Let C be a hyperelliptic curve over $\mathbb{Q}$ of genus $g \geq 2$. Then the set of rational points on C is finite by Faltings' theorem. It is an open problem whether there exists a bound for the number of rational points that depends only on g. We show that there is a bound that depends only on g and the Mordell-Weil rank r of C (the free abelian rank of the group of rational points on the Jacobian variety of C), provided that $r \leq g - 3$. The proof makes use of p-adic analytic methods.