

Efinaconazole (Jublia®): A New Topical Therapy for Toenail Onychomycosis

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Onychomycosis is a chronic fungal infection of the nail plate and nail bed that accounts for up to 50% of all nail diseases.¹ All told, the prevalence of onychomycosis has been estimated to be as high as 14% in North America.² Onychomycosis can be caused by a variety of dermatophytes, yeasts, and non-dermatophyte molds, but the vast majority – as many as 98% of infections – involve the dermatophytes *Trichophyton rubrum* and *Trichophyton mentagrophytes*.^{1,3} These organisms are not components of the normal skin flora and can live within the keratinized structures of the skin.⁴

Risk factors known to increase susceptibility to onychomycosis include older age, male sex, certain genotypes, smoking, use of shared bathing facilities, occlusive footwear, sports involvement, and foot trauma. Health conditions, including diabetes, HIV, psoriasis, and organ failure or transplant also are associated with an increased risk of developing onychomycosis.⁵ Untreated onychomycosis can lead to deformity or destruction of the infected nail and can spread to other nails, body areas, and to predisposed persons.⁴ Onychomycosis often affects a patient's emotional, social, and occupational functioning by causing embarrassment in social situations and feelings of uncleanliness, causing the patient to avoid showing their feet and an overall diminished self-esteem and avoidance of close relationships.⁶

The treatment of onychomycosis is challenging due to both the nature of the tissue involved and difficulties in delivery of the therapeutic agent to the appropriate site of action. The toenail is a slow-growing tissue, taking up to 78 weeks to grow out completely, depending on the age and health of the patient.² The presence of the nail plate itself prevents the direct application of topical treatments to the site of infection, owing to the plate's thickness and compact keratin-based structure, within which the dermatophyte can persist even after apparent clearance of dermatophyte colonization on pedal skin. Consequently, oral antifungal therapy is preferred even though safety concerns and drug interactions are common, especially in older patients on multiple medications.²

In patients who are unable or otherwise unwilling to pursue oral therapy for onychomycosis, topical therapy is an option. In June 2014, a new topical antifungal agent, efinaconazole (Jublia®; Valeant Pharmaceuticals North America LLC; Bridgewater, NJ) was granted an FDA-approved indication for the treatment of fungal infections of the toenails in patients over 18 years of age.² The purpose of this article is to review the pharmacology, clinical evidence, dosing and administration, toxicity, and cost associated with efinaconazole for the treatment of onychomycosis caused by common dermatophytes.

PHARMACOLOGY

Mechanism of Action

Efinaconazole is a triazole antifungal compound that exerts antifungal activity by inhibiting the fungal cytochrome P450 lanosterol 14- α -demethylase, an enzyme necessary for the biosynthesis of ergosterol, an essential component of fungal cell membranes.⁷ By decreasing ergosterol concentrations, the fungal cell membrane permeability is increased, resulting in leakage of cellular contents.⁸ Efinaconazole's mechanism of action is the same as that of other triazole antifungal compounds, including itraconazole and fluconazole. Interestingly, efinaconazole has a lower affinity for keratin compared to ciclopirox, another topical treatment for onychomycosis, and exhibits faster nail penetration that enables greater fungicide activity.⁹ The low surface tension of efinaconazole solution is hypothesized to increase penetration of the active ingredient through the nail plate and into the nail bed.¹⁰

Pharmacokinetics

Efinaconazole is a topical therapy that, when used as directed, is not subject to many of the limitations (e.g., drug-drug interactions and systemic side effects) of oral antifungal agents.⁸ Systemic absorption in adults with severe onychomycosis was determined after once-daily application for 28 days to 10 toenails and 0.5 cm of adjacent skin on 18 healthy adult subjects: the average peak blood concentration (C_{max}) on day 28 was <1 ng/mL and the plasma concentration versus time profile at steady state was generally flat over a 24-hour dosing interval, with a mean \pm SD AUC of 12.15 ± 6.91 ng·h/mL.⁸ In a separate study of healthy volunteers, the plasma half-life of efinaconazole following daily applications to all 10 toenails for 7 days was 29.9 hours.

