Purpose: To evaluate the dosimetric parameters of Praseodymium-142 ($^{142}$Pr) glass microspheres and its potential application in microsphere brachytherapy of nonresectable hepatic tumor for faster dose delivery and facilitated quality assurance, while maintaining comparable dose distribution of the currently used radionuclides. Methods: Dose profiles for a $^{142}$Pr point source were obtained using BRAIN-DOSE dose point kernel code and MCNPX2.6 Monte Carlo simulation. Microspheres containing $^{142}$Pr were studied and their dose distributions were compared to the doses of the currently used radionuclide Yttrium-90 ($^{90}$Y). Dose distributions due to glass microspheres ensembles within different sizes of spherical tumors were simulated. Physical properties, e.g. time to deliver 90% of the total dose for $^{142}$Pr and $^{90}$Y, were studied. Results: Dose rates from BRAIN-DOSE calculation for $^{142}$Pr and $^{90}$Y were 4.42 mGy/hr and 5.53 mGy/hr at 0.5 cm away from a 1 µCi source. From MCNPX2.6 the beta dose per decay at the tumor center for $^{142}$Pr and $^{90}$Y were $2.02 \times 10^{-12}$ Gy and $2.36 \times 10^{-12}$ Gy, respectively, for a tumor of 2.5 cm radius. For this case, simulation showed that the total dose in the tumor vicinity and therefore to adjacent organs due to the gamma yield was small, e.g. 0.03 Gy at 10 cm from the tumor center for 150 Gy total physical dose. Conclusions: Total dose per decay due to beta emissions were similar for both $^{142}$Pr and $^{90}$Y. Shorter half-life is an advantage of $^{142}$Pr, enabling faster dose delivery. The physical properties of $^{142}$Pr make it suitable for microsphere brachytherapy. Total gamma contribution of $^{142}$Pr was small, therefore may not be clinically relevant. Gamma radiation, however, opens possibilities for quality assurance, biodistribution imaging and dose distribution assessments.