**Table S1** Characteristics of the BDTT group and the classification method of BDTT in each of the included studies

| References | No. of patients[†] | BDTT type[‡] | | Obstructive jaundice | | Classification method of BDTT[§] |
|---|---|---|---|---|---|---|
| | | Macroscopic | Microscopic | Presence | Absence | |
| Shiomo et al. | 17 | 17 (100%) | 0 (0%) | 10 (58.8%) | 7 (41.2%) | Not mentioned in the original article. |
| Yeh et al. | 16 | 16 (100%) | 0 (0%) | 16 (100%) | 0 (0%) | Not mentioned in the original article. |
| Ikenaga et al. | 15 | 10 (66.7%) | 5 (33.3%) | 4 (26.7%) | 11 (73.3%) | Bile duct invasion was classified as b1 (invasion of the third order or more peripheral branches of the bile duct, but not of second order branches), b2 (invasion of the second order branches of the bile duct), b3 (invasion of the first order branches of the bile duct), or b4 (invasion of the common hepatic duct). Peripheral microscopic biliary invasion was categorized as b1, and macroscopic biliary invasion was categorized as b2–b4. |
| Shao et al. | 27 | 24 (88.9%) | 3 (11.1%) | NA | NA | Bile duct invasion in the intrahepatic or extrahepatic bile duct was classified into two categories according to the following criteria: microscopic bile duct invasion, which represents that the tumor thrombus can be seen in more than second branch of the biliary tree (excluding the second order branch), and macroscopic bile duct invasion, which represents that tumor thrombus was found in no more than the second order branch, i.e., in the common bile duct, the right or left main hepatic duct, or the second order branch of the intrahepatic bile duct. |
| Yu et al. | 20 | 16 (80%) | 4 (20%) | 14 (70%) | 6 (30%) | Microscopic BDTT was defined as tumor thrombi limited to the intrahepatic bile duct, whereas macroscopic BDTT was termed as tumor thrombi in both the intra- and extra-hepatic bile duct. |
| Noda et al. | 22 | 22 (100%) | 0 (0%) | 8 (36.4%) | 14 (63.6%) | Not mentioned in the original article. |
| Meng et al. | 35 | 28 (80%) | 7 (20%) | 17 (48.6%) | 18 (51.4%) | Bile duct invasion was classified as B1, central type (invasion of common hepatic duct or first-order branch of bile ducts with or without microscopic invasion of intrahepatic peripheral bile duct); B2, peripheral type (invasion of second-order or more peripheral branches of bile duct but no invasion of first-order branch or common hepatic duct). |
| Oba et al. | 13 | 13 (100%) | 0 (0%) | NA | NA | Macroscopic BDTT was defined as b2–4 (tumor thrombus in the common hepatic duct or the first to second branches of the bile duct). Microscopic BDTT was defined as b1 (tumor thrombus in the third order or more peripheral branches of the bile duct, but not in second order branches). |
| Wong et al. | 37 | NA | NA | 31 (83.8%) | 6 (16.2%) | Not mentioned in the original article. |
| Rammohan et al. | 39 | NA | NA | 18 (46.2%) | 21 (53.8%) | BDTT was classified according to the location of tumor thrombus, as proposed by Ueda et al. (Type 1: involving the second order intrahepatic duct; Type 2: involving the first order intrahepatic duct, Type 3a: extending to the hepatic confluence; Type 3b: implanted tumour growing in the common hepatic duct (CHD); Type 4: dislodged BDTT within the CHD). However, the original text did not point to the method about how to distinguish macroscopic BDTT and microscopic BDTT. |
| Kim et al. | 31 | 0 (0%) | 31 (100%) | 0 (0%) | 31 (100%) | Microscopic BDTT was termed as incidentally discovered tumor thrombi located in the peripheral bile ducts. Nevertheless, the specific definition of microscopic BDTT was not made. |
| Orimo et al. | 42 | 21 (50%) | 21 (50%) | 6 (14.3%) | 36 (85.7%) | Microscopic BDTT was defined as BDTT that developed in more than only the second branch of the intrahepatic bile duct. Macroscopic BDTT was defined as BDTT existing in the second or first branch of the biliary tree or the common bile duct. |
| Wang et al. | 28 | 12 (42.9%) | 16 (57.1%) | 12 (42.9%) | 16 (57.1%) | BDTT was divided into two types: microscopic BDTT, which can be observed beyond the second-order branch of the biliary tree, and macroscopic BDTT, which is restricted to the second-order branch. |
| Pang et al. | 35 | 29 (82.9%) | 6 (17.1%) | NA | NA | Not mentioned in the original article. |
| Yang et al. | 107 | 97 (90.7%) | 10 (9.3%) | 65 (60.7%) | 42 (39.3%) | Macroscopic BDTT was defined as tumor thrombus in the common hepatic ducts or the first to second branches of the bile duct. Microscopic BDTT was defined as tumor thrombus in the third order or lower peripheral branches of the bile duct. |

