We present several results on the joint similarity to $n$-tuples of operators in noncommutative varieties $V_P \subset B(\mathcal{H})^n$, where $P$ is a set of noncommutative polynomials in $n$ indeterminates and $B(\mathcal{H})$ is the algebra of all bounded linear operators on a Hilbert space $\mathcal{H}$. Several classical results concerning the similarity to contractions have analogues in our noncommutative multivariable setting. When $P$ consists of the commutators $X_iX_j - X_jX_i$, $i, j \in \{1, \ldots, n\}$, we obtain commutative versions of these results. (Received August 26, 2010)