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We consider the behavior of the heat kernel, which is the fundamental solution to the heat equation, on a Riemannian polytopal complex, which is a polytopal complex with a Riemannian metric on each polytope. We are interested in the case where the Riemannian polytopal complex is a co-compact cover of a finitely generated group. Under some geometric assumptions on the complex, the large time on-diagonal behavior of the heat kernel on the complex is asymptotically equivalent up to constants to the return probability for the symmetric random walk on the group. (Received September 16, 2008)