1.9. Lithium

Table 1.9-1. Lithium Dosage Forms

Formulation/Brand	Salt Form (S = 1)	Dosage Unit (1 mEq = 1 mmol)	F
Oral Tablets			
Generic lithium carbonate	Carbonate	300 mg/8.12 mEq	~1.0
Oral Capsules			
Generic lithium carbonate	Carbonate	150 mg/4.06 mEq	~1.0
Generic lithium carbonate		300 mg/8.12 mEq	~1.0
Generic lithium carbonate		600 mg/16.24 mEq	~1.0
Extended-Release Tablets			
Generic lithium carbonate	Carbonate	300 mg/8.12 mEq	~1.0
Lithobid (slow release)		300 mg/8.12 mEq	0.8
Generic lithium carbonate		450 mg/12.18 mEq	0.97
Oral Syrup			
Generic lithium citrate	Citrate	5 mL/8 mEq	1.0

Table 1.9-2. Select Drug–Drug Interactions

Drug	Affected Pharmacokinetic Parameter	Clearance Factor
Indomethacin	Renal clearance	0.62–0.83
ACE inhibitors	Renal clearance	<50 years; 0.87
		≥50 years; 0.69
Thiazide diuretics	Renal clearance	0.32–0.74

Dosing Strategies

Numerous equations and dosage prediction methods have been proposed to help clinicians identify an appropriate lithium dose for desired therapeutic concentrations.

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Dosage and Clearance Prediction Using Demographics

The most common characteristics used for prediction methods include estimations of renal function, age, and body weight as represented by the method of Zetin et al.[1]

$$Dose(mg/day) = 486.9 + (746.83 \times desired\ concentration)$$
$$- (10.08 \times age) + (5.95 \times weight) + (92.01 \times status)$$
$$- (147.8 \times sex) - (74.73 \times TCA)$$

where desired concentration is in mEq/L, age in years, actual body weight in kg; status is 1 for inpatient, 0 for outpatient; sex is 1 for male and 0 for female; and tricyclic anti-depressant (TCA) is 1 for concomitant TCA administration or otherwise 0 for none.

Pepin et al.[2] devised a prediction method based on their population pharmacokinetic findings that lithium clearance is related to estimated creatinine clearance (CrCl).

$$CL_{Li} = 0.235 \times CrCl$$

Units for CL_{Li} are the same as those used for CrCl.

The method of Jermain et al.[3] predicts lithium clearance based on population pharmacokinetics.

$$CL_{Li} = [0.0093_{(L/hr/kg)} \times LBW] + (0.0885 \times CrCl)$$

where LBW is the lean body weight in kg and CrCl is the estimated creatinine clearance *in liters per hour*.

References

1. Zetin M, Garber D, De Antonio M, et al. Prediction of lithium dose: a mathematical alternative to the test-dose method. *J Clin Psychiatry.* 1986;47:175–8.

2. Pepin SM, Bake DE, Nance KS, et al. Lithium dosage calculation from age, sex, height, weight, and serum creatinine. Paper presented at 15th Annual ASHP Midyear Clinical Meeting. San Francisco, CA; 1980 Dec 9.

3. Jermain DM, Crismon ML, Martin ES. Population pharmacokinetics of lithium. *Clin Pharm.* 1991;10:376–81.

4. Perry PJ, Alexander B, Dunner FJ, et al. Pharmaco-kinetic protocol for predicting serum lithium levels. *J Clin Psychopharmacol.* 1982;2:114–8.

Self-Assessment Problems

1. A 45-year-old male patient who weighs 92 kg and is 5'10" tall is to be started on regular release lithium carbonate tablets. He is exhibiting signs of acute mania. Laboratory results include a measured creatinine clearance of 80 mL/min.

    A. Design an every 12 hour dosage regimen using the Pepin and Jermain methods to target a concentration of approximately 1 mEq/L.

    B. What would be the impact of using Lithobid instead of regular release lithium carbonate tablets?

    C. The patient visits your clinic and has a blood pressure measured of 150/90 mmHg. He is started on hydrochlorothiazide 25 mg daily. What potential impact would this have on his lithium concentrations (assume his measured steady state concentrations at 12 hours after dosing are 1 mEq/L)? Would you suggest any alterations in the lithium dosing and monitoring?

2. A patient has been receiving 450 mg of lithium carbonate capsules every 12 hours. A steady state lithium concentration (12 hours after a dose) is determined to be 1.2 mEq/L. She is changed to 600 mg every 12 hours of Lithobid. What impact would you predict this would have on the steady state concentration, measured 12 hours after a dose?