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STUDI PUSTAKA

PENDEKATAN FARMAKOLOGI KLINIS MELALUI FARMAKOGENOMIK PADA ERA PENGOBATAN PRESISI

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Abstrak

Efek farmakologi suatu obat dapat bervariasi pada tiap individu, yang pada kondisi merugikan dapat menyebabkan morbiditas bahkan mortalitas. Kondisi yang merugikan tersebut dikenal sebagai *adverse drug reaction* (ADR). Salah satu kondisi yang dapat berkontribusi terhadap kejadian ADR adalah variabilitas genetik. Adanya variabilitas genetik, menjadi salah satu perhatian perkembangan ilmu farmakologi melalui farmakogenomik. Ilmu ini mempelajari pengaruh gen terhadap respon obat pada individu. Adanya farmakogenomik diharapkan dapat menghasilkan pengobatan yang presisi sehingga meningkatkan efektivitas dan keamanan penggunaan obat. Beberapa gen telah diidentifikasi berperan terhadap perubahan kadar obat di dalam darah melalui aspek farmakokinetik serta efek obat terhadap tubuh (farmakodinamik). Adanya perubahan farmakokinetik dan farmakodinamik berpotensi menyebabkan keadaan subterapeutik maupun menghasilkan efek toksik. Tujuan studi pustaka ini untuk memberikan ketersediaan informasi variasi genetik yang berpotensi mempengaruhi respon pengobatan, sehingga diharapkan dapat menunjang penerapan pengobatan yang lebih presisi.

Kata kunci: CYP, farmakogenomik, obat, pengobatan presisi

Abstract

One of the factors contributing to patient morbidity and death is the variable variability in treatment response. Adverse drug responses (ADRs) or subtherapeutic effects are possible in certain patients during medication administration. Genetic variation is among the numerous variables that contribute to this condition. Pharmacogenomics is the study of how genes influence an individual's response to drugs. The goal of pharmacogenomics is to optimize

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treatment for the patient. It has been established that a number of genes are associated with drug response, affecting both the direct effects of drugs (pharmacodynamics) and their blood levels (pharmacokinetics). Modifications to a medication's pharmacokinetics and pharmacodynamics may result in toxicity or reduce its efficacy. In order to enhance the precision of pharmacotherapy techniques, this study aims to elucidate the availability of data on genetic variants known to influence medication response.

Keywords: *CYP, drug, pharmacogenomics, precise medicine*

PENDAHULUAN

Adverse drug reaction (ADR) merupakan salah satu penyebab morbiditas bahkan mortalitas yang dapat menjadi beban tambahan pelayanan sistem kesehatan (Akhideno et al., 2018). Berdasarkan laporan ADR global, terdapat sekitar 15 juta kasus yang dilaporkan sejak tahun 1957 hingga 2018. Namun, tidak semua negara berkontribusi dalam laporan ini, sehingga diyakini bahwa kejadian ADR jauh lebih besar daripada yang terlaporkan (T P, 2009). Studi yang dilakukan oleh Chan, dkk (2018) memperkirakan bahwa biaya perawatan rumah sakit akibat ADR mencapai US$570,400 per 1000 pasien. Biaya akibat ADR menghabiskan sekitar 5% dari total dana kesehatan di Singapura (Chan et al., 2019). Diperkirakan lebih dari 50% total kasus ADR merupakan kasus yang dapat dicegah (Kalyani and Srihitha, 2017). Variabilitas respon obat interindividu merupakan salah satu faktor yang dapat berkontribusi terhadap kejadian ADR. Variabilitas respon ini dapat didasari oleh perbedaan genetik setiap individu (Cacabelos et al., 2019). Di sisi lain, variabilitas genetik juga dapat menyebabkan perubahan kadar obat di bawah kadar terapeutik (Westervelt et al., 2014). Hal ini dapat menghasilkan pengobatan yang tidak optimal (Epstein et al., 2010; Lloberas et al., 2017).

Dalam beberapa tahun terakhir, farmakogenomik menjadi salah satu fokus pengembangan farmakologi (T P, 2009), yaitu cabang ilmu farmakologi yang mempelajari kontribusi faktor genetik terhadap variasi respon obat (Katzung, 2018). Farmakogenomik berkembang menjadi modalitas sebagai pertimbangan untuk mencegah ADR. Selain itu, pencegahan ADR juga berdampak positif pada efisiensi biaya (Akhideno et al., 2018; Weinshilboum and Wang, 2017).

Saat ini, telah banyak studi yang mendukung pemilihan regimen obat berdasarkan status genetik pasien (Cacabelos et al., 2019; Di Sanzo et al., 2017; Kim et al., 2017; T P, 2009). Pemilihan regimen didasarkan pada profil genetik individu terhadap profil farmakokinetik maupun farmakodinamik obat. Dengan

pendekatan ini, pengobatan menjadi spesifik terhadap tiap individu untuk mencapai efikasi dan keamanan yang lebih presisi atau dikenal juga sebagai *personalized medicine* (Weinshilboum and Wang, 2017). Melalui tulisan ini, penulisan bermaksud memaparkan ketersediaan informasi mengenai hubungan variasi genetik individu terhadap respon obat tertentu selanjutnya dapat digunakan untuk meningkatkan ketepatan strategi pengobatan.

