

Preeclampsia-induced Hyponatremia, Hypokalaemia, Hypocalcemia and Hypomagnesemia

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Abstract

Preeclampsia is hypertensive complication that occur during pregnancy where elevated blood pressure in mother and baby. Generally, it occurs during 3rd trimester of gestational period, it is characterised by vasospasm, vasoconstriction, elevated blood pressure by the increased sensitivity of substances like aldosterone, endothelin, prostaglandin E₂, angiotensin-II, TRMP6 genes which causes electrolytes imbalances in maternal body. Conditions like hyponatremia, hypokalaemia, hypomagnesemia, hypocalcaemia are mostly commonly associated with preeclampsia. So, during this therapy potassium, calcium & magnesium are given, while sodium is restricted to minimize further progression of preeclampsia.

Introduction

Usually, hypertensive syndromes that occur during pregnancy, mainly like Preeclampsia, which result in risk for both maternal and child [1]. These syndromes are causal factors related to maternal health and serious problem resulting from associated prematurity [2]. Hypertensive disorders are a common complication of pregnancy that put women and their foetus at disproportionate risk [3]. These hypertensive disorders of pregnancy and in particular preterm preeclampsia is also associated with substantial risk for cardiovascular disease (CVD) and cerebrovascular disease [3]. Normally during gestation hypertension is diagnosed only after 20 weeks of gestation. During the delivery the most of the symptoms are resolved, only certain complication cases the preeclampsia can be persist after delivery also [4]. Preeclampsia induced maternal complications includes increase maternal cardiovascular, Metabolic, cerebrovascular disease premature mortality [5]. Preeclampsia induced neonatal complications includes secondary iatrogenic preterm delivery, increase risk of fetal growth restriction, placenta abruption, respiratory distress syndrome, bronchopulmonary dysplasia, retinopathy of prematurity, necrotizing enterocolitis, neurodevelopmental delay, fetal or neonatal death [6]. Pathophysiology includes due to poor placentation secondary to abnormal trophoblast invasion and spiral artery remodelling which leads to placental ischemia and leads to activation of maternal immune-mediated response and release of anti-angiogenic factors and leads to angiogenic imbalance, immune mediated exaggerated, inflammatory response, and endothelial cell dysfunction [7]. Pregnant women are prone to high volume losing electrolytes more rapidly [Table 1].

Discussion

Role of sodium, potassium, magnesium & calcium

Sodium

1. It maintains a normal balance of fluids and minerals in the body
2. It helps in development of nervous in premature babies
3. Monitoring of sodium intake during severe morning sickness and hyperemesis gravidarum

Potassium

1. It maintains Muscle communication, electrolyte balance, optimal fetal growth

2. It works with sodium to maintain proper fluid balance
3. Foods like sweets potatoes, tomatoes, kidney beans, bananas, dried fruits, yogurt, spinach, broccolis should be included in diet.

Magnesium

1. It maintains proper Mood, sleep, bone health, hydration.
2. It maintains normal blood pressure, protein synthesis, muscle and nerve functions & bone strength in babies
3. It reduces risk of still birth, fetal growth restrictions & preeclampsia.
4. Foods like nuts, seeds, grains, green leafy vegetables and beans should be included in diet.

Calcium

1. It supports musculoskeletal nervous (teeth and bone development in babies) & circulatory systems (reduces risk of hypertensive

Table 1: Pregnant women are prone to high volume losing electrolytes more rapidly.

Electrolytes	Normal ranges		
	1 st trimester – 1 st week – end of 12 th week	2 nd trimester – 13 th week – end of 26 th week	3 rd trimester – 27 th week – end of pregnancy
Sodium	135 – 139 mEq/L	131 – 136 mEq/L	134 – 137 mEq/L
Potassium	3.6 – 5.0 mEq/L	3.3 – 5.0 mEq/L	3.3 – 5.1 mEq/L
Magnesium	1.6 – 2.2 mg/dL	1.5 – 2.2 mg/dL	1.5 – 2.2 mg/dL
Calcium	8.8 – 10.6 mg/dL	8.2 – 9.0 mg/dL	8.2 – 9.7 mg/dL

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Table 2: Hypertremia induced preeclampsia.

