Purpose: Cancer is one of the leading causes of death worldwide; liver cancer in particular has one of the highest mortality rates. Early detection and precise treatment monitoring is crucial for full recovery of patients. However, the computed tomography (CT) systems currently in use are not providing the necessary soft-tissue contrast for tumor-imaging because of the minor differences in linear-attenuation-coefficients. On the contrary, grating-based phase-contrast computed tomography (PCCT) has the potential to enhance the soft-tissue information even without injecting a contrast agent. In this work we report on a feasibility study to determine the usefulness of PCCT in tumor-imaging. Methods: The formalin-fixed human liver sample was imaged in a benchmarking experiment with 23 keV at the synchrotron radiation source ESRF in Grenoble, France. On this note, we chose synchrotron radiation to determine the maximal diagnostic value achievable with PCCT. As a reference the same sample was imaged with the current standard modality, a lab-based microCT system and a magnetic resonance imaging (MRI) system. In respect to image quality we compared the diagnostic quality, contrast-to-noise ratio (CNR), and line profiles for each of the reconstructions. Results: For the phase-contrast reconstructions, we observed a significantly enhanced soft-tissue contrast when comparing to standard absorption CT. Further, we found that the pathological and anatomical information in the PCCT reconstructions are improved compared to the MRI scan. Conclusion: We demonstrated an improvement of soft-tissue contrast when using PCCT, which in the same time provides all the advantages of absorption CT. To the best of our knowledge this is one of the first works in which the high potential of grating-based PCCT for clinical tumor-imaging is presented. We strongly believe that this new modality, if made available for the clinic, will provide enhanced diagnostic qualities not only in tumor-imaging but also for many other applications.