When administered topically, efinaconazole is not considered an inhibitor of the CYP450 enzyme family. *In vitro* studies using human liver microsomes demonstrated that efinaconazole did not inhibit CYP1A2, CYP2A6, CYP2C8, CYP2C9, CYP2C19, CYP2D6, CYP2PE1 and CYP3A4 enzyme activities at expected concentrations following clinical use.⁸

Spectrum of Activity

Efinaconazole exhibits an *in vitro* minimum inhibitory concentration (MIC) of 0.06 μ g/mL against $\geq 90\%$ of isolates of *Tri-*



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chophyton rubrum and *Trichophyton mentagrophytes*, which are responsible for up to 98% of onychomycosis infections.⁸ Resistance is inducible in the presence of subtherapeutic drug concentrations of efinaconazole, but the mechanism of resistance has not been elucidated and the clinical significance of these *in vitro* results are unknown.

CLINICAL TRIALS

Approval for the treatment of onychomycosis with topical efinaconazole was based on one phase II and two phase III clinical trials. The primary endpoint in these studies was complete cure, defined as both 0% clinical involvement of the target toenail (i.e., 100% elimination of the visibly affected area of the toenail) as well as mycologic cure, defined as a negative KOH examination and negative fungal culture of the target toenail sample. Secondary endpoints included mycological cure only, treatment success, defined as <10% clinical involvement of the target toenail, complete or almost complete cure, defined as ≤5% clinical involvement and mycologic cure, and unaffected toenail growth (change from baseline).¹⁰ Of these, mycologic cure is the only consistently-defined efficacy parameter applied to toenail onychomycosis clinical trials that is objective; mycologic cure is widely accepted as the main treatment goal.²

The phase II trial, a multicenter, randomized, parallel-group, double-blind, vehicle-controlled study was conducted from October 2007 to February 2009 in Mexico.¹⁰ Subjects (n=135) with mild-to-moderate distal lateral subungual onychomycosis (DLSO) of the toenails were randomly assigned to receive efinaconazole 10% topical solution with semiocclusive debridement, efinaconazole 10% topical solution alone, efinaconazole 5% topical solution alone, or vehicle (placebo) alone, self-applied once-daily for 36 weeks, followed by a treatment-free follow-up period of 4 weeks. Subjects in the efinaconazole 10% topical solution with semiocclusive debridement arm applied a semiocclusive dressing to the target toenail 10 minutes after efinaconazole application.

At week 40, complete cure occurred in 22.2% of patients treated with efinaconazole 10% solution plus debridement, 25.6% of patients treated with efinaconazole 10% solution alone, and 15.8% of patients treated with efinaconazole 5% solution alone, and 9.1% of patients treated with vehicle.¹⁰ Tests of significance were not provided for these results. Mycologic cure occurred in 83.3% of patients treated with efinaconazole 10% solution plus debridement, 87.2% of patients treated with efinaconazole 10% solution alone, and 86.8% of patients treated with efinaconazole 5% solution alone. The percentage of patients with mycologic cure among patients treated with vehicle was not provided. At the 40-week follow-up visit, more patients achieved a target toenail area affected of <20% with efinaconazole 10% with debridement (67%) or efinaconazole 10% alone (69%) compared to vehicle (32%; $p<0.05$ for both efinaconazole groups versus vehicle). Mean toenail growth was also improved to a greater extent in the treatment arms (4.7 mm growth for the efinaconazole 10% solution arms; 3.8 mm growth for the efinaconazole 5% arm) versus vehicle (1.8 mm growth; $p<0.05$ for both efinaconazole arms versus vehicle).