PEMBAHASAN

Variabilitas Interindividu

Variabilitas individu merupakan salah satu faktor yang berkontribusi terhadap tercapainya efek terapeutik maupun munculnya efek samping suatu agen farmakologi. Hal ini disebabkan karena variabilitas genetik dapat terjadi pada level farmakokinetik maupun level farmakodinamik, bahkan fungsi sistem imun, seperti *human leukocyte antigen* (HLA) (Katzung, 2018). Pada level farmakokinetik, variabilitas dapat terjadi pada enzim pemetabolisme obat dan transporter protein. Sedangkan, pada level farmakodinamik, variabilitas terjadi pada protein target obat seperti reseptor, enzim, dan protein intraseluler (Lam, 2019). Variabilitas individu yang terjadi pada ≥1% populasi disebut sebagai polimorfime (Brunton et al., 2017; Katzung, 2018).

Polimorfisme enzim pemetabolisme obat secara garis besar dibedakan atas dua, yaitu polimorfisme sitokrom (CYP) dan non-CYP. Status metabolisme individu bergantung terhadap alel enzim tersebut. Sehingga, sangat banyak varian genotip yang dapat menentukan status metabolisme individu (Manikandan and Nagini, 2017). Polimorfisme pada CYP melibatkan beberapa CYP seperti 2D6, 2C19, 2C9, 2C8, 3A4, 3A5, 3A7, 4F2, 2B6, 2A6, dan 1A2 (Lam, 2019). Status metabolisme dikelompokkan menjadi empat kelompok, yaitu *poor metabolizer, intermediate metabolizer, extensive metabolizer,* dan *ultra-rapid metabolizer*. *Extensive metabolizer* dianggap sebagai fenotip normal (Brunton et al., 2017; Katzung, 2018). Polimorfisme pada enzim pemetabolisme obat non-CYP, juga memiliki peran dalam metabolisme dan proses eliminasi obat. Diantaranya *UDP-glucuronosyl transferase* (UGT), *thiopurine-S-methyltransferase* (TPMT), *dihydropyrimidine dehydrogenase* (DPD), *N-acetyltransferase* (NAT), dan *glutathione-s-transferase* (GST) (Lam, 2019).

Polimorfisme pada level transporter protein dapat terjadi pada kelompok transporter efluks maupun influks. Kelompok transporter efluks meliputi *adenosine triphosphate-binding cassette* (ABC) dan kelompok transporter influks meliputi *uptake solute carrier* (SLC) (Lam, 2019). Namun, polimorfisme yang

dianggap bermakna secara klinis oleh *International Transporter Consortium* (ITC) adalah ABCBG2 (BCRP) dan SLCO1B1 (OATP1B1) (Yee et al., 2018).

Fenotip dari variasi genetik terhadap protein target obat juga dapat mempengaruhi efek suatu obat (Goldstein et al., 2003). Sebagian besar obat memberikan efek terapeutik ketika berinteraksi dengan reseptornya, namun adanya variasi genetik pada reseptor obat akan menyebabkan perubahan efek yang dihasilkan. Beberapa reseptor target obat memiliki variabilitas individu, seperti *epidermal growth factor receptor type 2* (HER2), *adrenoceptor β-1* (ADRB1), *adrenergic alpha2C-receptor* (ADRA2C), reseptor *5-hydroxytryptamine* (5-HT), reseptor dopamin D3 (DRD3), dan *μ–opioid receptor* (MOR) (Lam, 2019). Selain itu, adanya variabilitas gen pengkode enzim lain yang terlibat dalam mekanisme kerja obat juga memperngaruhi efek suatu obat. Seperti VKORC1 dan *catecho-O-methyltransferase* (COMT).

Aplikasi Klinis Farmakogenomik

Beberapa area keilmuan dalam dunia kedokteran menjadi pusat pengembangan dan penerapan farmakogenomik. Onkologi, kardiologi, psikiatri, dan manajemen nyeri merupakan area pengembangan farmakogenomik yang telah eksis saat ini (Di Sanzo et al., 2017; Kim et al., 2017; Lam, 2019). Selain itu, *Food and Drug Administration* (FDA) telah mengeluarkan rekomendasi terapi berdasarkan dengan pendekatan farmakogenomik yang dapat diakses melalui tautan (https://www.fda.gov/medical-devices/precision-medicine/table-pharmacogenetic-associations) (Food and Drug Administration, 2020). Berdasarkan daftar obat yang beredar di Indonesia, pendekatan farmakogenomik dapat dilakukan pada beberapa obat (Tabel 1 dan 2).

Obat-obat ini dihubungkan dengan peningkatan kadar obat di dalam darah yang meningkatkan risiko terjadinya efek yang tidak diinginkan berdasarkan karakteristik obat tersebut (Food and Drug Administration, 2020). Adapun obat-obat lainnya yang telah didukung oleh studi terkait efek sampingnya pada manusia (Tabel 2).

Terdapat beberapa rekomendasi pemeriksaan genetik dalam penerapan pendekatan farmakogenomik di pelayanan kesehatan. Seperti pemeriksaan gen CYP2C9 dan VKORC1 pada pemberian warfarin untuk menentukan dosis presisi dan mencegah efek samping, seperti perdarahan (Katzung, 2018; Kim et al., 2017). Pemeriksaan genotip CYP2C19 pada pasien yang direncanakan menggunakan clopidogrel untuk mencegah trombosis (Kim et al., 2017). Pemeriksaan NAT2 pada pasien yang

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akan mendapatkan isoniazid guna optimalisasi dosis dan pencegahan toksisitas (Chan et al., 2017). Lebih lanjut, termasuk pemeriksaan HER2 pada pasien kanker payudara untuk penentuan pilihan terapi dengan atau tanpa trastuzumab (Carlson et al., 2006).

