Anonymous communications are important for many applications of the mobile ad hoc networks (MANETs) deployed in adversary environments. A major requirement on the network is to provide unidentifiability and unlinkability for mobile nodes and their traffics. Although a number of anonymous secure routing protocols have been proposed, the requirement is not fully satisfied. The existing protocols are vulnerable to the attacks of fake routing packets or denial-of-service (DoS) broadcasting, even the node identities are protected by pseudonyms. In this paper, we propose a new routing protocol, i.e., authenticated anonymous secure routing (AASR), to satisfy the requirement and defend the attacks. More specifically, the route request packets are authenticated by a group signature, to defend the potential active attacks without unveiling the node identities. The key-encrypted onion routing with a route secret verification message, is designed to prevent intermediate nodes from inferring a real destination. Simulation results have demonstrated the effectiveness of the proposed AASR protocol with improved performance as compared to the existing protocols.