Two identical, multicenter, randomized, double-blind, vehicle-controlled phase III trials were conducted in patients with mild-to-moderate toenail DLSO with a similar methodology to the aforementioned phase II trial.¹¹ Eligible study subjects were 18 to 70 years of age, with a clinical diagnosis of DLSO affecting at least 1 great toenail with an uninfected length of ≥3 mm from the

proximal nailfold and toenail thickness of ≤3 mm, evidence of toenail growth, positive KOH microscopy result, and culture of dermatophyte or mixed dermatophyte/*Candida* ≤42 days before baseline. Women of childbearing age were required to use birth control. Subjects were excluded if they had a history of immunosuppression or clinical signs indicative of possible immunosuppression, known HIV infection, uncontrolled diabetes mellitus, presence of toenail infection with a causative organism other than dermatophytes, severe moccasin tinea pedis at baseline, any disease or condition that might have caused toenail abnormalities or interfered with the evaluation, or a previous surgery on the target toenail. Patients were not excluded for concomitant use of drugs that inhibit CYP 3A4. The primary end point was complete cure, defined as both 0% clinical involvement of the target toenail and mycologic cure, at week 52.

Across the two trials, 1655 patients with DLSO were randomly assigned at 118 sites across the United States, Canada, and Japan to once-daily topical efinaconazole 10% topical solution or vehicle (both without debridement) for 48 weeks with 4-week post-treatment follow-up.¹¹ No significant or clinically meaningful differences were observed between treatment groups at baseline. Overall, 1436 patients (86.8%) completed the 48-week treatment and 1420 patients (85.8%) completed the 4-week post-treatment follow-up. A total of 235 patients (14.2%) were not included in the final analysis due to early discontinuation of the trial (n=98, 42%), loss to follow-up (n=78, 33%), adverse events (n=33, 14%), protocol violation (n=7, 3%), worsening condition (n=1, 0.5%), pregnancy (n=1, 0.5%), or other (n=17, 7%).

At week 52, 16.6% of patients had a complete cure with efinaconazole compared to 4.4% of patients receiving vehicle ($p<0.001$).¹¹ Fifty four percent of patients achieved mycologic cure with efinaconazole compared with 17% on vehicle ($p<0.001$). For comparison, phase III studies of oral itraconazole and terbinafine report mycologic cure rates of 54% and 70%, respectively (14% and 38%, for complete cure rates, respectively) using the same definitions of mycologic cure and complete cure but with only 12 weeks of treatment (Figure).^{12,13} Phase III studies of topical ciclopirox 8% nail lacquer solution (Penlac®), perhaps the most common topical treatment for onychomycosis, report mycologic and complete cure rates of 32% and 7%, respectively.¹⁴ In all studies, complete cure rates may be underestimated given that toenails require up to 78 weeks to grow cleanly, while efinaconazole phase III studies were carried on for only 52 weeks. At the time of this writing, no head-to-head studies or network meta-analyses have been performed comparing these first-line antifungal agents. Thus, although the endpoints in these studies are generally the same, caution should be exercised in making definitive conclusions on comparative efficacy between these agents because of differences in each agent's underlying studies.

TOXICITY

In phase III studies, adverse events occurred at a similar rate between efinaconazole and vehicle.¹¹ The Table summarizes adverse events that occurred more frequently in efinaconazole-treated patients versus vehicle-treated patients in both phase III trials.¹¹ Whether these differences were statistically significant was not reported. The most common adverse event associated with the treatment site was vesicle formation. Contact dermatitis and ingrowing nail also occurred more frequently in the efinaconazole group versus vehicle. Because topical efinaconazole is minimally absorbed, the reasons for higher rates of nasopharyngitis and si-

