We show that the bridge distance of a knot determines a lower bound on the genus of essential surfaces and Heegaard surfaces in the manifolds that result from non-trivial Dehn surgeries on the knot. In particular, knots with high bridge distance do not admit non-trivial non-hyperbolic surgeries or non-trivial cosmetic surgeries. We further show that if a knot has bridge distance at least 3 then its bridge number is bounded above by a function of Seifert genus, or indeed by the genus of (almost) any essential surface or Heegaard surface in the surgered manifold. (Received September 03, 2014)