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### Immunotherapeutic approaches in biliary tract carcinoma: current status and emerging strategies

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#### Abstract

For biliary tract carcinoma (BTC), complete surgical resection of tumor is only feasible in a minority of patients, and the treatment options for patients with advanced disease are limited. Advances in cancer immunology have led to identification of tumor-infiltrating immune cells as indicators of prognosis and response to treatment in BTC. This has also facilitated development of immunotherapy that focuses on enhancing the immune system against biliary tumors. This includes peptide- and dendritic cell- based vaccines that stimulate *in-vivo* immune responses against tumor-specific antigens. Adoptive immunotherapy, which entails the *ex-vivo* expansion of tumor-infiltrating immune cells for subsequent reintroduction, and cytokine-based therapies have been developed in BTC. Clinical studies indicate that this type of therapy is generally well tolerated. Combination therapy with dendritic cell-based vaccines and adoptive immunotherapy has shown particularly good potential. Emerging strategies through discovery of novel antigen targets and by reversal of tumor-associated immunosuppression are expected to improve the efficacy of immunotherapy in BTC. Collaborative efforts by integration of targeted immunotherapeutics with molecular

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