The text considers stability analysis of steady and time dependent flow in a pipe of circular cross section, whereas the steady flow is considered not only with the classical no-slip boundary condition on the pipe’s wall but also with Navier’s slip boundary condition. The problems are investigated both by theoretical and computational means mainly in framework of linear stability theory, and both approaches are based on detailed knowledge of spectrum of the Stokes operator that represents the damping term in stability equations. Concerning theoretical results a sufficient condition for monotone linear stability of oscillatory and steady flow (with the classical no-slip boundary condition) is derived by purely analytical means. For flow with Navier’s slip boundary condition the text presents several heuristic arguments on possible influence of the choice boundary of condition on stability characteristics of the flow. The heuristic arguments are verified by computational means, and computational means are also used to investigate stability of time dependent flow with the classical no-slip boundary condition, mainly for parameter values not covered by theoretical results. In contrast with results available in literature, the numerical approach also considers nonaxisymmetric disturbances to the flow. It was found that neither boundary condition nor oscillations superimposed to the steady flow can—in the linear framework—destabilize the flow, nevertheless on quantitative level (decay rates of disturbances) they have a significant effect on behaviour of disturbances.