double the dose of pantethine used for that stage: 1000 mg at stage 1, 2000 mg at stage 2, 3000 mg at stage 3. When lecithin is substituted for choline bitartrate we use a non-GMO soy lecithin which contains 1000 mg of choline per tablespoon (Table 1).

Indications

MAP is indicated for any tachyarrhythmia, including sinus tachycardia, atrial tachycardia, supra-ventricular tachycardia, atrial fibrillation, atrial flutter, and accelerated ventricular rhythms, provided there are no contraindications with other aspects of treatment. MAP is also indicated for ectopic arrhythmias such as premature atrial contractions (PACs) and premature ventricular contractions (PVCs). MAP is appropriate as adjuvant therapy in the vast majority of circumstances; however, potential interactions with other treatments and medications should always be scrutinized. Patients should be closely monitored for adverse events during initiation and dose escalation. Several noncardiac indications for MAP also exist, including anxiety, hyperactivity, reactive attachment disorder, PTSD, and other deficits of neurotransmitter and ANS balance.

Side Benefits

There are several potential side benefits to supplementation with choline and pantethine or PA. Patients who take methotrexate or who have defects in folate or choline metabolism are known to have a higher dietary requirement for choline.[7] Those who take oral contraception, estrogen, or progestin may have an increased requirement for pantothenic acid.[5]

Choline is important in several aspects of cardiovascular health. It is vital in the endothelial functions that regulate blood pressure; choline insufficiency has been implicated in atherosclerosis, and it has been shown to lower levels of homocysteine.[8,30–32] It may help to control severity and need for medication in asthma.[33,34] Choline may lower the incidence of neural tube defects.[14,35] It may have a positive effect on several neurological conditions and processes, including psychiatric disorders, dementia, memory, and cognition.[36–39] Diets deficient in choline induce fatty liver disease, and oral consumption of choline has been shown to help reverse fatty liver disease in several studies.[40–42] Therefore, it is an important therapy in patients with this condition or at risk for it due to other conditions such as metabolic syndrome. Several studies have linked the importance of dietary choline to the prevention of colon, breast, and other cancers.[43–45] Pantethine may improve responses to stress.[46] Pantethine has been shown to improve LDL cholesterol and triglyceride levels in repeated research at doses of at least 600 to 900 mg/day.[47–51]

Contraindications and Side Effects

It is theoretically contraindicated to use MAP in cases of bradycardia and bradydysrhythmias or in conditions in which increasing the refractory period of the SA or AV node would be contraindicated such as first, second, or third degree AV heart blocks, SA node exit blocks, sinus pauses, and sinus arrest. There are no known interactions between choline and other supplements, drugs, diseases, conditions, or lab tests.[52] The most concerning possibility for interactions between pantethine or PA and other drugs, supplements, and conditions is in anticoagulation/antiplatelet therapy and bleeding disorders.[53,54] Extreme caution should be used in these circumstances and best practices would dictate counseling patients to discontinue use of pantethine two weeks before surgery.[53]

Choline can cause adverse reactions including sweating, gastrointestinal distress, nausea, vomiting, diarrhea, and a fishy body odor.[7] Guidelines indicate that daily choline doses should not exceed 3500 mg per day in adults; however, doses of 12,000 to 16,000 mg/day have been used in a study on seizure disorders and doses of 7500 mg/day in a study on high blood pressure, both without significant adverse events.[7,55] A single prospective investigation found an association between high choline diets and colorectal adenomas in women, though this observation may have been attributable to any of several other factors.[56] People

Table 2: MAP – Summary of Cases 1–3

Patient	Presentation	Objective Findings	Final MAP Dose	Other Treatments	Final Outcome on Stable MAP
44 yo female	Ten years of palpitations, two week exacerbation palpitations, occurring every 30 seconds.	ECG: accelerated junctional rhythm with nonspecific ST changes.	Stage 1: PA 1000 mg/ Lecithin 2000 mg	None	After one week: normal ECG. After one month: only a single episode of palpitations over the previous two-week period.
29 yo male	Ten month history of palpitations, 30 seconds in duration, up to three times daily, worse post-exercise, worse anxiety, especially test anxiety.	Exercise stress test: atrial bigeminy and quadrigeminy, up to 13 PACs/min, ectopic atrial pacemaker, inappropriate blood pressure response to exercise.	Stage 2: Pantethine 1000 mg / Choline bitartrate 4000 mg	B complex vitamin 2/d, magnesium glycinate 480 mg/d, botanical formula 2 mL, 3×/d; all of these unchanged since MAP stage 1.	After one month: no palpitations or arrhythmic beats, no complaints or symptoms postexercise, before or during stressful events or exams.
59 yo female	3 months of palpitations, "flutters" lasting up to a week or more.	ECG: persistent ectopic rhythm. Holter monitor: atrial tachycardia, premature atrial and ventricular beats.	Stage 2: Pantethine 1000 mg/Choline bitartrate 4000 mg	Quetiapine 12.5 mg/d, tyrosine 1000 mg/d 5-HTP 300 mg/d, methylfolate 3.75 mg/d; all since before MAP initiation.	After two weeks: self report of "significant improvements" in palpitations and symptomatic heartbeats.