Procainamide for Wide Complex Tachycardia

Introduction

1. Ventricular tachycardia (VT) is an uncommon but dangerous medical condition, with an extremely variable clinical presentation.
2. Intravenous procainamide is guideline recommended and is the drug of choice for the treatment of hemodynamically stable VT with a class IIa recommendation.
3. Procainamide is an old drug with new evidence that supports it's use but dosing strategies and administration techniques makes it difficult to use at the bedside.

Pharmacology

Procainamide	
Dose and administration	Bolus Dosing • 10-17 mg/kg over 20-60 minutes (Max dose suggest 1g and max rate of 20-50 mg/min) or • 100 mg every 5 minutes at max rate of 50 mg/min to max dose 1g Renal Adjustments • eCrCl 10-50 ml/min: Reduce initial dosing by 25-50 % • eCrCL < 10 ml/min: Reduce initial dosing by 50-75% Maintenance Infusion Dosing • 1-6 mg/min
Mechanism of Action	• Class 1A anti-arrhythmic that binds to fast sodium channels inhibiting recovery after repolarization. It also prolongs the action potential and reduces the speed of impulse conduction
PK/PD	• Onset: IV <2 minutes; IM 10-30 minutes • Time to Peak: IV 25-60 minute; IM 15-60 minutes • Duration: IV/IM: 3-4 hours • Metabolism: Converted by the liver to N-acetylprocainamide (NAPA), an active compound • Half-life: 2.5– 4.7 hr (NAPA— 7 hr); increased in renal impairment • Excretion: 40– 70% excreted unchanged by the kidneys
Adverse Effects	• Hypotension • Hepatotoxicity • Positive ANA titer • Lupus-like syndrome • Anaphylaxis caused by sulfite salt • Myasthenia gravis exacerbation • Angioedema
Drug Interactions and warnings	• Interacts with diazepam, diltiazem, milrinone, phenytoin, and hydralazine
Compatibility	• Compatible in ○ 0.9 % Sodium Chloride and 0.45% sodium chloride, • Incompatible with ○ D5 (depending on procainamide concentration), LR, and D5NS
Comments	• Define hospital's dosing and administration policy as there is a risk for adverse event's due to multiple dosing strategies in the literature

Overview of Evidence

Author, year	Design/ sample size	Intervention & Comparison	Outcome
Ortiz, 2017	Randomized controlled trial n= 62	• IV procainamide 10 mg/kg over 20 min • IV amiodarone 5mg/kg over 20 min	• Major cardiac adverse occurred in **3 of 33 (9%) procainamide and 12 of 29 (41%) amiodarone patients.** • Tachycardia terminated within 40 min in 22 **(67%) procainamide and 11 (38%) amiodarone patients.**
Maril, 2010	Multicenter cohort study n= 187	• IV Amiodarone 2 mg/kg infusion at a rate of at least 10 mg/ min • IV Procainamide 10 mg/kg infusion at a rate of at least 15 mg/ min	• The rates of VT termination **were 25% (13 / 53) and 30% (9 / 30) for amiodarone** and procainamide, respectively.
Komura, 2010	Retrospective analysis n= 90	• IV Procainamide 100 mg over 1–2 min • IV Lidocaine bolus of 50 mg	• Procainamide and lidocaine terminated VTs in 53/70 **(75.7%) and in 7/20 (35.0%) respectively.**
Maril, 2006	Retrospective case series n= 33	• IV Amiodarone 150 mg over 15 minutes	• **Amiodarone rate of successful ventricular tachycardia termination was 8 of 28 (29%).** • Two of 33 patients (6%) required direct current cardioversion for presyncope or hypotension temporally associated with amiodarone treatment.
Gorgels, 1996	Randomized parallel study n= 79	• IV Procainamide 10 mg/kg • IV Lidocaine 1.5 mg/kg	• **Lidocaine terminated 6 of 31 VTs and procainamide 38 of 48 (p <0.001).** • A comparison of the QRS width and QT interval before and at the end of the injection revealed **significant lengthening of these values after procainamide** but no change after lidocaine.
Callans, 1992	Observational study n= 15	• IV Procainamide rate of 50 mg/min until the arrhythmia terminated or a total dose of 15 mg/kg	• Procainamide was well tolerated and resulted in **termination of ventricular tachycardia in 93% of patients** after administration of 100 to 1,080 mg (median dose 600 mg).

References

1. Procainamide. Micromedex [Electronic version].Greenwood Village, CO: Truven Health Analytics. Retrieved July 6, 2020, from http://www.micromedexsolutions.com/
2. Long B, Koyfman A. Best Clinical Practice: Emergency Medicine Management of Stable Monomorphic Ventricular Tachycardia. J Emerg Med 2017;52:484-492.
3. Ortiz M, Martín A, Arribas F, et al. Randomized comparison of intravenous procainamide vs. intravenous amiodarone for the acute treatment of tolerated wide QRS tachycardia: the PROCAMIO study. Eur Heart J. 2017;38(17):1329-1335. doi:10.1093/eurheartj/ehw230
4. Marill KA, deSouza IS, Nishijima DK, et al. Amiodarone or procainamide for the termination of sustained stable ventricular tachycardia: an historical multicenter comparison. Acad Emerg Med. 2010;17(3):297-306. doi:10.1111/j.1553-2712.2010.00680.x
5. Komura S, Chinushi M, Furushima H, et al. Efficacy of procainamide and lidocaine in terminating sustained monomorphic ventricular tachycardia. Circ J. 2010;74(5):864-869. doi:10.1253/circj.cj-09-0932
6. Marill KA, deSouza IS, Nishijima DK, Stair TO, Setnik GS, Ruskin JN. Amiodarone is poorly effective for the acute termination of ventricular tachycardia. Ann Emerg Med. 2006;47(3):217-224. doi:10.1016/j.annemergmed.2005.08.022
7. Gorgels AP, van den Dool A, Hofs A, et al. Comparison of procainamide and lidocaine in terminating sustained monomorphic ventricular tachycardia. Am J Cardiol. 1996;78(1):43-46. doi:10.1016/s0002-9149(96)00224-x
8. Callans DJ, Marchlinski FE. Dissociation of termination and prevention of inducibility of sustained ventricular tachycardia with infusion of procainamide: evidence for distinct mechanisms. J Am Coll Cardiol. 1992;19(1):111-117. doi:10.1016/0735-1097(92)90060-z
9. Wellens HJ, Bär FW, Lie KI, Düren DR, Dohmen HJ. Effect of procainamide, propranolol and verapamil on mechanism of tachycardia in patients with chronic recurrent ventricular tachycardia. Am J Cardiol. 1977;40(4):579-585. doi:10.1016/0002-9149(77)90074-1