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Editorial

Vagus Nerve Stimulation Could be an Adjunctive Therapy in the Management of Moderate to Severe Gestational Diabetes Mellitus

Gopal Krushna Pal[1,*], Manoharan Renugasundari[2]

[1]Editor-in-Chief, IJCEP and Executive Director, All India Institute of Medical Sciences (AIIMS), Patna, INDIA.
[2]Associate Editor, IJCEP and Tutor, Department of Physiology, All India Institute of Medical Sciences (AIIMS), Patna, INDIA.

Gestational Diabetes Mellitus (GDM) is any degree of glucose intolerance with onset or first recognition during pregnancy. In the past ten years, the prevalence of GDM has increased to nearly 20%, making it likely that one in every five pregnant women will have GDM. Prevalence of GDM is 17.8% in urban, 13.8% in semi urban and 9.9% in rural India. Due to lifestyle, Indian women are at 11-fold increased risk of GDM. Obesity or being overweight is increasing in young girls which increases the risk for GDM. In 90% cases, GDM disappears after delivery, but 50% of women may develop diabetes in 5-10 years. Increased blood glucose diagnosed in the 1st trimester increases the risk of congenital malformation. Elevated glucose levels during pregnancy raises the likelihood of having a big size fetus, which requires delivery usually by caesarean section. Later, type 2 diabetes and cardiovascular disease develop in women with GDM. Additionally, it raises the infants' risk of macrosomia and subsequent obesity or diabetes.[1] Women with GDM are additionally bound to have recurrent GDM in ensuing pregnancies. In antenatal care programs, the need to concentrate on its prevention, early detection, medical management, and lifestyle changes is highlighted by the high prevalence of GDM even in low-income populations. Though mild GDM is treated mostly by nutrition therapy (Diet Management), moderate to severe GDM requires insulin therapy. Usually, insulin therapy in the later part of pregnancy is not very effective due to various reasons including sociocultural factors.

Vascular dysfunction is linked to GDM. Glucose and insulin have an impact on Sympathetic Nervous System Activity (SNA), which is an important regulator of vascular function. Even though there have been previous reports of increased sympathetic activity in the later part of the pregnancy, there have also been recent reports of vagal withdrawal in GDM.[2] Insulin resistance and diabetes during pregnancy are contributed by decreased vagal activity, which reduces insulin secretion and sensitivity. As a result, any strategy to increase vagal strength will lessen the severity of GDM and improve fetomaternal outcomes in this common pregnancy disorder.

The vagus nerve plays a significant role in the maintenance of metabolic homeostasis, and assumes a key part in the regulation of neuroendocrine-immune axis, especially during states of glucose alterations. In GDM, stimulating the vagus nerve increases insulin sensitivity and insulin secretion. Vagus nerve stimulation can be used generally to describe any technique that stimulates the vagus nerve, including manual or electrical stimulation.

Numerous studies have demonstrated the efficacy of Vagus Nerve Stimulation (VNS) in a variety of disorders.[3,4] Researchers are increasingly focusing on electrical vagal nerve stimulation, and also on non-invasive procedures. Preliminary reports have shown promising results for VNS in the treatment of stroke, autoimmune diseases, heart and lung failure, obesity, pain management, and diabetes. VNS has been shown to be useful in the treatment of a number of diseases and has been used quite effectively for the treatment of epilepsy and depression in adults.[3,4]

The VNS controls the inflammatory tone by altering the release of pro-inflammatory and anti-inflammatory cytokines through a variety of pathways, including the hypothalamic-pituitary-adrenal axis, splenic sympathetic anti-inflammatory pathway, and cholinergic anti-inflammatory pathway. Inflammation is a common factor in etiopathogenesis of many clinical disorders. Through the hypothalamic-pituitary-adrenal axis, VNS reduces stress by lowering cortisol secretion. Both splenic sympathetic anti-inflammatory pathway and the cholinergic anti-inflammatory pathway control TNF-α and Ach expression and reduce inflammation.[5] In an experimental model of Type 2 diabetes mellitus, study has demonstrated that it may be useful in controlling blood glucose levels.[6] According to Huang F *et al.* patients with impaired glucose tolerance and pre-diabetes may benefit from VNS.[7] Yin *et al.* hypothesized that increasing GLP-1 release from the intestine and increasing insulin release from the pancreas, as well as improving sympathovagal balance, could be the mechanisms by which the VNS reduce blood glucose.[8]

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Numerous studies on vagus nerve stimulation during pregnancy indicate that it is a safe treatment, which improves obstetric outcomes, and does not cause teratogenicity.[9] Despite the fact that VNS has the potential to be a promising therapeutic tool in a variety of clinical conditions and during pregnancy, the sample size of those studies was insufficient to reach any firm conclusions regarding the safety of VNS during pregnancy. As a result, it was suggested that a larger case series or randomized control trials be conducted to confirm the findings. In addition, there have not yet been any reports of effects VNS in GDM women. Therefore, it will be beneficial to have a method of VNS that is less risky for GDM women and easy to perform.

Recently we have reported that practice of yoga for 2 weeks in addition to the standard treatment reduces the cardiometabolic risks, psychological stress and improved quality of life and fetomaternal outcomes in GDM patients.[10] It is possible that yoga that includes primarily on slow pranayama improves vagal activity and insulin secretion, which in turn reduces the severity of GDM. Yoga practice as such promotes parasympathetic tone. The strength of vagal activation increases with increase in duration of expiration in slow pranayamas, resulting in improved vagal discharge and increased vagal tone. On practice of pranayama, cerebral blood flow and tissue oxygenation increases that improves neuronal activities of the brain centers. Improved hypothalamic function facilitates sympathovagal outflow by facilitating vagal discharge. Gradual increase in lung volume increases nerve traffic from thoracic cage proprioceptors that strengthens vagal tone through central limbic-hypothalamic influence. Practice of chandranadi pranayama (left nostril breathing) and anulom-viloma pranayama (alternate nostril breathing) effectively increases vagal tone and decreases sympathetic tone. Yoga practice during pregnancy, according to studies, helps with good pregnancy outcomes, fetomaternal outcomes, and ease of delivery. Yoga practice has been proposed to be a best method of noninvasive VNS, which could be the ideal methos of VNS in pregnancy.

Glycemic control and fetomaternal outcomes in GDM are poor in developing nations like India due to a variety of socioeconomic factors, one of which is poor treatment compliance. Therefore, strategies that include vagal nerve stimulation as an adjunct therapy, such as yoga, which is a non-pharmacological intervention, will improve cardiovagal modulation, fetomaternal outcomes, glycemic control in GDM women. However, effects of direct (invasive) VNS in GDM should be investigated to establish the efficacy of VNS in this common form of gestational problem. These strategies may be less cost-effective and more socially and psychologically acceptable for pregnant women.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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***Correspondence:**
Dr. Gopal Krushna Pal
Editor-in-Chief, IJCEP and
Executive Director, All India Institute of Medical Sciences (AIIMS), Patna-801507, INDIA.
Email: drgkpal@gmail.com

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