Review Article

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The Diabetic Crisis in India: Understanding and Preventing Diabetic foot Complications

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Introduction

India currently holds the unenviable title of the "Diabetic Capital of the World." With approximately 3.5 crore (35 million) diabetics in the country, this number is expected to surge to 5.2 crore (52 million) by 2025. Shockingly, every fifth patient visiting a consulting physician and every seventh patient visiting a family physician in India has diabetes. This alarming rise in diabetes prevalence has led the World Health Organization (WHO) to declare India as the epicentre of this global health crisis. Understanding the gravity of the situation, there is a growing emphasis on increasing patient knowledge about the disease and its complications as a means to enhance treatment compliance and reduce associated health risks.

Complications and Catastrophes: The Impact on Lower Extremities

Diabetes is fraught with various complications, and some of the most devastating affect the lower extremities. Research by Levin and O'Neal has estimated that a staggering 20% of all hospital admissions for diabetes are due to foot problems. More alarming still, Warren and Kihn found that 91.8% of lower extremity amputations were performed on people with diabetes, often as a result of gangrene, necrosis, and ulceration.

The underlying pathology of diabetic foot complications involves neuropathy, microvascular diseases, and macrovascular diseases. These conditions can occur in isolation or in various combinations, posing a significant risk for complications such as ulceration, gangrene, and infection. Patients with foot deformities are particularly vulnerable, as even slight pressure on fixed bony deformities can lead to ischemic necrosis and skin ulcers. Among these complications, neuropathy is a leading factor in diabetic foot ulceration. Despite extensive research, the exact cause of diabetic neuropathy remains uncertain. It is believed to result from metabolic defects triggered by high blood sugar levels and vascular changes that lead to nerve hypoxia. Evidence supporting hypoxia as a key factor includes reduced endoneurial blood flow, increased vascular resistance, and decreased production of nitric oxide by endothelial cells.

While microvascular dysfunction has been a primary focus, peripheral vascular disease also plays a significant role. Reduced blood flow to the limbs can exacerbate nerve ischemia, making peripheral neuropathy and peripheral vascular disease common etiological agents in diabetic foot ulcers.

Identifying Risk Factors and Sensory Neuropathy

Research by Ward JD highlighted that neuropathic ulceration and gangrene in diabetic feet occur due to a lack of sensation to painful stimuli. This lack of sensation, combined with the easy development of infections in high-pressure areas, can rapidly lead to tissue breakdown and abnormally fast blood flow, contributing to ischemia. Studies by Boulton AJ and Sosenko JM

emphasized the importance of sensory neuropathy as a key factor in foot ulcer development. Pressure threshold measurements were shown to be highly accurate in identifying foot ulcer patients, offering a simple and cost-effective method for detecting those at risk.

Common risk factors for ulceration include ill-fitting shoes/socks, acute mechanical trauma, stress ulcers, and paronychia. Preventive foot care is essential, as sensory loss and potential vascular complications significantly increase the risk of insensitive foot lesions in diabetic patients. Timely identification of at-risk individuals and education in preventive foot care is crucial. Additionally, the presence of diabetic foot ulcers is strongly associated with age and diabetic complications, including cardiovascular issues and neuropathy, which are critical factors related to amputation.

Prevention: The Key to Reducing Diabetic Foot Ulcers

Studies, such as those by Kumar S., Ashe HA et al. and Mayfield JA, Sugarman JR, have emphasized the importance of preventive measures. Detecting patients without protective sensation and providing them with protective footwear and education can prevent damage, although compliance remains a challenge. Nonetheless, offering adequate prevention measures to all people with diabetes at risk of foot ulcers and amputations can be a cost-effective and limb-saving strategy.

Multi-disciplinary Approaches and Understanding Pathogenesis

Multi-disciplinary management programs focusing on prevention education, regular foot examinations, aggressive intervention, and optional therapeutic footwear have demonstrated significant reductions in lower extremity amputations. In addition to risk factors, factors like increased peak plantar pressures, autonomic and motor neuropathy, limited joint mobility, and impaired wound healing contribute to diabetic foot ulcer formation. Understanding the pathogenesis of foot ulcers is essential for developing appropriate treatments.

