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I. PURPOSE:

To provide a process for IV to PO sequential therapy conversion by pharmacists within the guidelines established in this policy/protocol.

Intravenous (IV) to oral (PO) therapy interchange programs are often used in hospital settings to promote cost-effective utilization of medications. Studies have also shown that appropriate conversion from IV to PO antimicrobial therapy can decrease the length of hospitalization without adversely affecting patient outcome and may also improve patient care by reducing the risk of intravascular catheter infection due to shorter line dwell times and less endoluminal contamination.¹⁻⁸ Additional benefits of IV to PO conversion include greater patient comfort, decreased nursing needs, and easier ambulation.⁹


Patients that are started on parenteral therapy often become candidates for conversion to oral therapy as their conditions improve and they prepare for discharge. This route of administration may be ideal so long as the medication achieves the desired concentrations in blood and/or the targeted site(s) of action. The conversion from IV to PO formulations of the same medication while maintaining equivalent potency is known as “sequential therapy.”⁹

II. POLICY

It is the policy of SHC to provide a process for IV to PO conversion considerations and specific criteria for the substitution and therapeutic interchange of medications as set forth by the SHC Pharmacy and Therapeutics (P&T) Committee, the Antimicrobial Subcommittee, and the Stanford Antimicrobial Safety & Sustainability Program.


III. PROCEDURE:

- A. If a patient meets the approved criteria for transition to oral therapy (Section D), the clinical pharmacist will determine if it is clinically appropriate to perform a sequential IV to PO therapy interchange. The pharmacist will also screen the patient for any protocol exclusion criteria and medication-specific exclusion criteria. NOTE: The “PO” route may include feeding tube, nasogastric tube (ensure NG is not on continuous suction), G tube, and other enteral routes.


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- B. If an interchange is deemed to be appropriate, the pharmacist will enter a new order using the “per Protocol” order mode and enter a standardized i-Vent, documenting the conversion using the “IV to PO conversion” category.
- C. The pharmacist must enter Epic order comments stating “IV to PO Conversion per P&T policy for all interchanged orders. For antimicrobial interchanges: the pharmacist must notify the covering provider that the antimicrobial has been converted from IV to PO per protocol. The provider has the option to switch back to the IV route if parenteral therapy is deemed necessary.
- D. Criteria for patient eligibility

Inclusion Criteria	<ul style="list-style-type: none"> • Patients improving clinically • Tolerating food or enteral feeding, oral medications • Able to adequately absorb oral medications via the oral, gastric tube, or nasogastric tube route • Not displaying signs of shock, not on vasopressor blood pressure support <p><i>Additional requirements for antimicrobials:</i></p> <ul style="list-style-type: none"> • Afebrile for at least 24 hours (temperature $\leq 100.9^{\circ}\text{F}$ or $\leq 38.3^{\circ}\text{C}$) • Signs and symptoms of infection improvement according to assessment: <ul style="list-style-type: none"> ▪ WBC 4 – 15 K/uL ▪ Improving WBC (decrease of > 2 K/uL + WBC between 4 – 20 K/uL) and/or improving differential counts ▪ Improving signs and symptoms ▪ Hemodynamically stable: patient is not septic
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Exclusion Criteria	<ul style="list-style-type: none"> • NPO status • Persistent nausea and vomiting, diarrhea (e.g. > 5 liquid stools/day) • Patient with the following GI conditions: <ul style="list-style-type: none"> ○ Ileus or suspected ileus with no active bowel sounds ○ Patient is known to have a malabsorption syndrome ○ Proximal resection of small intestines ○ High nasogastric (NG) tube output or requiring continuous GI suction (>500mL/day) ○ Active GI bleed ○ Active gut GVHD • Patients with Grade III or IV mucositis • Patients with dysphagia and unable to tolerate enteral meds <p><i>Additional exclusions for antimicrobials:</i></p> <ul style="list-style-type: none"> • Day 1 of ABX • Vital signs signifying lack of clinical improvement: e.g. heart rate ≥ 90 beats per minute (not attributed to chronic cardiac condition, i.e. AFib), respiratory rate ≥ 20 breaths per minute, AND systolic blood pressure ≤ 90 mm Hg • ID consultation specifying IV route only • Patient has a serious or life threatening infection: <ul style="list-style-type: none"> ○ E.g. Meningitis, endocarditis, intracranial abscesses, empyema, osteomyelitis, septicemia, inadequately drained abscesses
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E. Intravenous to Oral Dose Conversion and Bioavailability