Tabel 1. Obat-Obat dengan Potensi Efek yang Tidak Diinginkan dan Rekomendasi Penggunaan Obat Sesuai Pendekatan Farmakogenomik

Obat	Sitokrom	Fenotip	Rekomendasi
Amfetamin	CYP2D6	*poor metabolizer* (de la Torre et al., 2012)	-
Aripiprazole	CYP2D6	*poor metabolizer*	Diberikan separuh dosis normal (Dean and Kane, 2021)
Atomoxetine	CYP2D6	*poor metabolizer*	Dimulai dengan dosis rendah 0,5 mg/kgBB, kemudian lanjutkan dengan target kadar obat mendekati 400 ng/ml (Dean, 2020)
Brexpiprazole	CYP2D6	*poor metabolizer*	Diberikan separuh dosis normal (PharmKGB, 2023)
Carvedilol	CYP2D6	*poor metabolizer*	Titrasi naik dosis perlahan sampai target terapi tercapai (Dean, 2018)
Clobazam	CYP2C19	*intermediate* atau *poor metabolizer*	Dosis awal 5 mg/hari kemudian titrasi sesui respon klinis hingga maksimal 20 mg/hari untuk pasien dengan berat badan ≤30 kg; 40 mg/hari untuk pasien dengan berat badan >30 kg (Dean, 2019)
Piroxicam	CYP2C9	*intermediate* atau *poor metabolizer*	Ganti obat alternatif lainnya (PharmKGB, 2023)
Vortioxetine	CYP2D6	*poor metabolizer*	Inisiasi dengan 50% dosis normal, kemudian titrasi sampai maksimal 10 mg (PharmKGB, 2023)

Tabel 2. Obat-Obat dengan Potensi Efek yang Tidak Diinginkan

Obat	Gen	Alel/Fenotip	Jenis Efek
Allopurinol	HLA-B	*58:01 allele positive	Sindrom Steven Johnson/*toxic necrotizing epidermolysis* (Fan et al., 2017)
Azathioprine	TPMT dan/atau NUDT15	*intermediate* atau *poor metabolizer*	Toksisitas sumsum tulang, intoleransi saluran cerna (Liu et al., 2015)
Capecitabine	DPYD	*intermediate* atau *poor metabolizer*	Toksisitas gastrointestinal dan hematologi (Si et al., 2014)
Carbamazepine	HLA-A; HLA-B	HLA-A: *31:01 alel positif HLA-B: *15:02 alel positif	*mild rash maculopapular exanthema* (MPE), *hypersensitivity syndrome* (HSS), Sindrom Steven Johnson (SSJ)/*toxic necrotizing epidermolysis* (NET); SSJ/NET (Fan et al., 2017; Genin et al., 2014)
Celecoxib	CYP2C9	*poor metabolizer*	Perdarahan gastroduodenal (Pilotto et al., 2007)
Citalopram	CYP2C19	*poor metabolizer*	Mual, muntah, *drowsiness* (Yu et al., 2003)
Clozapine	CYP2D6	*poor metabolizer*	Hiperglikemia (Vasudev et al., 2017)
Codeine	CYP2D6	*ultra-rapid metabolizer*	*dizziness* atau sakit kepala ringan, mual, muntah, mulut kering, pandangan kabur, gatal, ruam (Prows et al., 2014) [a]Depresi napas dan susunan saraf pusat (Ginsberg, 2005; Madadi et al., 2007)
Efavirenz	CYP2B6	*poor metabolizer*	Hepatotoksik (Manosuthi et al., 2014)
Fluorouracil	DPYD	*intermediate* atau *poor metabolizer*	Toksisitas gastrointestinal, hematologi, dan *hand-foot syndrome* (Jeong et al., 2021)
Gefitinib	CYP2D6	*poor metabolizer*	Ruam (Suzumura et al., 2012)

			[b]Hepatotoksik (Takimoto et al., 2013)
Irinotecan	UGT1A1	*28/*28 (*poor metabolizer*)	Diare, neutropeni (Hirasawa et al., 2013; C. Xu et al., 2016)
Isoniazid	NAT	*poor metabolizer*	Hepatotoksik (Huang et al., 2002; Sotsuka et al., 2011)
Lapatinib	HLA-DRB1 HLA-DQA1	*07:01 alel positif *02:01 alel positif	Hepatotoksik (Parham et al., 2016)
Metoclopramide	CYP2D6	*poor metabolizer*	*Acute distonic reaction* (Sindrom Ekstrapiramidal) (van der Padt et al., 2006; Wee Chua et al., 2019)
Nilotinib	UGT1A1	*28/*28 (*poor metabolizer*)	Hiperbilirubinemia (Shibata et al., 2014)
Oxcarbazepine	HLA-B	*15:02 alel positif	*Drug reaction with eosinophilia and systemic symptoms* (DRESS), SSJ (Liu et al., 2018)
Pazopanib	HLA-B; UGT1A1	HLA-B: *57:01 alel positif UGT1A1: *28/*28 (*poor metabolizer*)	Hepatotoksik (C. F. Xu et al., 2016) Hiperbilirubinemia (Xu et al., 2010)
Propafenone	CYP2D6	*poor metabolizer*	Efek samping sistem saraf pusat (pandangan kabur, *dizziness*, dan parastesia) (Siddoway et al., 1987)
Simvastatin	SLCO1B1	521 TC or 521 CC (*intermediate* atau *poor function transporters*)	Miopati (Jiang et al., 2016)
Sulfamethoxazole and Trimethoprim	NAT	*poor metabolizer*	Hepatotoksik (Soejima et al., 2007) Reaksi hipersensitivitas (Zielin, 1998)
Sulfasalazine	NAT	*poor metabolizer*	Reaksi hipersensitivitas (Chen et al., 2007; Tanaka et al., 2002)

