H. pylori susceptibility testing at TCHHN?
    a. 2 days
    b. 3 days
    c. 5 days
    d. 7 days
9. What is the FDA approved alteplase dosing for a massive pulmonary embolism (PE)?
    a. 100mg IV over 2 hours
    b. 10mg IV bolus over 1 minute and 90mg IV over
    c. 0.6mg/kg (max 50mg) over 15 minutes
    d. 50mg IV over 2 hours
10. In the RCT (n=118), what was one major benefit of alteplase reduce dose regimen (50mg IV over 2 hours)?
    a. Increase reperfusion rates
    b. Reduced incidence of bleeds
    c. Reduced pulmonary hypertension
    d. Cost effective

Date originated: August 21, 2025 **CME credit designation expiration: August 21, 2026**

Disclosure Information: The authors, planners, and CME Committee members have indicated no significant financial interest or arrangements with any organization that could be perceived as a real or apparent conflict of interest in the context of this activity's subject matter. There is no commercial support or sponsorship for this activity.

Objectives: At the conclusion of this educational activity, participants should be able to: (1) Explain changes to the formulary, (2) Implement guidelines and best practices relating to the usage of the drugs and topics discussed, and (3) Assist with carrying out of Antimicrobial Stewardship efforts and other Network initiatives.

Accreditation & Credit Designation: The Christ Hospital Health Network is accredited by the Ohio State Medical Association to provide continuing medical education for physicians. The Christ Hospital Health Network designates the enduring-material CME activity for a maximum of 1.0 AMA PRA Category 1 Credit™.

In order to obtain the above credits, physicians and/or allied health members must complete the following steps: