Tumor hypoxia is the result of an inadequate supply of oxygen to tumor cells which can be caused by multiple factors. It is associated with aggressive local tumor growth and invasion, increased risk of metastasis, higher resistance to radiotherapy (RT) and chemotherapy, overall resulting in a poor clinical prognosis. Many locally advanced solid tumors may exhibit hypoxic and/or anoxic tissue areas that are heterogeneously distributed within the tumor mass. As hypoxia is a negative prognostic factor concerning response to radiotherapy and chemotherapy, in vivo measurement of tumor hypoxia could be helpful to identify patients with worse prognosis or patients that could benefit from appropriate treatments such as intensity modulated radiotherapy (IMRT) that may accurately conform the dose distribution to small intratumoral regions showing differences in the oxygen level. A manifold of different methods to assess the oxygen tension (pO2) in tissues have been developed, each of them offering advantages as well as drawbacks. They range from invasive direct measurement techniques of the pO2 in tissue by using a polarographic electrode, to non-invasive imaging techniques such as positron emission tomography (PET) or magnetic resonance imaging (MRI). This article provides an overview over the various methods, with a particular emphasis on PET and MRI for imaging of hypoxia, and reviews their performance in preclinical and clinical studies.