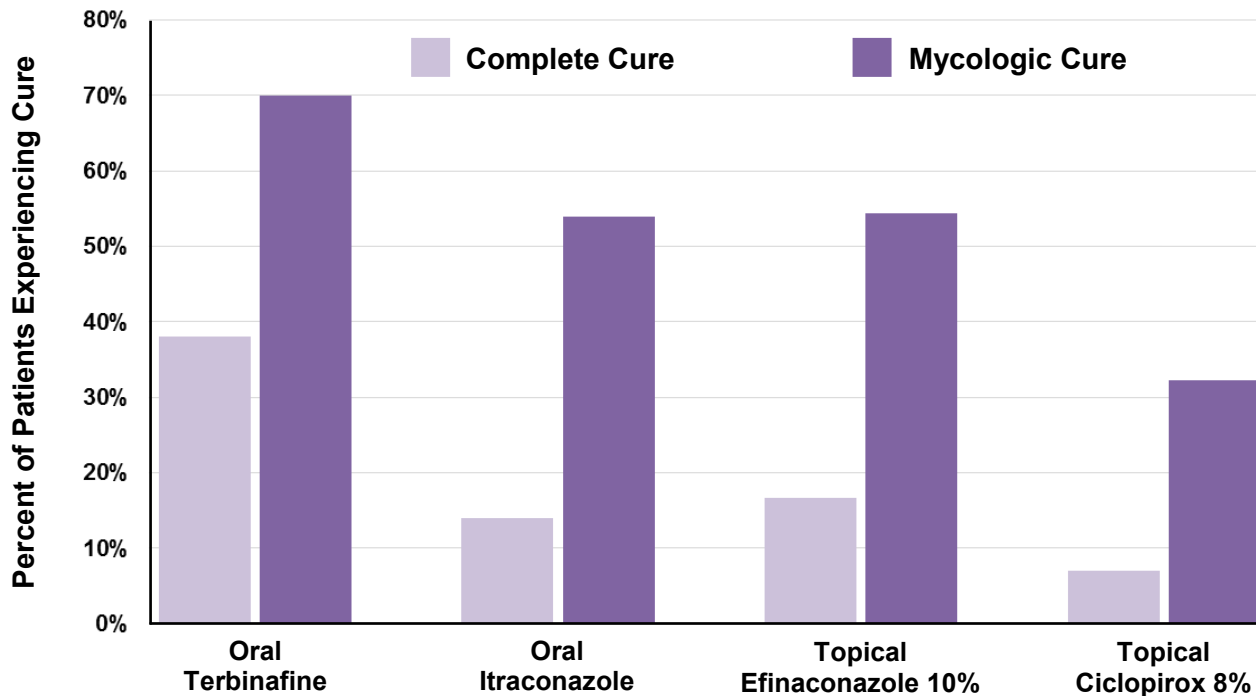


FIGURE | Complete cure and mycologic cure rates from phase III trials of oral (12 week therapy) and topical (48 week therapy) antifungal therapies.^{8,12,13,14}

nasitis in efinaconazole-treated patients are unclear. Likewise, rates of upper respiratory tract infections were inconsistent between studies, which may be due simply to chance as no mechanism for this adverse event has been elucidated. Efinaconazole was not associated with clinically meaningful changes from baseline in laboratory or vital sign measurements. Although overall adverse event rates occurred in >50% of patients treated with efinaconazole and vehicle, the vast majority (>90%) of these adverse events were not deemed to be related to the study drug, and >80% resolved without further complications.

DOSING & ADMINISTRATION

Efinaconazole should be applied to the affected toenail(s) once daily for 48 weeks, using a brush applicator included with the product.⁸ The toenail, toenail folds, toenail bed, hyponychium, and the undersurface of the toenail plate must be completely covered. The patient must wait at least 10 minutes after showering, bathing, or washing before applying efinaconazole. Pedicures, nail polish, and cosmetic nail products should be avoided while using

efinaconazole. Efinaconazole does not require removal or debridement at any point during therapy, which is an advantage over other topical treatments for onychomycosis. Efinaconazole is for topical use only and not for oral, ophthalmic, or intravaginal use.

