



Portal vein tumor thrombus should not be considered as a contraindication for liver resection

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Hepatocellular carcinoma (HCC) is one of most frequently occurring cancers, approximately 12.5–39.7% of HCC patients associate with portal vein tumor thrombus (PVTT) at the time of diagnosis (1). These patients were belonging to the Barcelona clinic liver cancer stage C and usually associated with poor liver function, treatment difficultly and poor prognosis, the median survival time (MST) was 2.7 months for patients without any treatment (2). According to official guidelines, these patients are only recommended oral sorafenib for treatment, but the patient's MST is only 5.5 months, and always accompany with many side effects, the quality of life of patients is poor (3). In recent years, many clinical studies have suggested that liver resection (LR) could prolong the survival time of PVTT patients. It means that the treatment of HCC patients with PVTT is not limited to sorafenib, breaking the conventional treatment to choose LR for PVTT patients may be able to benefit many selected patients. LR for the treatment of PVTT has been attempted in many Asian countries. However, due to the lack of large-sample, multi-center and prospective study, this treatment is still not widely recognized.

We read the paper by Kokudo *et al.* (4) that published in *Journal of Hepatology*, which compared the survival benefit of LR and non-LR for 6,474 HCC patients with PVTT, of these patients, 2,093 underwent LR and the other 4,381 received non-LR treatments, including transcatheter arterial chemoembolization (TACE), chemotherapy, transarterial chemoinfusion, ablation therapy and other treatments. In Child-Pugh A patients, the MST for LR group (2.87 years, 95% CI, 2.60–3.37) was 1.77 years longer than for the non-LR group (1.10 years, 95% CI, 1.03–1.17). And in Child-Pugh B patients, the MST for LR group (1.44 years, 95% CI, 1.23–2.22) was 0.96 years longer than for the non-LR group (0.48 years, 95% CI, 0.44–0.52). Furthermore, the investigators used propensity score matching (PSM) to confirm the survival

benefit of LR in Child-Pugh A patients with PVTT, there were 1,058 patients in each of the two groups were successfully enrolled, by this statistical method to eliminate differences, the MST for LR group (2.45 years, 95% CI, 2.15–2.67) was 0.88 years longer than for the non-LR group (1.57 years, 95% CI, 1.43–1.72). The subgroup analysis showed that the age, etiology of the underlying liver disease, viral infection, alpha-fetoprotein level and tumor number did not affect the survival benefit for the PSM patients. In the LR group, there is no survival difference in the VP4 patients ($P=0.024$), compared with non-LR group. At least, the researchers suggested that PVTT should not be considered as a contraindication for LR, and LR should be recommended for the PVTT is limited to the first-order branch, especially in patients with good liver function.

A lot of articles about LR for HCC patients with PVTT have been reported, most of the studies are from Asian countries. In an article we published last year (5), we analyzed a total 1,580 HCC patients with PVTT from four tertiary hospitals in China, all patients were divided into four groups, LR ($n=745$), TACE ($n=604$), TACE combined with sorafenib (TACE-Sor, $n=113$) and TACE combined with radiotherapy (TACE-RT, $n=118$). The MST of LR for type I, II, and III patients (95% CI) were 15.9 (13.3–18.5), 12.5 (10.7–14.3), and 6.0 (4.3–7.7) months, respectively; in the TACE group were 12.2 (0–24.7), 10.6 (6.8–14.5), and 8.9 (5.2–12.6) months, respectively. We found that the MST in LR group is better than any other groups for type I and type II PVTT patients with good liver function, and the best treatment for type III PVTT patients is TACE-RT. Liu *et al.* (6) using PSM to estimate the survival time of 108 and 108 HCC patients with PVTT undergoing LR and TACE, the 1-, 3-, and 5-year survival rates were 84% *vs.* 71%, 69% *vs.* 50%, and 59% *vs.* 35%, showed that LR provides significantly better long-term survival than TACE. Zheng *et al.* (7) found

that LR is a safe and effective treatment for the PVTT patients with compensated liver function. Zhang *et al.* (8) evaluated the efficacy of preoperative chemoembolization (n=85) for PVTT patients compared with the immediate LR group (n=205), the 1-, 3-, and 5-year survival rates were 61.2% vs. 48.3%, 31.7% vs. 18.7%, and 25.3% vs. 13.9%, and no significant difference was found for patients with type III PVTT (P=0.684). In conclusion, LR can improve the MST of PVTT patients, combined with other treatments may be able to achieve better efficacy.

In the past decades, HCC with PVTT has been considered an absolute contraindication for LR. The main reason may be that such patients belong to advanced intrahepatic metastasis, and usually associated with poor liver function, with the limitations of such operation, so the surgeons believed that conservative treatment may be the best option for PVTT patients. However, with the deepening of the research of PVTT, according to the invading location of the PVTT, our research team proposed Cheng's classification to divided the PVTT into four types (type I, segmental/sectoral branches of portal vein; type II, left and/or right portal vein; type III, main portal vein trunk; and type IV, superior mesenteric vein), we found that the MST of different types of PVTT was significant differences, The 1- and 3-year postoperative overall survival rates of type I to IV were 52.1% and 25.1%, 38.2% and 17.7%, 24.7% and 3.6%, 18.3% and 0%, respectively (9). Therefore, we suggest that the PVTT is not the absolute contraindication of LR, it should be selected according to the Cheng's classification and patient's liver function.

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