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Sensitivity of oxygen challenge test in comparison with angiography in patients with diabetic foot

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Background and aims: Transcutaneous oxygen tension pressure (TcPO2) is the most appropriate non-invasive vessel method to indicate ischaemia in patients with diabetic foot ulcer (DFU). A stimulation test (ST) with 100% O_2 inhalation leads in healthy persons to an increase of TcPO2 above 100 mmHg and stimulated value below 30 mmHg corresponds to severe ischaemia. According to the international experts consent, 2009, ST is able to distinguish causes of low basal values of TcPO2. If the stimulation results in TcPO2 > 100 mmHg PAD is not likely and low TcPO2 is due to reversible diffusion barrier (inflammation, swelling). The principal goal of our study was to assess the relationship between TcPO2 values (basal and stimulated) and angiographic findings. A sensitivity of each stimulation test was verified against angiographically verified stenosis. **Materials and methods:** The study comprises 28 consecutive patients (31 limbs) complying with admittance criteria (DM, limb defect Wagner > 2, clinical signs of ischaemia) treated at our foot clinic in period from 02/2010 to 01/2014. A majority of the patients (97%) had an entrance TcPO2 <40 mmHg and were indicated for angiography and revascularisation. Jointly with the entrance TcPO2 we performed ST with inhalation of 100% oxygen. Stimulated values we obtained were evaluated in 5 different ways: 1. according to the absolute value of TcPO2 at the end of measurement when TcPO2< 40 mmHg (stimulation test 1), < 30 mmHg (stimulation test 2) and < 20 mmHg (stimulation test 3) evidence ischaemia. 2. according to a relative increase of TcPO2 after simulation compared to normobaric value, TcPO2 < 10 mmHg. (stimulation test 4) corresponds to ischaemia. The final evaluation is complex as it considers both an absolute value of TcPO2 after stimulation and at the same time its relative increase compared to the normobaric value. Ischaemia is indicated by the value after stimulation < 35 mmHg and concurrently to an increase of less than 50% compared to the normobaric value (stimulation test 5). We used Graziani's Morphological Classification to evaluate ischaemia and to classify the patients into7 classes according to severity of angiographic findings. **Results:** In the angiographic results we did not prove significant differences in average basal and stimulated TcPO2 values. These differences are similar in all the classes; the increase after stimulation is in a range of 0-20 mmHg for all the classes. We proved a significant correlation of TcPO2 values before and after stimulation (after stimulation TcPO2 = 1.322 TcPO2, $p < 0.001$, $r = 0.964$). We tested the concordance of stimulation tests and determined 11/31 (35.4%) of discordant pairs between ST1 and ST3 ($p < 0.001$), and 13/31 (31.70%) of discordant pairs between ST3 and ST5 ($p < 0.001$). The highest sensitivity against angiographically verified stenosis stenosis showed the combined test ST5 – 100% (CI 90.79 – 100.0). On the other hand, the lowest sensitivity of 58.065 % (CI 50.38 – 75.45) attributes to ST3. **Conclusion:** We proved a statistically significant difference between stimulation tests. The highest sensitivity to stenosis evidenced by angiography features the combined stimulation test which examines both absolute value of TcPO2 after stimulation (< 35 mmHg), and its relative increase (<50% TcPO2 value before stimulation). A significant relation between stimulated TcPO2 value and angiographic finding in a limb with defect was not proven.

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