Tolterodine	CYP2D6	*poor metabolizer*	[a]Pemanjangan interval QT (Lui and Fung, 2010)
Tramadol	CYP2D6	*ultra-rapid metabolizer*	Mual, muntah (Siew et al., 2007) [a]Depresi napas (Orliaguet et al., 2015)
Warfarin	CYP2C9 dan VKORC1-1639G>A	CYP2C9: *intermediate* atau *poor metabolizer*	Perdarahan (Misasi et al., 2016; Nahar et al., 2013)

[a]*Case Report*

[b]*Digunakan bersama inhibitor CYP3A4*

Tabel 3. Obat-Obat dengan Potensi Efek Subterapeutik yang Beredar di Indonesia dan Rekomendasi Penggunaan Obat Sesuai Sesuai Pendekatan Farmakogenomik

Obat	**Gen**	**Fenotip** (referensi dan rekomendasi dosis)	**Rekomendasi**
Clopidogrel	CYP2C19	*intermediate* atau *poor metabolizer*	Hindari penggunaan clopidogrel (Dean and Kane, 2022)
Codein	CYP2D6	*poor metabolizer*	Hindari penggunaan opioid (Dean and Kane, 2021)
Tacrolimus	CYP3A5	*intermediate metabolizer*	Penyesuaian dosis sesuai kadar obat (PharmKGB, 2023)

Faktor Lain Yang Mempengaruhi Respon Obat

Hubungan antara dosis, konsentrasi obat, dan efek obat dapat dipengaruhi oleh faktor fisiologis maupun patologis (Brunton et al., 2017; Katzung, 2018). Kadar suatu obat di dalam tubuh akan dipengaruhi oleh kemampuan obat tersebut diabsorpsi oleh tubuh. Perubahan pH saluran cerna dapat menyebabkan perubahan kapasitas absorpsi suatu obat, yang mana dapat menyebabkan perubahan respon obat baik peningkatan kadar maupun penurunan kadar obat tersebut (Brunton et al., 2017). Keadaan protein plasma juga mempengaruhi efek obat. Pada obat-obat yang memiliki ikatan protein tinggi dan rentang kadar terapeutik yang sempit, pergeseran sedikit saja pada ikatan obat dari protein plasma akan menyebabkan peningkatan kadar obat yang bermakna sehingga meningkatkan potensi terjadinya efek samping (Katzung, 2018). Keadaan hipoalbuminemia yang berat juga dapat meningkatkan potensi efek samping obat yang berikatan dengan

albumin (Lee et al., 2016). Ikatan obat-albumin merupakan bentuk inaktif, sedangkan obat yang dapat memberikan respon farmakologi adalah yang obat bebas (Brunton et al., 2017). Penurunan fungsi ginjal juga dapat berkontribusi terhadap peningkatan potensi toksisitas obat-obat yang diekskresikan melalui ginjal. Apabila terjadi penurunan fungsi ginjal, maka eliminasi obat pun mengalami penurunan. Sehingga, terjadi peningkatan risiko toksisitas obat (Lea-Henry et al., 2018). Di sisi lain perbedaan atau perubahan fisiologis pada anak-anak, ibu hamil, geriatri, dan penyakit kritis dapat mempengaruhi respon obat (Katzung, 2018). Efek samping akibat obat juga dapat disebabkan oleh faktor lain seperti interaksi antar obat, interaksi obat dan makanan, serta eksipien obat (de Boer et al., 2015; Moore et al., 2015; Shah, 2014).

KESIMPULAN

Farmakogenomik merupakan salah satu modalitas baru dalam pendekatan farmakologi. Pendekatan secara farmakogenomik dapat membantu menurunkan risiko terjadinya efek samping dan mengoptimalkan efektivitas obat, sehingga menjadikan pengobatan lebih presisi. Namun, efek suatu obat tidak hanya dipengaruhi oleh variasi genetik melainkan juga oleh banyak faktor seperti perubahan fisiologis, keadaan patologis, serta efek lainnya. Faktor-faktor tersebut perlu dipertimbangkan oleh klinisi dalam pemberian terapi.

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DAFTAR PUSTAKA

Akhideno, P., Fasipe, O., Isah, A., Owhin, O., 2018. Economic burden, impact, and consequence of adverse drug reactions among medical inpatients in clinical practice. J. Clin. Sci. 15, 186. https://doi.org/10.4103/jcls.jcls_64_18

Brunton, L., Knollmann, B., Randa, H.-D., 2017. Goodman and Gilman's The Pharmacological Basis of Therapeutics, 14th ed. McGraw Hill Education.

Cacabelos, R., Cacabelos, N., Carril, J.C., 2019. The role of pharmacogenomics in adverse drug reactions. Expert Rev. Clin. Pharmacol. 12, 407–442. https://doi.org/10.1080/17512433.2019.1597706

Carlson, R.W., Moench, S.J., Hammond, M.E.H., Perez, E.A., Burstein, H.J., Allred, D.C., Vogel, C.L., Goldstein, L.J., Somlo, G., Gradishar, W.J., Hudis, C.A., Jahanzeb, M., Stark, A., Wolff, A.C., Press, M.F., Winer, E.P., Paik, S., Ljung, B.M., 2006. HER2 testing in breast cancer: NCCN Task Force report and recommendations. JNCCN J. Natl. Compr. Cancer Netw. 4.

