

Table S1 Univariate and multivariate competing-risks regression analysis of risk factors associated with recurrence in the entire cohort

Variables	HR comparison	UV HR (95% CI)	UV P value	MV HR (95% CI)	MV P value
Age	>60 vs. ≤60 years	0.93 (0.83–1.05)	0.270		
Gender	Male vs. Female	1.26 (1.09–1.47)	0.003	1.23 (1.05–1.44)	0.007
ASA score	>2 vs. ≤2	0.92 (0.79–1.07)	0.280		
HBV (+)	HBV vs. non-HBV	1.08 (0.95–1.23)	0.230		
HCV (+)	HCV vs. non-HCV	0.99 (0.85–1.17)	0.960		
Cirrhosis	Yes vs. No	1.21 (1.10–1.34)	<0.001	1.23 (1.11–1.37)	<0.001
Child-Pugh grade	B vs. A	1.06 (0.78–1.41)	0.720		
Preoperative hemoglobin	<110 vs. ≥110 g/dL	0.94 (0.71–1.24)	0.660		
Preoperative platelet counts	<100 vs. ≥100×10 ⁹ /L	0.93 (0.81–1.08)	0.360		
Preoperative AFP	>400 vs. ≤400 µg/L	1.19 (1.07–1.33)	0.001	1.05 (0.94–1.18)	0.280
Maximum tumor size	>5 vs. ≤5 cm	1.44 (1.31–1.59)	<0.001	1.23 (1.08–1.40)	<0.001
Tumor number	Multiple vs. Solitary	1.64 (1.46–1.85)	<0.001	1.37 (1.19–1.58)	<0.001
Satellite nodules	Yes vs. No	1.46 (1.32–1.61)	<0.001	1.15 (1.01–1.31)	<0.001
Tumor encapsulation	Incomplete vs. Complete	1.34 (1.17–1.54)	<0.001	1.21 (1.05–1.41)	<0.001
Tumor differentiation	Poor vs. Well or moderate	1.25 (1.11–1.42)	<0.001	1.04 (1.01–1.18)	<0.001
Microvascular invasion	Yes vs. No	1.39 (1.25–1.54)	<0.001	1.13 (1.01–1.27)	<0.001
Extent of hepatectomy	Major vs. Minor	1.46 (1.30–1.64)	<0.001	1.13 (0.97–1.31)	0.316
Type of hepatectomy	Non-anatomical vs. Anatomical	1.18 (1.05–1.32)	0.004	0.97 (0.85–1.11)	0.760
Resection margin	<1.0 vs. ≥1.0 cm	1.10 (0.99–1.21)	0.064	1.08 (0.98–1.20)	0.873
Intraoperative blood loss	>600 vs. ≤600 mL	1.26 (1.07–1.48)	0.005	1.06 (0.89–1.27)	0.230
Intraoperative blood transfusion	Yes vs. No	1.43 (1.22–1.67)	<0.001	1.11 (0.93–1.32)	0.107
Application of Pringle maneuver	No vs. Yes	0.77 (0.66–0.91)	0.001	0.82 (0.70–0.97)	0.011

ASA, American Society of Anesthesiologists; AFP, alpha-fetoprotein; CI, confidence interval; HBV, hepatitis B virus; HCV, hepatitis C virus; HR, hazard ratio; MV, multivariate; UV, univariate.

Table S2 Univariate and multivariate competing-risks regression analysis of risk factors associated with recurrence in the PSM cohort.

