Both stroke and diabetes mellitus (DM) are increasingly common conditions that contribute to worldwide morbidity and mortality, thus necessitating urgent action. Globally, there were 33 million estimated cases of stroke in 2013, with a loss of 39.4 and 62.8 million disability-adjusted life years (DALYs) due to ischaemic and haemorrhagic stroke, respectively. Furthermore, stroke was the second most common cause of death (11.8%) and the third most common cause of disability (4.5%). A systematic review of 64 studies from the Middle East indicated incidence and prevalence rates of 22.7–250 and 508–777 per 100,000 people per year, respectively. Over the next 20 years, stroke-related mortality is predicted to triple in Africa, the Middle East and Latin American countries. In 2014, an estimated 422 million adults worldwide had DM, with the prevalence almost doubling from 4.7% in 1980 to 8.5% in 2014, the greatest burden of which was in low- and middle-income countries. In the Eastern Mediterranean region, the prevalence of DM is particularly high (3.5–30%), with Gulf Cooperation Council countries observed to have some of the highest DM prevalence rates in the region.

Diabetes is associated with several neurological disorders, with stroke being the most well-recognised and, likely, the most common. Diabetes is known to influence almost all varieties of stroke, including large artery stroke due to atherosclerosis, lacunar stroke and, possibly, intracerebral haemorrhage due to microvascular injury and embolic stroke due to diabetes; the latter of which is a significant risk factor for atrial fibrillation and hence part of risk factor assessment. Diabetic individuals have a 2.5–3.6-times higher risk of stroke compared to non-diabetics, with diabetic women at an increased risk compared to men. Rammal et al. estimated the prevalence of diabetes in ischaemic stroke to be 37.5% in the Arab world, based on an analysis of 29 studies of 10,242 patients. In an unpublished case-control study conducted in Oman, the prevalence of DM was 62.3% versus 44.7% among ischaemic stroke cases compared to controls ($P <0.001$). In another study from Oman based on stroke registry data, 52% of 600 patients with ischaemic stroke had diabetes.

A growing body of literature in recent decades has recognised the link between DM and cerebral atrophy, as well as cognitive dysfunction. The strong interrelationship between DM and stroke may be due not only to micro- and macrovascular injuries associated with DM, but also to other shared risk factors such as genetic, demographic and lifestyle factors that are likely influenced by age and gender. In terms of the mechanism of vascular injury in diabetes, evidence indicates that hyperglycaemia (and possibly insulin resistance) leads to oxidative stress and the overproduction of reactive oxygen species, triggering multiple biochemical pathways and, ultimately, endothelial dysfunction and vascular injury. Early endothelial changes may lead to accelerated macrovascular atherosclerosis as well as changes in microvascular blood flow control and permeability. The phenomenon of ‘metabolic memory’ complicates the course of DM, with a prolonged progression of micro- and macrovascular complications observed, even after prompt and intensive glycaemic control. Currently, mechanisms of nonvascular brain injury are still being explored. Several of the above mechanisms as well as endothelial dysfunction, alterations in blood brain barrier function and inflammation may contribute to nonvascular neurological injury.

In view of the strong relationship between diabetes and stroke, it is natural to explore various methods of cerebrovascular evaluation to better understand the pathophysiology of these conditions or to predict episodes of cerebrovascular injury. Carotid Doppler ultrasonography is a relatively simple and noninvasive method of visualising the superficial blood vessels and can be used to clinically evaluate the cervical carotid and parts of the vertebral arteries in the context of stroke. Using Doppler ultrasonography, the carotid intima media thickness is...
ness (CIMT) can be measured and used as surrogate evidence of vascular disease as thickening of the tunica intima is known to be a precursor of atherosclerosis. Apart from accelerated atherosclerosis, diabetes is also known to be a risk factor for other mechanisms of neurological injury associated with diabetes, with several other mechanisms well recognised in relation to diabetes. Cerebrovascular atherosclerosis can be easily explored using vascular Doppler ultrasonography and angiography. However, CSVD as well as nonvascular diabetic encephalopathy are conditions that may also be explored clinically based on other methods such as retinal or skin vascular changes or utilising advanced brain MRI modalities. More studies are necessary to explore the utility of the latter approach in predicting neurobehavioural changes in patients with diabetes, enhancing our understanding of its pathophysiology and developing better methods of managing these conditions.

References