Chan, S.L., Chua, A.P.G., Aminkeng, F., Chee, C.B.E., Jin, S., Loh, M., Gan, S.H., Wang, Y.T., Brunham, L.R., 2017. Association and clinical utility of NAT2 in the prediction of isoniazid-induced liver injury in Singaporean patients. PLoS ONE 12, 1–16. https://doi.org/10.1371/journal.pone.0186200

Chan, S.L., Ng, H.Y., Sung, C., Chan, A., Winther, M.D., Brunham, L.R., Wee, H.L., 2019. Economic burden of adverse drug reactions and potential

for pharmacogenomic testing in Singaporean adults. Pharmacogenomics J. 19, 401–410. https://doi.org/10.1038/s41397-018-0053-1

Chen, M., Xia, B., Chen, B., Guo, Q., Li, J., Ye, M., Hu, Z., 2007. N-acetyltransferase 2 slow acetylator genotype associated with adverse effects of sulfasalazine in the treatment of inflammatory bowel disease. Can. J. Gastroenterol. 21, 155–158. https://doi.org/10.1155/2007/976804

de Boer, A., van Hunsel, F., Bast, A., 2015. Adverse food-drug interactions. Regul. Toxicol. Pharmacol. 73, 859–865. https://doi.org/10.1016/j.yrtph.2015.10.009

de la Torre, R., Yubero-Lahoz, S., Pardo-Lozano, R., Farré, M., 2012. MDMA, methamphetamine, and CYP2D6 pharmacogenetics: what is clinically relevant? Front. Genet. 3, 235. https://doi.org/10.3389/fgene.2012.00235

Dean, L., 2020. Atomoxetine Therapy and CYP2D6 Genotype, in: Pratt, V.M., Scott, S.A., Pirmohamed, M., Esquivel, B., Kattman, B.L., Malheiro, A.J. (Eds.), Medical Genetics Summaries. National Center for Biotechnology Information (US), Bethesda (MD).

Dean, L., 2019. Clobazam Therapy and CYP2C19 Genotype, in: Pratt, V.M., Scott, S.A., Pirmohamed, M., Esquivel, B., Kattman, B.L., Malheiro, A.J. (Eds.), Medical Genetics Summaries. National Center for Biotechnology Information (US), Bethesda (MD).

Dean, L., 2018. Carvedilol Therapy and CYP2D6 Genotype, in: Pratt, V.M., Scott, S.A., Pirmohamed, M., Esquivel, B., Kattman, B.L., Malheiro, A.J. (Eds.), Medical Genetics Summaries. National Center for Biotechnology Information (US), Bethesda (MD).

Dean, L., Kane, M., 2022. Clopidogrel Therapy and CYP2C19 Genotype, in: Pratt, V.M., Scott, S.A., Pirmohamed, M., Esquivel, B., Kattman, B.L., Malheiro, A.J. (Eds.), Medical Genetics Summaries. National Center for Biotechnology Information (US), Bethesda (MD).

Dean, L., Kane, M., 2021a. Aripiprazole Therapy and CYP2D6 Genotype, in: Pratt, V.M., Scott, S.A., Pirmohamed, M., Esquivel, B., Kattman, B.L., Malheiro, A.J. (Eds.), Medical Genetics Summaries. National Center for Biotechnology Information (US), Bethesda (MD).

Dean, L., Kane, M., 2021b. Codeine Therapy and CYP2D6 Genotype, in: Pratt, V.M., Scott, S.A., Pirmohamed, M., Esquivel, B., Kattman, B.L., Malheiro, A.J. (Eds.), Medical Genetics Summaries. National Center for Biotechnology Information (US), Bethesda (MD).

Di Sanzo, M., Cipolloni, L., Borro, M., La Russa, R., Santurro, A., Scopetti, M., Simmaco, M., Frati, P., 2017. Clinical Applications of Personalized Medicine: A New Paradigm and Challenge. Curr. Pharm. Biotechnol. 18, 194–203. https://doi.org/10.2174/1389201018666170224105600

Epstein, R.S., Moyer, T.P., Aubert, R.E., OKane, D.J., Xia, F., Verbrugge, R.R., Gage, B.F., Teagarden, J.R., 2010. Warfarin Genotyping Reduces Hospitalization Rates. Results From the MM-WES (Medco-Mayo Warfarin Effectiveness Study). J. Am. Coll. Cardiol. 55, 2804–2812. https://doi.org/10.1016/j.jacc.2010.03.009

Fan, W.L., Shiao, M.S., Hui, R.C.Y., Su, S.C., Wang, C.W., Chang, Y.C., Chung, W.H., 2017. HLA Association with Drug-Induced Adverse Reactions. J. Immunol. Res. 2017. https://doi.org/10.1155/2017/3186328

Food and Drug Administration, 2020. Table of Pharmacogenetic Associations [WWW Document].

Genin, E., Chen, D.-P., Hung, S.-I., Sekula, P., Schumacher, M., Chang, P.-Y., Tsai, S.-H., Wu, T.-L., Bellón, T., Tamouza, R., Fortier, C., Toubert, A., Charron, D., Hovnanian, A., Wolkenstein, P., Chung, W.-H., Mockenhaupt, M., Roujeau, J.-C.,

2014. HLA-A*31:01 and different types of carbamazepine-induced severe cutaneous adverse reactions: an international study and meta-analysis. Pharmacogenomics J. 14, 281–288. https://doi.org/10.1038/tpj.2013.40

Ginsberg, D.L., 2005. Codeine intoxication associated with ultrarapid CYP 2D6 metabolism. Prim. Psychiatry 12, 26–27. https://doi.org/10.1016/s1077-9108(08)70202-0

Goldstein, D.B., Tate, S.K., Sisodiya, S.M., 2003. Pharmacogenetics goes genomic. Nat. Rev. Genet. 4, 937–947. https://doi.org/10.1038/nrg1229

Hirasawa, A., Zama, T., Akahane, T., Nomura, H., Kataoka, F., Saito, K., Okubo, K., Tominaga, E., Makita, K., Susumu, N., Kosaki, K., Tanigawara, Y., Aoki, D., 2013. Polymorphisms in the UGT1A1 gene predict adverse effects of irinotecan in the treatment of gynecologic cancer in Japanese patients. J. Hum. Genet. 58, 794–798. https://doi.org/10.1038/jhg.2013.105