BDTT, bile duct tumor thrombus; NA, data not available. [†], This indicated the number of patients in the BDTT group. [‡], BDTT was divided into two types—macroscopic and microscopic BDTT—in most of the studies. Some of the studies showed the number of patients with macroscopic or microscopic BDTT, although the classification method of BDTT was not mentioned in the text. [§], The classification method of BDTT was cited from the original text of the included studies with or without mild modifications.

**Table S2** Survival outcomes of HCC patients with or without BDTT after hepatectomy

| References | BDTT group | | | | Non-BDTT group | | | |
|---|---|---|---|---|---|---|---|---|
| | MOST (months) | 1-year (%) | 3-year (%) | 5-year (%) of OS rates | MOST (months) | 1-year (%) | 3-year (%) | 5-year (%) of OS rates |
| Shiomo *et al.* | 27.6 | 74.0 | 47.0 | 28.0 | 54.0 | 88.0 | 63.0 | 48.0 |
| Yeh *et al.* | 21.3 | 60.0 | 20.0 | 6.7 | 30.1 | 70.2 | 46.8 | 33.0 |
| Ikenaga *et al.* | 11.4 | 46.0 | 23.0 | 0.0 | 56.1 | 80.0 | 63.0 | 48.0 |
| Shao *et al.* | 17.4 | 70.3 | 25.9 | 7.4 | 36.7 | 90.6 | 54.0 | 37.7 |
| Yu *et al.* | 15.1 | 73.1 | 20.6 | 18.5 | 37.8 | 72.2 | 53.5 | 43.4 |
| Noda *et al.* | 17.6 | 62.0 | 30.0 | 30.0 | 75.6 | 89.0 | 73.0 | 61.0 |
| Meng *et al.* | 7.9 | 35.3 | 19.1 | 10.3 | 25.2 | 71.1 | 35.1 | 19.2 |
| Oba *et al.* | 46.0 | 77.0 | 76.0 | 48.0 | 68.0 | 88.0 | 67.0 | 52.0 |
| Wong *et al.* | 44.0 | 69.4 | 54.3 | 38.5 | 31.7 | 71.0 | 45.2 | 34.6 |
| Rammohan *et al.* | 7.6 | 36.5 | 21.0 | 12.4 | 25.2 | 70.6 | 36.0 | 18.2 |
| Kim *et al.* | 60.0 | 90.1 | 61.0 | 42.4 | NA | 86.4 | 84.4 | 83.9 |
| Orimo *et al.* | 29.5 | 75.1 | 44.9 | 36.6 | 91.4 | 89.0 | 72.4 | 61.9 |
| Wang *et al.* | 31.4 | 81.8 | 50.0 | 37.5 | 68.8 | 90.9 | 66.9 | 55.9 |
| Pang *et al.* | 15.2 | 68.8 | 19.9 | 16.6 | 80.7 | 84.0 | 64.0 | 55.0 |
| Yang *et al.* | 16.6 | 60.5 | 20.1 | 12.0 | 84.0 | 84.9 | 69.9 | 57.6 |

