Reliably assessing tissue viability during surgery is of major importance in surgical procedures. The most basic requirement for viability is sufficient oxygen supply to the tissue. Therefore it is highly desirable to visualize in real-time the dynamic process of blood perfusion up to and within the microvasculature. A modality sensitive to structures in the range of few hundred micrometers and offering high contrast to the embedding tissue is then needed. To this end, a number of methods have been developed, but have had no significant impact on the clinical routine due to various deficiencies. In this paper we demonstrate the applicability of optoacoustic imaging, which combines ultrasonic resolution with strong optical contrast. A method for optoacoustic perfusion assessment, based on a local and repeatable injection of saline, was proposed and assessed ex-vivo on large pig bowels and in-vivo in mouse tails. The obtained dynamic perfusion images highlight the method’s potential to enable immediate and quantitative assessment of tissue viability during surgery.