Huang, Y.S., Chern, H. Der, Su, W.J., Wu, J.C., Lai, S.L., Yang, S.Y., Chang, F.Y., Lee, S.D., 2002. Polymorphism of the N-acetyltransferase 2 gene as a susceptibility risk factor for antituberculosis drug-induced hepatitis. Hepatology 35, 883–889. https://doi.org/10.1053/jhep.2002.32102

Jeong, S.H., Chavani, O., Burns, K., Porter, D., Findlay, M., Helsby, N., 2021. Severe 5-Fluorouracil-Associated Gastrointestinal Toxicity Unexplained by Dihydropyrimidine Dehydrogenase Deficiency and Renal Impairment: Should We Be Investigating Other Elimination Pathways to Assess the Risk of 5-Fluorouracil Toxicity? Eur. J. Drug Metab. Pharmacokinet. 46, 817–820. https://doi.org/10.1007/s13318-021-00721-0

Jiang, J., Tang, Q., Feng, J., Dai, R., Wang, Y., Yang, Y., Tang, X., Deng, C., 2016. Association between SLCO1B1 − 521T > C and − 388A > G polymorphisms and risk of statin - induced adverse drug reactions : A meta - analysis. SpringerPlus 1–16. https://doi.org/10.1186/s40064-016-2912-z

Kalyani, S.S.A., Srihitha, P., 2017. An Epidemiological Study on Adverse Drug Reaction in Indian Population: Meta-Analysis. Int. J. Pharm. Clin. Res. 9, 654–659.

Katzung, B.G., 2018. Basic & Clinical Pharmacology, 14th ed. McGraw Hill Education, San Fransisco.

Kim, S., Yun, Y.M., Chae, H.J., Cho, H.J., Ji, M., Kim, I.S., Wee, K.A., Lee, W., Song, S.H., Woo, H.I., Lee, S.Y., Chun, S., 2017. Clinical pharmacogenetic testing and application: Laboratory medicine clinical practice guidelines. Ann. Lab. Med. 37, 180–193. https://doi.org/10.3343/alm.2017.37.2.180

Lam, Y.W.F., 2019. Principles of Pharmacogenomics, Second Edi. ed, Pharmacogenomics. Elsevier Inc. https://doi.org/10.1016/b978-0-12-812626-4.00001-2

Lea-Henry, T.N., Carland, J.E., Stocker, S.L., Sevastos, J., Roberts, D.M., 2018. Clinical pharmacokinetics in kidney disease: Fundamental principles. Clin. J. Am. Soc. Nephrol. 13, 1085–1095. https://doi.org/10.2215/CJN.00340118

Lee, S.Y., Meehan, R.S., Seldin, D.C., Sloan, J.M., Quillen, K., Shelton, A., Brauneis, D., Sanchorawala, V., 2016. Effect of severe hypoalbuminemia on toxicity of high-dose melphalan and autologous stem cell transplantation in patients with AL amyloidosis. Bone Marrow Transplant. 51, 1318–1322. https://doi.org/10.1038/bmt.2016.132

Liu, Y., Yu, Y., Nie, X., Zhao, L., Wang, X., 2018. Oxcarbazepine-Induced Cutaneous Adverse Reaction : a Meta-Analysis. Pharmacogenomics.

Liu, Y.P., Xu, H.Q., Li, M., Yang, X., Yu, S., Fu, W.L., Huang, Q., 2015. Association between thiopurine smethyltransferase polymorphisms and azathioprine-induced adverse drug reactions in patients with autoimmune diseases: A meta-analysis. PLoS ONE 10, 1–14. https://doi.org/10.1371/journal.pone.0144234

Lloberas, N., Elens, L., Llaudó, I., Padullés, A., Van Gelder, T., Hesselink, D.A., Colom, H., Andreu, F., Torras, J., Bestard, O., Cruzado, J.M., Gil-Vernet, S., Van Schaik, R., Grinyó, J.M., 2017. The combination of CYP3A4∗22 and CYP3A5∗3 single-nucleotide polymorphisms determines tacrolimus dose requirement after kidney transplantation. Pharmacogenet. Genomics 27, 313–322. https://doi.org/10.1097/FPC.0000000000000296

Lui, C.T., Fung, H.T., 2010. A case of tolterodine poisoning. Hong Kong J. Emerg. Med. 17, 168–172. https://doi.org/10.1177/102490791001700211

Madadi, P., Koren, G., Cairns, J., Chitayat, D., Gaedigk, A., Leeder, J.S., Teitelbaum, R., Karaskov, T., Aleksa, K., 2007. Safety of codeine during breastfeeding: Fatal morphine poisoning in the breastfed neonate of a mother prescribed codeine. Can. Fam. Physician 53, 33–35.

