

Transcutaneous Oximetry Optimizes Clinical Management and Cost-Effectiveness of Diabetic Foot Ulcers Treated with Hyperbaric Oxygen: A Review of Point of Care Screening Options

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ABSTRACT

Hyperbaric oxygen therapy has been employed to treat diabetic foot ulcers for more than four decades. While supported by some high-quality evidence, sufficient conflicting data exists to make its use open to criticism. Even systematic and other reviews favorably disposed to this treatment adjunct invariably plead for better patient selection. Common among several causes of non-healing ulcers is persistent hypoxia. Transcutaneous oximetry uniquely measures tissue oxygen tension. Combination air and oxygen testing provide an evidence-based approach to hyperbaric patient selection by demonstrating locally reversible hypoxia. Transcutaneous oximetry differentiates hyperbaric responders from non-responders early in their treatment course by detecting neo-angiogenesis, thereby providing the basis for continued hyperbaric dosing only in those benefiting. Finally, such testing guides therapeutic endpoint determination, namely normalized peri-ulcer oxygen tensions. This contrasts with continuing medically unnecessary and costly hyperbaric treatments until wound closure. Blood pressure and blood flow measurements represent oxygen delivery surrogates and imperfect ones at that. Recently introduced near-infrared spectroscopy and long-wave infrared thermography provide insights into tissue oxygen saturation and changes in micro-vascular density, respectively. Neither, however, guide clinically efficacious and cost-effective hyperbaric oxygenation in the manner afforded by transcutaneous oximetry. This paper describes evidenced-based guidance for hyperbaric oxygen dosing of diabetic foot ulcers, reviews point-of-care screening options and argues the continued superiority of transcutaneous oximetry in the current era.

Keywords: ankle-brachial index; Doppler ultrasound; laser Doppler flowmetry; long-wave infrared thermography; near-infrared spectroscopy; skin perfusion pressure; toe-brachial index.

Key points: Conflicting clinical research renders the treatment of diabetic foot ulcers with hyperbaric oxygen open to criticism. It is incumbent on providers, therefore, to employ best available guidance when electing to screen and treat this condition if clinical outcomes are to be optimized and wasteful healthcare spending avoided. Of all traditional and newly introduced point-of-care lower extremity vascular screening options, only transcutaneous oximetry identifies reversible peri-ulcer hypoxia, the basis for hyperbaric oxygen therapy, determines responders early in their treatment course, and guides determination of therapeutic endpoint.