Medication for Conversion	Drug-Specific Exception(s)	IV Dose	PO Equivalent	Oral Bioavailability ¹⁰⁻¹⁵
acetaminophen	<ul style="list-style-type: none"> NPO <u>and</u> NPR Post-op x24 hr 	1000 mg IV Q6H PRN	1000 mg Q6H PRN	85-98%
famotidine	n/a	20 mg IV Q12H	20 mg PO Q12H	45% ¹
folic acid	n/a	1 mg IV daily	1 mg PO daily	75-90%
levothyroxine	<ul style="list-style-type: none"> Myxedema coma Patients with Endocrine consult 	0.075 mg IV daily	0.1 mg PO daily <i>*Reminder: 0.75:1 IV to PO conversion¹⁴, unless otherwise noted (e.g. Endocrine recommendations, new TSH/ fT4 results)</i>	60-80% ¹⁵
lacosamide	n/a	100 mg IV Q12H	100 mg PO Q12H	~100%
levetiracetam	n/a	500 mg IV Q12H	500 mg PO Q12H	96% ¹²
metoclopramide	n/a	10 mg IV Q6H PRN	10 mg PO Q6H PRN	80%
multivitamin	n/a	10 ml IV daily	1 tablet PO daily	-
pantoprazole	n/a	40 mg IV daily	40 mg PO daily (lansoprazole 30mg ODT daily when applicable)	77%
ondansetron	n/a	4 mg IV Q6H PRN	8 mg PO Q6H PRN	56%


¹ Serum levels do not consistently correspond to the famotidine dose or the degree of gastric acid inhibition

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thiamine	• Wernicke’s encephalitis	100 mg IV daily	100 mg PO daily	5%
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F. Antimicrobial Intravenous to Oral Dose Conversion

Medication	IV Dose	PO Equivalent	Bioavailability
azithromycin	250 mg IV daily 500 mg IV daily	250 mg PO daily 500 mg PO daily	38%
ciprofloxacin <i>*Avoid suspension via feeding tube (OG and NG tubes ok)</i>	200 mg IV Q12H 400 mg IV Q12H 400 mg IV Q8H	250 mg PO Q12H 500 mg PO Q12H 750 mg PO Q12H	50-85%
clindamycin	600mg IV q8h	300-450 mg PO Q6H 600 mg PO Q8H	90%
doxycycline	100mg IV q12h	100 mg PO Q12H	Near complete
fluconazole	100 mg IV daily 200 mg IV daily 400 mg IV daily	100 mg PO daily 200 mg PO daily 400 mg PO daily	>90%
levofloxacin	750 mg IV daily	750 mg PO daily	99%
linezolid	600 mg IV Q12H	600 mg PO Q12H	>99%
metronidazole	500 mg IV Q8H	500 mg PO Q8H	80%
moxifloxacin	400 mg IV daily	400 mg PO daily	90%
posaconazole			
rifampin	600 mg IV daily	600 mg PO daily	90-95%
trimethoprim / sulfamethoxazole (TMP/SMX)	5-20 mg TMP/kg/day in divided doses	(Same dose 1:1 conversion) 1 double strength = 160 mg TMP 1 single strength = 80 mg TMP	>90%

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I. COMPLIANCE:


- A. All workforce members including employees, contracted staff, students, volunteers, credentialed medical staff, and individuals representing or engaging in the practice at SHC are responsible for ensuring that individuals comply with this procedure;
- B. Violations of this procedure will be reported to the Department Manager and any other appropriate Department as determined by the Department Manager or in accordance with hospital policy. Violations will be investigated to determine the nature, extent, and potential risk to the hospital. Workforce members who violate this procedure will be subject to the appropriate disciplinary action up to and including termination.

II. RELATED DOCUMENTS / PROCEDURES:


- A. N.A.