Efinaconazole is classified as pregnancy category C, as no adequate and well-controlled studies with this agent in pregnant women have been conducted.⁸ Efinaconazole excretion into breast milk has not been studied. Efinaconazole has not been studied in pediatric subjects to date. Of the total number of subjects in clinical trials, 11.3% were ≥65 years of age, while no subjects were aged ≥75 years. No overall differences in safety and effectiveness were observed between older and younger subjects, and other reported clinical experience has not identified differences in responses between the elderly and younger subjects.⁸

COST & OTHER CONSIDERATIONS

Efinaconazole was granted an FDA-approved indication for the treatment of onychomycosis on June 6, 2014 under the trade name Jublia®, and its patent is set to expire October 5, 2021.¹⁵

TABLE | Adverse event rates occurring more frequently in efinaconazole- versus vehicle-treated patients in phase III studies.¹¹

Adverse Event	Study 1		Study 2	
	Efinaconazole (n=653)	Vehicle (n=213)	Efinaconazole (n=574)	Vehicle (n=200)
Application Site Vesicles	2.0%	0%	1.2%	0%
Contact Dermatitis	2.9%	1.9%	2.4%	1.5%
Ingrowing Nail	2.6%	0.5%	1.9%	1.0%
Nasopharyngitis	11.9%	11.7%	11.0%	7.5%
Sinusitis	4.6%	1.9%	3.0%	2.5%

Consequently, a generic version of efinaconazole will likely not be available until after that time. Like many brand-only drugs, Jublia® is either listed as 'tier 3' or higher or is not covered on most insurance formularies.¹⁶ Coverage and eligibility depends on the patient's specific insurance carrier and plan. At the time of this writing, the manufacturer offers a \$0 co-pay card (i.e., covering the cost of any copay) for patients with commercial insurance that covers Jublia® for any prescriptions through June 30th, 2015.¹⁷ Commercially-insured patients whose insurance does not cover Jublia® may pay more. The average cash price for Jublia® 4 mL is \$581 among major chain pharmacies in Gainesville, Florida. Depending on the size of the infected nail(s), 48 weeks' worth of treatment can exceed \$5,000. For example, Jublia® is applied 1 drop once daily per affected toenail, and a 2nd drop is applied to the end of the great toenail if this nail is infected. A 4-mL bottle contains eighty 0.05 mL drops. Assuming only 1 great toe is infected, the patient will need 8.4 bottles (the patient will have to purchase 9 whole bottles) of Jublia®, costing an average total cash price of \$5,231.88.

Because efinaconazole is only available as a brand formulation, the choice to treat onychomycosis with this agent may not be appropriate for all patient populations. Another topical agent approved for onychomycosis, ciclopirox 8% nail lacquer solution (Penlac®), has several generic options available and is tier 1 on most insurance formularies. Oral options for onychomycosis, including terbinafine and itraconazole, also have generic equivalents with tier 1 status, and are likely less expensive than Jublia®.

In contrast to efinaconazole, topical ciclopirox 8% nail lacquer solution requires regular filing and trimming of loose nail material, as well as debridement of the nail with alcohol, every seven days.¹⁴ Also, the patient must not shower or take a bath for 8 hours after application. Like efinaconazole, ciclopirox is applied daily for 48 weeks. Although the efficacy of ciclopirox has never been directly compared with efinaconazole in a formalized clinical trial, studies of ciclopirox efficacy suggest that mycologic cure rates with ciclopirox 8% nail lacquer may be lower than those reported with efinaconazole 10% solution and complete cure rates may be as much as two- to three-fold lower, despite required concomitant nail debridement with ciclopirox and not with efinaconazole.² However, differences in these trials makes definitive conclusions impossible.

For patients eligible for oral terbinafine or itraconazole therapy, treatment duration typically is 12 weeks and consists of either once-daily administration (terbinafine and itraconazole) or pulse therapy (itraconazole), which requires twice-daily administration for 1 week intervals separated by 3 weeks of drug-free periods.^{12,13} Both of these agents have generic options available and are tier 1 on most insurance formularies. However, as mentioned above, these agents may be of limited use in patients concurrently taking medications that are substrates of CYP2D6 (some antidepressants, beta blockers, MAO inhibitors, etc.) or CYP3A4 (macrolide antibiotics, statins, warfarin, calcium channel blockers, etc.). Because these agents are systemically absorbed, adverse reactions are more common and may be intolerable for some patients. Common adverse reactions to these agents include dizziness, headache, nausea, vomiting, diarrhea, abdominal pain, dyspepsia, and reversible increases in liver enzymes.^{12,13}

