abstract We construct a sequence of binary black hole puncture data derived under the assumptions (i) that the ADM mass of each puncture as measured in the asymptotically flat space at the puncture stays constant along the sequence, and (ii) that the orbits along the sequence are quasi-circular in the sense that several necessary conditions for the existence of a helical Killing vector are satisfied. These conditions are equality of ADM and Komar mass at infinity and equality of the ADM and a rescaled Komar mass at each puncture. In this paper we explicitly give results for the case of an equal mass black hole binary without spin, but our approach can also be applied in the general case. We find that up to numerical accuracy the apparent horizon mass also remains constant along the sequence and that the prediction for the innermost stable circular orbit is similar to what has been found with the effective potential method.