Electrolytes imbalance	Causes	Mechanism
Hypertremia	Water and electrolytes imbalance	Increased sensitivity of vasopressor substances like aldosterone decreased cyclic GMP endothelin and PGE2 leads to sodium retention and potassium depletion
Hypokalaemia	Vomiting, diarrhoea, excess you use for diuretics	Increased sensitivity of aldosterone leads to potassium depletion
Hypocalcaemia	Hypoparathyroidism	Disrupted calcium homeostasis can lead to altered vasoconstriction and decreased intracellular calcium in smooth muscle cells resulting increased sensitivity of angiotensin-II leads to vasoconstriction and hypertension
	Calcium deficiency	
Hypomagnesaemia	Little intake of magnesium	Increased sensitivity of TRPM6 at 12 weeks gestation leads to magnesium depletion.
	Excessive loss of magnesium through kidneys and gastrointestinal tract	
	Mutations of TRPM6 genes	

Table 3: General treatments include Anti-Hypertensive, Anti-Convulsant & Corticosteroids to patients.

Symptoms	Treatment
Increased BP	Hydralazine (increased risk of maternal hypotension)
	Labetalol
	Nifedipine
	Sodium nitroprusside (emergency condition, but cyanide crosses placenta fatal toxicity)
Proteinuria	Eat less protein
	Decreased salt intake
	Eat more fibre
	Physical exercise
	Regularly checking blood sugar & GFR blood tests
Thrombocytopenia	Platelet Transfusion
Increased liver enzymes	Ursodeoxycholic acid (15mg/kg/day)
Severe headache	Practise good sitting posture
	Some amount of rest & relax
	Eat well balanced diet
	Ice pack on head
	Drink plenty of water
Shortness of breath	Get enough sleep
	Nasal saline sprays/ prescription nasal steroids
	Practising good posture
	Sleeping with pillows and supporting the upper back
Nausea & vomiting	Practising breathing technique
	Anti-emetics drugs
Edema particularly in your face & hands	Avoid standing for long periods
	Wear comfortable shoes and socks
	Try to rest with your feet up
	Drink plenty of water
	Decreased salt intake
	Anti-diuretics drugs

Changes in vision	Start eating healthy foods
	Regular exercise
	Get enough sleep, rest to eyes
	Lubricating drops
	It improves after giving birth

disorders, risk of preterm delivery, risk of postpartum haemorrhage)

2. It also maintains normal heart rhythm & blood clotting abilities in babies
3. During 2nd and 3rd trimester the calcium requirement is high
4. Foods like fishes (salmon, sardines), dairy products, leafy vegetables, legumes and seeds should be included in diet.

Mechanism

Hypertremia induced preeclampsia –water and electrolytes leading to sodium retention and potassium depletion which leads to peripheral vascular resistance hypertension, hypomagnesaemia, hypocalcaemia Hypokalaemia induced preeclampsia – during vomiting conditions eliminates acid, and causes metabolic alkalosis, and leads to potassium loss [8]. Hypocalcaemia induced preeclampsia – calcium plays a crucial role in the function of vascular smooth muscles [9]. Alternation of plasma calcium concentration leads increase in Blood pressure [10]. Hypomagnesaemia induced preeclampsia – magnesium act as a co-factor of many enzymes NA⁺, K⁺ATPase involved in peripheral vasodilation [11]. Ca⁺, Mg⁺ which acts relaxants effect on blood vessel of pregnant women [12]. Both magnesium and sodium are known to decrease intracellular calcium which leads to smooth muscle contraction. Leads to elevated blood pressure [Table 2].

Pharmacotherapy

(i) Non-pharmacological therapy

1. Regular exercise to be done
2. Drink 5-8 glasses of water daily
3. Eat healthy food (leafy vegetables & fruits)
4. Avoid fried foods and junk food

5. Elevate your feet during the day several times
6. Avoid alcohol, caffeine etc.,

Pharmacological therapy

General treatment includes Anti-Hypertensive, Anti-Convulsant & Corticosteroids to patients [13]. Magnesium sulphate which is mostly commonly used in preeclampsia which shows a relaxant effect on umbilical arterial tone leading to vasoconstriction effect on angiotensin-II and endothelin-I in foetal placental vasculature in mother [13]. According to FDA class of drugs like category-A, B, C are given to preeclampsia patients while D & X are avoided drugs [Table 3].

Conclusion

Hyponatremia, Hypokalaemia, Hypocalcaemia & Hypomagnesaemia are mainly electrolytes imbalance in preeclampsia condition [14]. Constant monitoring of serum electrolytes should be done to preeclampsia patients [15]. So, supplementation like potassium, calcium, magnesium and control restriction on sodium should be done to decrease progression of preeclampsia [16].

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