SUMMARY

Efinaconazole is an effective topical antifungal treatment option for mild to moderate onychomycosis. This agent may be

most useful in patients who cannot tolerate oral antifungal therapy due to adverse effects and drug interactions, and those who are unwilling to debride the nail tissue as required with ciclopirox. Efinaconazole possesses a mechanism of action similar to other antifungals, yet has been hypothesized to possess intrinsic properties that better allow it to penetrate the nail tissue and eliminate the pathogenic dermatophyte causing the infection. Nevertheless, to date head-to-head studies among antifungal agents remain scarce, thus whether these proposed properties translate to improved cure rates is not known. The most common adverse events associated with efinaconazole are local in nature and include dermatitis and vesicle formation at or near the site of application. Efinaconazole may not be appropriate for all patient populations due to cost concerns and a lack of head-to-head comparisons. Future research is needed to further elucidate the precise role of efinaconazole in the routine treatment of onychomycosis.

REFERENCES

- Gupta AK, Daigle D, Foley KA. The prevalence of culture-confirmed toenail onychomycosis in at-risk patient populations. *J Eur Acad Dermatol Venereol*. 2014;Epub ahead of print.
- Ghannoum MA, Hajjeh RA, Scher R, et al. A large-scale North American study of fungal isolates from nails: the frequency of onychomycosis, fungal distribution, and antifungal susceptibility patterns. *J Am Acad Dermatol*. 2000;43(4):641-8.
- Del rosso JQ. The role of topical antifungal therapy for onychomycosis and the emergence of newer agents. *J Clin Aesthet Dermatol*. 2014;7(7):10-8.
- Longo D, Fauci A, Kasper D et al. *Harrison's Principles of Internal Medicine*, 18th Edition. McGraw-hill; 2011.
- Rosen T, Friedlander SF, Kircik L, et al. Onychomycosis: epidemiology, diagnosis, and treatment in a changing landscape. *J Drugs Dermatol*. 2015;14(3):223-8.
- Elewski BE. Onychomycosis: pathogenesis, diagnosis, and management. *Clin Microbiol Rev*. 1998;11(3):415-29.
- Tosti A. Efinaconazole solution 10%: topical antifungal therapy for toenail onychomycosis. *Cutis*. 2013;92(4):203-8.
- Jublia® [package insert]. Bridgewater, NJ: Valeant Pharmaceuticals North America LLC; 2014.
- Sugiura K, Sugimoto N, Hosaka S, et al. The low keratin affinity of efinaconazole contributes to its nail penetration and fungicidal activity in topical onychomycosis treatment. *Antimicrob Agents Chemother*. 2014;58(7):3837-42.
- Tschen EH, Bucko AD, Oizumi N, Kawabata H, Olin JT, Pillai R. Efinaconazole solution in the treatment of toenail onychomycosis: a phase 2, multicenter, randomized, double-blind study. *J Drugs Dermatol*. 2013;12(2):186-92.
- Elewski BE, Rich P, Pollak R, et al. Efinaconazole 10% solution in the treatment of toenail onychomycosis: Two phase III multicenter, randomized, double-blind studies. *J Am Acad Dermatol*. 2013;68(4):600-8.
- Sporanox® (itraconazole) [package insert]. Titusville, NJ: Janssen Pharmaceuticals Inc; 2012.
- Lamisil® (terbinafine HCl) [package insert]. East Hanover, NJ: Novartis Pharmaceuticals Corp; 2012.
- Penlac® Nail Lacquer (ciclopirox) Topical Solution, 8% [package insert]. Bridgewater, NJ: Dermik Laboratories, a division of sanofi-aventis U.S. LLC; 2006
- "203567 Drug Patent Expiration (Jublia / Efinaconazole)." DrugPatentWatch. ThinkBiotech LLC, n.d. Web. 14 Mar. 2015. <<http://www.drugpatentwatch.com/ultimate/NDA/203567>>.
- Fingertip Formulary. Fingertip Formulary, LLC., n.d. Web. 14 Mar. 2015. <<http://www.fingertipformulary.com/drugs/Jublia/>>
- "Save on JUBLIA®." JUBLIA® (efinaconazole) Topical Solution 10%. Valeant Pharmaceuticals International, Inc., n.d. Web. 14 Mar. 2015. <<http://www.jubliarx.com/save>>.