HCC, hepatocellular carcinoma; BDTT, bile duct tumor thrombus; MOST, median overall survival time; OS, overall survival; NA, data not available.
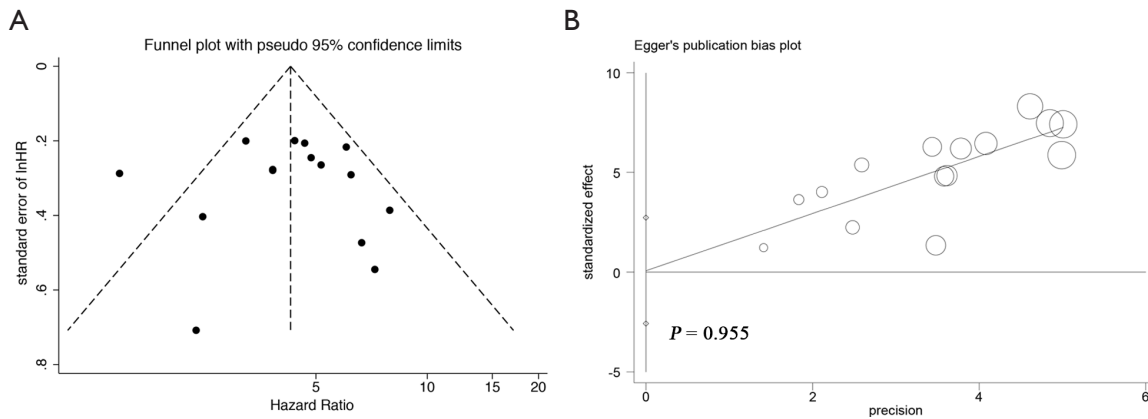


**Figure S1** Funnel plot (A) and Egger's plot (B) for the evaluation of the publication bias of HR.
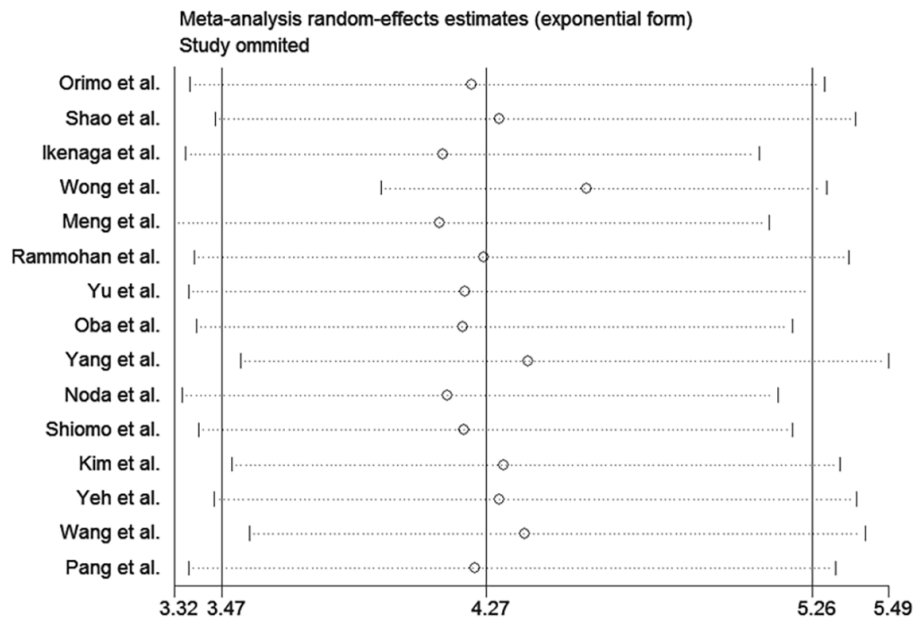
**Figure S2** Sensitivity analysis for the evaluation of the potential heterogeneity of HR.