Motivated by the European call option pricing, we construct a jump-diffusion process \( \{X_t\}_{t \geq 0} \), starting from \( x \in \mathbb{R} \) and solving a stochastic differential equation (SDE), which is driven by a Brownian motion and an independent pure jump component exhibiting state-dependent jump intensity and infinite jump activity. We obtain the second order expansion, in a small time \( t \), of the tail probability \( \mathbb{P}[X_t \geq x + y] \), for any \( y > 0 \). A numerical example shows the accuracy of this expansion. As an application of this expansion and a suitable change of the underlying probability measure, we obtain the second order expansion, in a short maturity \( t \), of out-of-the-money European call option prices when the underlying stock price is modeled as the exponential of the jump-diffusion process \( \{X_t\}_{t \geq 0} \) under the risk-neutral probability measure. (Received August 22, 2014)