III. DOCUMENT INFORMATION:

- A. Legal References / Regulatory Requirements:
 1. Nathwani D, Tillotson G, Davey P. Sequential antimicrobial therapy--the role of quinolones. J Antimicrob Chemother. Apr 1997;39(4):441-446.
 2. Vogel F. Sequential therapy in the hospital management of lower respiratory infections. The American journal of medicine. Dec 29 1995;99(6B):14S-19S.
 3. Davey P, Nathwani D. Sequential antibiotic therapy: the right patient, the right time and the right outcome. The Journal of infection. Jul 1998;37 Suppl 1:37-44.
 4. Bernig T, Weigel S, Mukodzi S, Reddemann H. Antibiotic sequential therapy for febrile neutropenia in pediatric patients with malignancy. Pediatric hematology and oncology. Jan-Feb 2000;17(1):93-98.
 5. Skoutelis AT, Gogos CA, Maraziotis TE, Bassaris HP. Management of brain abscesses with sequential intravenous/oral antibiotic therapy. European journal of clinical microbiology & infectious diseases : official publication of the European Society of Clinical Microbiology. May 2000;19(5):332-335.

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6. Pablos AI, Escobar I, Albinana S, Serrano O, Ferrari JM, Herreros de Tejada A. Evaluation of an antibiotic intravenous to oral sequential therapy program. *Pharmacoepidemiology and drug safety*. Jan 2005;14(1):53-59.
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 8. Wilcox MH. Implementation of sequential therapy programs--a microbiologist's view. *The Journal of infection*. Jul 1998;37 Suppl 1:51-54.
 9. Kuper K. Chapter 29. Intravenous to Oral Therapy Conversion. *Competence Assessment Tools for Health-System Pharmacies Fourth Edition*, Copyright, 2008, ASHP.
 10. Micromedex online, accessed September 30, 2012
 11. Lexi-comp online accessed September 30, 2012
 12. Wright, Chanin et al. "Clinical Pharmacology and Pharmacokinetics of Levetiracetam." *Frontiers in Neurology* 4 (2013): 192. PMC. Web. 8 July 2015.
 13. Considerations for PO to IV dose conversions. *Pharmacist's Letter/Prescriber's Letter* 2010;26(9):260912.
 14. Jonklaas J, Bianco AC, Bauer AJ et al. Guidelines for the Treatment of Hypothyroidism. *Thyroid* 2014; 24(12): 1670-1751.
 15. Institute for Safe Medication Practices (ISMP). *Acute Care ISMP Medication Safety Alert!* 2019;24(12): 4-5.
- B. Original Document:
1. Owner:
 2. Author and date: Emily Mui, Pharm.D. BCPS; 5/2012
 3. Stored in: Pharmacy – Departmental Manual
- C. Distribution and Training Requirements:
1. New documents or any revised documents will be distributed to Department Manual holders. The department/unit/clinic manager will be responsible for communicating this information to the applicable workforce members.
- D. Review and Renewal Requirements:
1. This policy will be reviewed and/or revised every three years or as required by change of law or practice.

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E. Review and Revision History:

1. Denise Gin, Pharm.D, BCPS; Lina Meng, Pharm.D. BCPS; Craig Sterling, Pharm.D.; Paul Mohabir, M.D.; Thomas Weiser, MD, MPH: 12/2012
2. Lina Meng, Pharm.D., BCPS, Cherwyn Flores, Pharm.D., Emily Mui, Pharm.D., BCPS: 8/2014
3. Lina Meng, Pharm.D., BCPS: 2/2015
4. Janjri Desai, Pharm.D., MBA, BCPS, Lina Meng, Pharm.D., BCPS, Emily Mui, Pharm.D., BCPS: 08/2015
5. Janjri Desai, Pharm.D., MBA, BCPS; Esther Kimm, Pharm.D. 12/2017
6. Jamie Kuo, PharmD, BCCCP, Emily Mui, PharmD: 08/2019

F. Approvals:

1. Pharmacy and Therapeutics Committee: 05/2012
2. Pharmacy and Therapeutics Committee: 02/2013
3. Pharmacy and Therapeutics Committee: 02/2015
4. Pharmacy and Therapeutics Committee: 09/2015
5. Pharmacy and Therapeutics Committee: 01/2018
6. Pharmacy and Therapeutics Committee: 08/2019

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