Editorial

COVID-19: POTENTIAL TREATMENT STRATEGY- EXPLORING REJUVENATION OF THE THYMUS AS AN OPTION

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Highlights
Children and COVID-19
The elderly and COVID-19
Rejuvenating the atrophic thymus
Zinc gluconate
Vitamin C
Vitamin E
Growth factor hormone
Treatment of other infections

Summary
Most cases of COVID-19 in children are mild and may not show severe symptoms of the disease before they overcome it. The thymus is essential for the development and maturation of T cells which help to reduce the rate of infections. The thymus is most active during neonatal life and early childhood. It begins a gradual process of reduction in size after puberty. It is hardly visible at old age where it has largely been replaced by fatlike substances. It's near absence or inactivity at old age may account for the high rate of deaths from COVID-19 in the elderly. There is a possibility that the activities of the thymus play a major role in the survival of children infected with SARS-CoV-2 and may account for the extremely low rate of death in children infected with the virus. Substances that can rejuvenate the thymus and lower the potential for its involution may be useful in the prevention and management of COVID-19 patients. Such substances include supplementation with zinc gluconate, vitamin E and high dose vitamin C. Other infections should be treated appropriately. These measures can serve as additional strategies in the reduction of the global burden of COVID-19.

Key words: COVID-19, SARS-CoV-2, Thymus, Vitamin C, Vitamin E, Zinc gluconate

INTRODUCTION

The thymus is present before birth and it is very active during the early stages of life (Janeway et al., 2001). It grows to reach its peak at puberty (Jacobs et al., 1999) after which it begins to regress and it is almost nonexistent in the elderly leaving a fatlike tissue substance behind. An ageing thymus is associated with loss of cellularity, loss of mass and loss of organization which result in atrophy. The risk for severe illnesses from COVID-19 increases with age just as the functionality of the thymus decreases with increase in age. People above 65 years of age are at higher risk for severe illness from COVID-19 than younger people below the age of 18 years who have active thymus. The people with the greatest risk for severe illness from COVID-19 are those aged 85 years or older. 80% of COVID-19-related deaths reported in the United States as at 6th June 2020 were adults aged 65 years and older (CDC, 2020). Available statistics reveal that children are less likely to have severe cases of COVID-19. In a study in the U.S. between February 12 and April 2, 2020, less than 2% were observed in children younger than 18 years (CDC, 2020). This suggests that children are at low risk for severe disease or death from COVID-19 than adults. Data on clinical manifestations of COVID-19 show that the disease is generally milder in children compared with adults (Wei et al., 2020;Lu X, et al., 2020) although some children have had to be hospitalized for intensive care (Shekerdemian et al., 2020). Statistics from ECDC revealed that as at 6th August 2020, persons below the age of 19 years constitute less than 5% of the total cases in the EU/EEU and UK (ECDC, 2020). Most cases affecting children are mild or asymptomatic and are not detected or diagnosed before such children overcome the disease. For this reason, children are much less likely to be hospitalized or have fatal outcomes with COVID-19 (ECDC, 2020). However, children with underlying health conditions such as immune suppression, cancer, obesity and diabetes are at increased risk for severe disease (Sherkerdemian et al., 2020). Transmission of the virus from mother to newborn is not common (Cao et al., 2020), perhaps as a result of an active thymus during intrauterine life. Although most children infected with SARS-CoV-2 are mildly affected, they can transmit the virus to other persons (CDC, 2020). Thymic atrophy contributes to the development of immunosenescence. It is believed that age-associated thymic atrophy which occurs in older people leads to a gradual loss of the ability of the immune system to respond to infections as well as to vaccines (Savino, 2006). Treatments that have led to the rejuvenation of the thymus include growth factor hormone, some antioxidants, appropriate nutrition and treatment of infections.

Effects of the Antioxidants -Zinc gluconate, Vitamins C and E and Growth Hormone on the Thymus

Zinc is an essential trace element and its deficiency leads to thymic atrophy, immunological dysfunction and increased susceptibility to infections (Golden et al., 1997). A restoration of microarchitecture and weight in the atrophic thymus has been achieved with supplementation of zinc (Dardenne et al., 1993). The absence of zinc in diets has been found to contribute to the hypo cellularity of the thymus and elevated corticosterone levels. Fewer T cells have also been observed in the thymus of zinc deficient rats (Hosea et al., 2004) while zinc supplementation has been found to improve T-cell regeneration (Lovino, 2019). Naturally, zinc products often contain cadmium. A prolonged intake of high levels of cadmium can lead to renal failure. Therefore, supplements containing low levels of cadmium such as zinc gluconate are advised.

Long-term administration of high-dose vitamin C reduces age-associated thymic atrophy (Obukhova et al., 2009) and age-related thymic involution in aged mice. Vitamin C increases the number of T cells in peripheral blood and memory T cells in the spleen of mice. Naive T cells in peripheral blood lymphocytes, memory T-cell populations in splenocytes were all markedly increased in long-term high-dose vitamin C. Effective maintenance of the immune cells is partly through the suppression of age-related thymic involution (Uchio et al., 2015).

Vitamin E enhances T-cell differentiation. This is associated with increased binding capacity of thymic epithelial cells (TEC) to immature T cells via increased expression of adhesion molecule, ICAM-1 (Moriguchi et al., 1998). Vitamin E reduces prostaglandin E2 production from thymocytes and increases T cell differentiation in the thymus (Moriguchi et al., 1993).

The Keratinocyte growth factor hormone, Ghrelin improves the architecture, cellularity and output of the thymus (Min et al., 2007) and activates T cells in aged mice (Dixit et al., 2007). Thymic involution is notably observed around the time of puberty when sex steroid production increases. Thymic size is influenced by a series of hormones, including sex steroids and those involved in the hypothalamic-pituitary-adrenal axes (Moriguchi, 1993). It has been revealed that castration of male rodents results in significant enlargement of their thymus (Williams et al., 2008).

Infections with certain microorganisms contribute to loss in thymic cellularity and thymocyte depletion (Deobagkar-Lele et al., 2013; Borges et al., 2012). Treatment of these diseases enhances thymic cellularity.

CONCLUSION

The thymus appears to confer resistance to SARS-CoV-2 on children. A plan for the rejuvenation of the thymus with zinc gluconate, high dose vitamin C and vitamin E as well as treatment of underlining conditions may be useful in the prevention and treatment strategies for COVID-19 in the adults.

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