

tachycardia only after administration of α -adrenergic receptor blockers and sufficient volume expansion to avoid the potential for hypertensive crisis because of unopposed stimulation of α -adrenergic receptors. There is no evidence to support the preference of β 1-selective adrenergic receptor blockers over nonselective β -adrenergic receptor blockers. Labetalol, as a mixed α and β receptor antagonist, should not be used as the initial therapy because it can result in paradoxical hypertension and hypertensive crisis given the 1:5 or 1:9 ratio of α to β antagonist action. Methyl-paratyrosine (metyrosine) inhibits catecholamine synthesis and may be used in combination with α -adrenergic receptor blockers for a short period before surgery to further stabilize blood pressure (BP) or used to help control symptoms related to catecholamine excess in those with mPPGL. Use of metyrosine is controversial with varying data. It has been shown in 1 study that, when used in combination with phenoxybenzamine, there were large hemodynamic swings with a wider range of intraoperative BP variations than those treated with phenoxybenzamine alone with no

differences in postoperative outcomes,⁷⁸ whereas another study showed this combination to improve intraoperative hemodynamic stability and was associated with decreased cardiovascular morbidity.⁷⁹ Metyrosine is expensive, is not readily available, and has significant adverse effects, and as a result, it is being used less in clinical practice. Independent of medication regimen, treatment should also include a high-sodium diet and increased fluid intake. Preferred drugs and dosing recommendations are shown in Table 5.

It should be noted that a large observational case series of 110 patients with and 166 patients without α -blockade from 1 center found no differences in maximal intraoperative systolic BP and only a minor difference in mean maximal systolic arterial pressure between groups.⁸⁰ Of course, both groups had experienced anesthesiologists well prepared for treating PPGL for the surgical cases. Interestingly, 1 retrospective case series showed no difference in outcomes whether α -blockade was used perioperatively or not,⁸¹ claiming that the anesthesiologist

TABLE 5. Medications Commonly Used for Hemodynamic Control in Patients With PPGL

Class of Drug	Drug Name	Average Dosing	Special Issues	Common Adverse Effects
α-Blockers				
Selective α 1 blockers	Doxazosin	2–8 mg given every 12–24 h	Less potent than nonselective α -blockers	Orthostatic hypotension, dizziness, tachycardia
	Prazosin	2–5 mg given every 8 h	Less potent than nonselective α -blockers	Orthostatic hypotension, dizziness, tachycardia
	Terazosin	4–8 mg given every 12–24 h	Less potent than nonselective α -blockers	Orthostatic hypotension, dizziness, tachycardia
Nonselective α -blocker	Phenoxybenzamine	10–20 mg given every 8–12 h	Expensive, supply limited at times; irreversible binding to α receptors	Orthostatic hypotension, nasal congestion, tachycardia
β-Blockers				
Selective β 1-blocker	Metoprolol tartrate	25–50 mg given every 12 h	Aim for heart rate <90/min	Fatigue, dizziness, asthma exacerbation
	Atenolol	25–50 mg given once or twice daily	Aim for heart rate <90/min	Fatigue, dizziness, asthma exacerbation
Nonselective β -blocker	Propranolol	20–40 mg given every 8–12 h	Aim for heart rate <90/min	Fatigue, dizziness, asthma exacerbation
α-Blockers and β-blockers				
	Labetalol	200–2400 mg daily	Used only after the α -blocker as labetalol is a more potent β than α antagonist	Fatigue, dizziness
	Carvedilol	6.25–50 mg given every 12 h	Used only after the α -blocker as carvedilol is a more potent β than α antagonist	Fatigue, dizziness
Calcium channel blockers				
	Amlodipine	5–10 mg daily	Nondihydropyridine calcium channel blocker preferred	Edema, headache
	Nifedipine	30–60 mg given every 12 h	Nondihydropyridine calcium channel blocker preferred	Edema, headache
Tyrosine hydroxylase inhibitor				
	Metyrosine	250–500 mg titrated up to every 6 h	It inhibits the regulatory enzyme of the catecholamine synthesis; not always available, expensive	Severe fatigue, extrapyramidal neurologic adverse effects, nausea, diarrhea, anxiety