PERSONALIZED MEDICINE CORNER

Is there a benefit for pharmacogenomic testing with warfarin?

Warfarin is an anticoagulant associated with high bleeding risk and variable dose requirements that are influenced by clinical (e.g., age, weight, and concomitant medications) and genetic (e.g., *CYP2C9* and *VKORC1* genotype) factors. The *CYP2C9* gene codes for the major warfarin metabolizing enzyme, and *VKORC1* codes for vitamin K reductase, the target protein of warfarin. Dosing algorithms that use genotype and clinical variables are available to assist with dosing (i.e., WarfarinDosing.org). If genotype is not known, the algorithm recommends a dose based on clinical factors, a strategy that has been shown to be more accurate than the traditional approach of starting at 5 mg/day.¹

Results of clinical trials examining the use of genotype to guide warfarin dosing have varied.² In a European trial, use of pharmacogenetic information to dose warfarin was more accurate than a traditional dosing approach.³ A trial in the U.S., published at the same time, showed that use of a dosing algorithm with genotype provided no benefit over an algorithm that used only clinical factors.⁴ However, the U.S. trial has been criticized for not using loading doses or including genotypes important for African Americans who made up nearly 30% of the study population. Although the Center for Medicare and Medicaid Services (CMS) does not pay for warfarin pharmacogenetic testing outside of a clinical trial, some institutions still offer testing to assist with warfarin dosing based on the significant evidence that genotype influences dose requirements.

A recent post-hoc analysis of the ENGAGE AF-TIMI 48 trial published in *Lancet* provided additional evidence to support pharmacogenetic testing for warfarin.⁵ ENGAGE AF-TIMI 48 was a prospective, randomized study that compared the oral factor Xa inhibitor edoxaban to warfarin titrated to an International Normalized Ratio (INR) of 2-3 in over 20,000 individuals with atrial fibrillation. The study found that edoxaban was noninferior to warfarin for preventing stroke and systemic embolism with significantly fewer major bleeding events. In a post-hoc analysis, investigators compared clinical events according to *CYP2C9* and *VKORC1* genotypes: among patients assigned to warfarin, genotype combinations associated with increased sensitivity to warfarin conferred a higher risk for over-anticoagulation and overt bleeding events in the first 90 days of therapy. Edoxaban was associated with lower bleeding risk compared to warfarin in those with a highly sensitive genotype, but not in those with a normal response genotype.

Investigators noted that these study results demonstrated “clear and significant associations” between *CYP2C9* and *VKORC1* genotypes and warfarin bleeding outcomes and supported the role of genetic data in complementing traditional clinical predictors of adverse effects with warfarin.⁵ An accompanying editorial called for CMS to reconsider their position on reimbursement for pharmacogenetic testing for warfarin so that individuals with warfarin sensitive *CYP2C9* and *VKORC1* can be offered alternative anticoagulant medications.⁶ Additional trials of pharmacogenetic dosing of warfarin are on-going.²

References:

1. Klein TE, et al. *N Engl J Med* 2009;360:753-64.
2. Cavallari LH, et al. *Clin Pharmacol Ther* 2014;96:22-4.
3. Pirmohamed M, et al. *N Engl J Med* 2013;369:2294-303.
4. Kimmel SE, et al. *N Engl J Med* 2013;369:2283-93.
5. Mega JL, et al. *Lancet* 2015;385:2280-7.
6. Wu AH. *Lancet* 2015;385:2231-2.

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