Manikandan, P., Nagini, S., 2017. Cytochrome P450 Structure, Function and Clinical Significance: A Review. Curr. Drug Targets 19, 38–54. https://doi.org/10.2174/1389450118666170125144557

Manosuthi, W., Sukasem, C., Lueangniyomkul, A., Mankatitham, W., Thongyen, S., Nilkamhang, S., Manosuthi, S., Sungkanuparph, S., 2014. CYP2B6 haplotype and biological factors responsible for hepatotoxicity in HIV-infected patients receiving efavirenz-based antiretroviral therapy. Int. J. Antimicrob. Agents 43, 292–296. https://doi.org/10.1016/j.ijantimicag.2013.10.022

Misasi, S., Martini, G., Paoletti, O., Calza, S., Scovoli, G., Marengoni, A., Testa, S., Caimi, L., Marchina, E., 2016. VKORC1 and CYP2C9 polymorphisms related to adverse events in case-control cohort of anticoagulated patients. Med. U. S. 95, 1–7. https://doi.org/10.1097/MD.0000000000005451

Moore, N., Pollack, C., Butkerait, P., 2015. Adverse drug reactions and drug–drug interactions with over-the-counter NSAIDs. Ther. Clin. Risk Manag. 11, 1061–1075. https://doi.org/10.2147/TCRM.S79135

Nahar, R., Deb, R., Saxena, R., Puri, R.D., Verma, I.C., 2013. Variability in CYP2C9 allele frequency: A pilot study of its predicted impact on warfarin response among healthy South and North Indians. Pharmacol. Rep. 65, 187–194. https://doi.org/10.1016/S1734-1140(13)70977-0

Orliaguet, G., Hamza, J., Couloigner, V., Denoyelle, F., Loriot, M.A., Broly, F., Garabedian, E.N., 2015. A case of respiratory depression in a child with ultrarapid CYP2D6 metabolism after tramadol. Pediatrics 135, e753–e755. https://doi.org/10.1542/peds.2014-2673

Parham, L.R., Briley, L.P., Li, L., Shen, J., Newcombe, P.J., King, K.S., Slater, A.J., Dilthey, A., Iqbal, Z., McVean, G., Cox, C.J., Nelson, M.R., Spraggs, C.F., 2016. Comprehensive genome-wide evaluation of lapatinib-induced liver injury yields a single genetic signal centered on known risk allele HLA-DRB1∗07:01. Pharmacogenomics J. 16, 180–185. https://doi.org/10.1038/tpj.2015.40

PharmKGB, 2023a. Brexpiprazole [WWW Document]. PharmGKB. URL https://www.pharmgkb.org/chemical/PA166160053/prescribingInfo#guideline-annotations (accessed 11.16.23).

PharmKGB, 2023b. Antiinflammatory and antirheumatic products, non-steroids [WWW Document]. PharmGKB. URL https://www.pharmgkb.org/chemical/PA10384/guidelineAnnotation/PA166192321 (accessed 11.17.23).

PharmKGB, 2023c. Vortioxetine [WWW Document]. PharmGKB. URL https://www.pharmgkb.org/chemical/PA166122595/guidelineAnnotation/PA166288221 (accessed 11.17.23).

PharmKGB, 2023d. Tacrolimus [WWW Document]. PharmGKB. URL https://www.pharmgkb.org/chemical/

PA451578/prescribingInfo#guideline-annotations (accessed 11.17.23).

Pilotto, A., Seripa, D., Franceschi, M., Scarcelli, C., Colaizzo, D., Grandone, E., Niro, V., Andriulli, A., Leandro, G., di Mario, F., Dallapiccola, B., 2007. Genetic Susceptibility to Nonsteroidal Anti-Inflammatory Drug-Related Gastroduodenal Bleeding: Role of Cytochrome P450 2C9 Polymorphisms. Gastroenterology 133, 465–471. https://doi.org/10.1053/j.gastro.2007.05.025

Prows, C.A., Zhang, X., Huth, M.M., Zhang, K., Saldaña, S.N., Daraiseh, N.M., Esslinger, H.R., Freeman, E., Greinwald, J.H., Martin, L.J., Sadhasivam, S., 2014. Codeine-related adverse drug reactions in children following tonsillectomy: A prospective study. Laryngoscope 124, 1242–1250. https://doi.org/10.1002/lary.24455

Shah, V., 2014. New allergy drug excipient allergy. Clin. Transl. Allergy 4, P134. https://doi.org/10.1186/2045-7022-4-s3-p134

Shibata, T., Minami, Y., Mitsuma, A., Morita, S., Inada-Inoue, M., Oguri, T., Shimokata, T., Sugishita, M., Naoe, T., Ando, Y., 2014. Association between severe toxicity of nilotinib and UGT1A1 polymorphisms in Japanese patients with chronic myelogenous leukemia. Int. J. Clin. Oncol. 19, 391–396. https://doi.org/10.1007/s10147-013-0562-5

Si, D., Wang, J., Xu, Y., Chen, X., Zhang, M., Zhou, H., 2014. Association of common polymorphisms in b1-adrenergic receptor with antihypertensive response to carvedilol. J. Cardiovasc. Pharmacol. 64, 306–309. https://doi.org/10.1097/FJC.0000000000000119

Siddoway, L.A., Thompson, K.A., McAllister, C.B., Wang, T., Wilkinson, G.R., Roden, D.M., Woosley, R.L., 1987. Polymorphism of propafenone metabolism and disposition in man: Clinical and pharmacokinetic consequences. Circulation 75, 785–791. https://doi.org/10.1161/01.CIR.75.4.785

Siew, H.G., Ismail, R., Adnan, W.A.W., Zulmi, W., 2007. Impact of CYP2D6 genetic polymorphism on tramadol pharmacokinetics and pharmacodynamics. Mol. Diagn. Ther. 11, 171–181. https://doi.org/10.1007/bf03256239

Soejima, M., Sugiura, T., Kawaguchi, Y., Kawamoto, M., Katsumata, Y., Takagi, K., Nakajima, A., Mitamura, T., Mimori, A., Hara, M., Kamatani, N., 2007. Research article Association of the diplotype configuration at the N-acetyltransferase 2 gene with adverse events with co-trimoxazole in Japanese patients with systemic lupus erythematosus. Arthritis Res. Ther. 9. https://arthritis-research.biomedcentral.com/articles/10.1186/ar2134

Sotsuka, T., Sasaki, Y., Hirai, S., Yamagishi, F., Ueno, K., 2011. Association of isoniazid-metabolizing enzyme genotypes and isoniazid-induced hepatotoxicity in tuberculosis patients. In Vivo 25, 803–812.

