Screening for atherosclerosis in Streptozotocin-induced type 2 diabetic rat models using trans-abdominal ultrasound evaluation of abdominal aortic tunica intima thickness

Rachmi Fauziah Rahayu[1,2], Adi Prayitno[1], Subapriya Suppiah[3], Bambang Purwanto[1,4], Widiastuti Soewondo[1,5], Ida Nurwati[1,6], Paramasari Dirgahayu[1,5]

[1]Doctoral Program of Medical Science, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia, [2]Department of Radiology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia, [3]Department of Radiology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Selangor, Malaysia, [4]Department of Internal Medicine, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia, [5]Department of Parasitology and Mycology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia, [6]Department of Biochemistry Sciences, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia

ABSTRACT

Introduction: Atherosclerosis is a common complication of Type 2 diabetes mellitus (T2DM) and is attributed to the development of cardiovascular diseases (CVD), such as ischaemic stroke and myocardial infarction. At present, most screening methods for CVD risks, such as the Framingham risk score, have their limitations, especially in predicting total future CVD events. In recent times, ultrasonography (USG) has shown promise to enable the detection of subclinical atherosclerosis through measurements of the tunica intima thickness in large arteries. Our study evaluates the potential of USG as a screening tool for the measurement of tunica intima thickness in the abdominal aorta in a Streptozotocin (STZ)-induced diabetic rat model and aimed to explore the association between T2DM and atherosclerosis. **Materials and Methods:** Our study used a pre-test and post-test-controlled group design, having 20 male Wistar rats (3-4 months old, weighing 200-300 grams), randomized into control and treatment groups (n=10 each). An intraperitoneal injection of STZ (45 mg/kg body weight) to induce T2DM was administered in the treatment group, while the control group did not receive any intervention. Blood glucose levels were measured on days 0 and 12 to confirm T2DM induction. Ultrasonographic measurements of tunica intima thickness in the abdominal aorta were taken on day 1 (baseline) and day 14, using an ultrasound scanner with a L12- 3 broadband linear array transducer. Statistical analysis was conducted with IBM® SPSS® Statistics 22.0 using non-parametric Wilcoxon tests due to non-normal data distribution. **Results:** The treatment group exhibited a significant rise in blood glucose levels from 77.2 ± 11.5 mg/dL on day 1 to 347.4 ± 108.5 mg/dL on day 12 ($p = 0.005$), confirming T2DM induction. A significant increase in the tunica intima thickness of the abdominal aorta was noted, from 4.1 ± 0.8 mm on day 1 to 10.8 ±0.6 mm on day 14 ($p = 0.005$). In contrast, the control group showed no significant changes in tunica intima thickness (7.6 ± 2.0 mm on day 1 to 4.0 ± 0.9 mm on day 14). This suggests that STZ-induced T2DM leads to significant thickening of the tunica intima in the abdominal aorta, an early marker of atherosclerosis. Ultrasound measurement of tunica intima thickness could serve as an effective screening tool for detecting early-stage atherosclerosis in diabetic models. **Conclusion:** Ultrasound-based assessment of tunica intima thickness in the abdominal aorta is a promising tool for early detection of atherosclerosis in T2DM. This method may aid in monitoring therapeutic interventions and guiding precision medicine to prevent cardiovascular complications in diabetic patients.