Research by Viswanathan V from Chennai, South India, noted that recurrent foot infections are common among Indian diabetic patients, with a lower prevalence of peripheral vascular disease. This unique perspective underscores the need for region-specific approaches to diabetic foot care.

Conclusion

Diabetic foot complications present a grave challenge, particularly in India, the Diabetic Capital of the World. Understanding the intricate interplay of risk factors, sensory neuropathy, and vascular complications is vital for preventing diabetic foot ulcers and their catastrophic consequences. Early detection, patient education, and multi-disciplinary interventions are key strategies in mitigating the impact of this growing health crisis. Developing region-specific approaches to diabetic foot care will be essential in addressing this complex issue and improving the quality of life for millions of individuals living with diabetes in India.

References:

1. Levin ME, O'Neal LW. The Diabetic Foot. 3rd Ed. Vol. II, St.Louis CV Mosby Co. 1983; 1-55.
2. Warren R, Kinn R, A survey of lower extremity amputation for ischemia surgery. 1968; 63:107-20.
3. Bauman J, Girling J, Brand P Pantar, Pressures and tropical ulcerations. J Bone Joint Surgery 1963; 45B: 652-73.
4. Linger C, Albeanu D, Blois CJ, The tuning fork revisited. Diabetic Medicine, 1990; 7: 859-64.
5. Livingstone L. Use of the Doppler for ankle: Brachial index a literature review. J Brit Pod Med. 1994; 49: 27-8.

6. Boulton AJM, Malik RA, Arezzo JC et al. Diabetic Somatic neuropathy diabetic case. 2004; 27:1458-1487.
7. Ward JD, Tesfaye S. Pathogenesis of diabetic neuropathy in the textbook of diabetes, Vol. 2 (Pickup J, Williams SG Eds) Blackwell Science, Oxford UK, 1977; pp. 49.1-49.19.
8. Sterens' MJ, Feldmand EL, Green DA. The aetiology of diabetic neuropathy is the combined role of metabolic and vascular defects. Diabetes Med. 1995; 12: 566-579.
9. Tuck RR, Schmelzer JD et al., Endo neuronal blood flow and oxygen tension in the sciatic nerve of rats with experimental diabetic neuropathy. Brain 1984; 107: 935-950.
10. Tesfayes, Hams, et al., Impaired blood flow and arteriovenous shunting in human diabetic neuropathy a novel technique of nerve photography and fluorescein angiography. Diabetologia. 1993; 36:1266-1274.
11. J. Dward. Wien Klin Wochensche. Pub Med. 1984; 96 (1) : 17- 20.
12. Boulton AJ. Impaired Vibration perception and diabetic. Med. 1986; 3 (4); 335-7.
13. Sosenkoj M, Kato M. Comparison of quantitative sensory threshold measures for their association with foot ulceration in diabetic patients. Diabetic care. 1990; 13 (10): 1057-61.
14. Boulton AJ. Clinical presentation and management of diabetic neuropathy and foot ulcerations. Diabetic Med. 1991; 8: 352-7.
15. Kumar S, Asheha, Parnell LN, Fernando DS, Tsigos C, Young RJ. The prevalence of foot ulceration and its correlates in type II diabetic patients a population-based study. Diabetic Medicine. 1994; 11 (5): 480-4.
16. Mayfield JA, Sugarman JR. The use of Semmes – Weinstein monofilament and another threshold test for preventing foot ulceration and amputation in persons with diabetes. J Family Practice. 2000; 49 :11:17-29.
17. Viswanathan V. The diabetic foot: perspectives from Chennai, South India, Int J Low Extremity Wounds. 2007; 6(1): 34-6.
18. Lavvery LA, Peters EJ, Armstrong DG. What are the most effective interventions in presenting diabetic foot ulcers? INT. Wound Journal; 2008; 5 (3): 425-33.
19. Viswanathan V, Sivagami Madhavan, Saraswathy Gnanasundaram, Gautham Gopalakrishna, Bhabendra Nath Das, Seena Rajasekar, Ambady Ramachandran.Effectiveness of different types of footwear insoles for the diabetic neuropathic foot: a follow-up study. Diabetes Care. 2004; 27(2) 474-7