Suzumura, T., Kimura, T., Kudoh, S., Umekawa, K., Nagata, M., Matsuura, K., Tanaka, H., Mitsuoka, S., Yoshimura, N., Kira, Y., Nakai, T., Hirata, K., 2012. Reduced CYP2D6 function is associated with gefitinib-induced rash in patients with non-small cell lung cancer. BMC Cancer 12, 1. https://doi.org/10.1186/1471-2407-12-568

T P, A., 2009. Pharmacogenomics: The Right Drug to the Right Person. J. Clin. Med. Res. 1, 191–194. https://doi.org/10.4021/jocmr2009.08.1255

Takimoto, T., Kijima, T., Otani, Y., Nonen, S., Namba, Y., Mori, M., Yokota, S., Minami, S., Komuta, K., Uchida, J., Imamura, F., Furukawa, M., Tsuruta, N., Fujio, Y., Azuma, J., Tachibana, I., Kumanogoh, A., 2013. Polymorphisms of CYP2D6 gene and gefitinib-induced hepatotoxicity. Clin. Lung Cancer 14, 502–507. https://doi.org/10.1016/j.cllc.2013.03.003

Tanaka, E., Taniguchi, A., Urano, W., Nakajima, H., Matsuda, Y., Kitamura, Y., Saito, M., Yamanaka, H., Saito, T., Kamatani, N., 2002. Adverse effects of sulfasalazine in patients with rheumatoid arthritis are associated with diplotype configuration at the N-acetyltransferase 2 gene. J. Rheumatol. 29, 2492–2499.

van der Padt, A., van Schaik, R.H.N., Sonneveld, P., 2006. Acute dystonic reaction to metoclopramide in patients carrying homozygous cytochrome P450 2D6 genetic polymorphisms. Neth. J. Med. 64, 160–162.

Vasudev, K., Choi, Y.H., Norman, R., Kim, R.B., Schwarz, U.I., 2017. Genetic Determinants of Clozapine-Induced Metabolic Side Effects. Can. J. Psychiatry 62, 138–149. https://doi.org/10.1177/0706743716670128

Wee Chua, E., Harger, S.P., Kennedy, M.A., 2019. Metoclopramide-induced acute dystonic reactions may be associated with the CYP2D6 poor metaboliser status and pregnancy-related hormonal changes. Front. Pharmacol. 10, 2–6. https://doi.org/10.3389/fphar.2019.00931

Weinshilboum, R.M., Wang, L., 2017. Pharmacogenomics: Precision Medicine and Drug Response. Mayo Clin. Proc. 92, 1711–1722. https://doi.org/10.1016/j.mayocp.2017.09.001

Westervelt, P., Cho, K., Bright, D.R., Kisor, D.F., 2014. Drug–gene interactions: Inherent variability in drug maintenance dose requirements. P T 39, 630–637.

Xu, C., Tang, X., Qu, Y., Keyoumu, S., Zhou, N., Tang, Y., 2016. UGT1A1 gene polymorphism is associated with toxicity and clinical efficacy of irinotecan-based chemotherapy in patients with advanced colorectal cancer. Cancer Chemother. Pharmacol. 78, 119–130. https://doi.org/10.1007/s00280-016-3057-z

Xu, C.F., Johnson, T., Wang, X., Carpenter, C., Graves, A.P., Warren, L., Xue, Z., King, K.S., Fraser, D.J., Stinnett, S., Briley, L.P., Mitrica, I., Spraggs, C.F., Nelson, M.R., Tada, H., Du Bois, A., Powles, T., Kaplowitz, N., Pandite, L.N., 2016. HLA-B∗57:01 confers susceptibility to pazopanib-associated liver injury in patients with cancer. Clin. Cancer Res. 22, 1371–1377. https://doi.org/10.1158/1078-0432.CCR-15-2044

Xu, C.F., Reck, B.H., Xue, Z., Huang, L., Baker, K.L., Chen, M., Chen, E.P., Ellens, H.E., Mooser, V.E., Cardon, L.R., Spraggs, C.F., Pandite, L., 2010. Pazopanib-induced hyperbilirubinemia is associated with Gilbert's syndrome UGT1A1 polymorphism. Br. J. Cancer 102, 1371–1377. https://doi.org/10.1038/sj.bjc.6605653

Yee, S.W., Brackman, D.J., Ennis, E.A., Sugiyama, Y., Kamdem, L.K., Blanchard, R., Galetin, A., Zhang, L., Giacomini, K.M., 2018. Influence of Transporter Polymorphisms on Drug Disposition and Response: A Perspective From the International Transporter Consortium. Clin. Pharmacol. Ther. 104, 803–817. https://doi.org/10.1002/cpt.1098

Yu, B.N., Chen, G.L., He, N., Ouyang, D.S., Chen, X.P., Liu, Z.Q., Zhou, H.H., 2003. Pharmacokinetics of citalopram in relation to genetic polymorphism of CYP2C19. Drug Metab. Dispos. 31, 1255–1259. https://doi.org/10.1124/dmd.31.10.1255

Zielin, E., 1998. The arylamine N-acetyltransferase (NAT2) polymorphism and the risk of adverse reactions to co-trimoxazole in children 779–785. https://doi.org/10.1007/s002280050551

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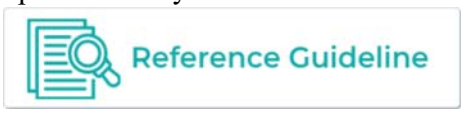

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