Variables	HR comparison	UV HR (95% CI)	UV P value	MV HR (95% CI)	MV P value
Age	>60 vs. ≤60 years	0.95 (0.82–1.12)	0.570		
Gender	Male vs. Female	1.27 (1.05–1.54)	0.016	1.25 (1.02–1.53)	0.026
ASA score	>2 vs. ≤2	0.97 (0.79–1.19)	0.770		
HBV (+)	HBV vs. non-HBV	1.14 (0.94–1.37)	0.170		
HCV (+)	HCV vs. non-HCV	0.94 (0.74–1.20)	0.650		
Cirrhosis	Yes vs. No	1.19 (1.04–1.36)	0.009	1.15 (1.00–1.33)	0.042
Child-Pugh grade	B vs. A	1.03 (0.64–1.66)	0.890		
Preoperative hemoglobin	<110 vs. ≥110 g/dL	1.09 (0.79–1.49)	0.600		
Preoperative platelet counts	<100 vs. ≥100×10 ⁹ /L	0.90 (0.75–1.08)	0.250		
Preoperative AFP	>400 vs. ≤400 µg/L	1.14 (0.98–1.32)	0.075	1.00 (0.86–1.17)	0.940
Maximum tumor size	>5 vs. ≤5 cm	1.45 (1.26–1.67)	<0.001	1.22 (1.00–1.50)	0.048
Tumor number	Multiple vs. Solitary	1.61 (1.37–1.91)	<0.001	1.37 (1.12–1.68)	0.001
Satellite nodules	Yes vs. No	1.37 (1.19–1.56)	<0.001	1.07 (0.90–1.27)	0.400
Tumor encapsulation	Incomplete vs. Complete	1.26 (1.06–1.51)	0.010	1.11 (0.92–1.34)	0.250
Tumor differentiation	Poor vs. Well or moderate	1.39 (1.17–1.66)	<0.001	1.20 (0.99–1.45)	0.058
Microvascular invasion	Yes vs. No	1.42 (1.23–1.65)	<0.001	1.20 (1.02–1.41)	0.029
Extent of hepatectomy	Major vs. Minor	1.47 (1.25–1.72)	<0.001	1.12 (0.88–1.43)	0.320
Type of hepatectomy	Non-anatomical vs. Anatomical	1.07 (0.92–1.25)	0.360		
Resection margin	<1.0 vs. ≥1.0 cm	1.22 (1.07–1.40)	0.003	1.23 (1.07–1.41)	0.003
Intraoperative blood loss	>600 vs. ≤600 mL	1.28 (1.04–1.56)	0.017	1.05 (0.85–1.31)	0.630
Intraoperative blood transfusion	Yes vs. No	1.38 (1.13–1.67)	0.001	1.06 (0.83–1.32)	0.640
Application of Pringle maneuver	No vs. Yes	0.81 (0.68–0.95)	0.012	0.80 (0.67–0.95)	0.012

ASA, American Society of Anesthesiologists; AFP, alpha-fetoprotein; CI, confidence interval; HBV, hepatitis B virus; HCV, hepatitis C virus; HR, hazard ratio; MV, multivariate; PSM, propensity score matching; UV, univariate.

Table S3 Univariate and multivariate competing-risks regression analysis of risk factors associated with cancer-specific mortality (CSM) in the entire cohort

Variables	HR comparison	UV HR (95% CI)	UV P value	MV HR (95% CI)	MV P value
Age	>60 vs. ≤60 years	0.89 (0.76–1.05)	0.170		
Gender	Male vs. Female	1.23 (1.02–1.50)	0.034	1.20 (0.97–1.46)	0.240
ASA score	>2 vs. ≤2	0.93 (0.76–1.13)	0.480		
HBV (+)	HBV vs. non-HBV	1.09 (0.92–1.29)	0.300		
HCV (+)	HCV vs. non-HCV	0.96 (0.78–1.19)	0.750		
Cirrhosis	Yes vs. No	1.30 (1.14–1.49)	<0.001	1.26 (1.09–1.44)	0.015
Child-Pugh grade	B vs. A	0.98 (0.66–1.46)	0.940		
Preoperative hemoglobin	<110 vs. ≥110 g/dL	1.09 (0.79–1.50)	0.570		
Preoperative platelet counts	<100 vs. ≥100×10 ⁹ /L	0.87 (0.73–1.05)	0.150		
Preoperative AFP	>400 vs. ≤400 µg/L	1.49 (1.31–1.70)	<0.001	1.18 (1.02–1.35)	0.001
Maximum tumor size	>5 vs. ≤5 cm	2.06 (1.81–2.34)	<0.001	1.50 (1.26–1.77)	<0.001
Tumor number	Multiple vs. Solitary	1.93 (1.68–2.23)	<0.001	1.39 (1.16–1.65)	<0.001
Satellite nodules	Yes vs. No	1.83 (1.61–2.08)	<0.001	1.33 (1.12–1.58)	<0.001
Tumor encapsulation	Incomplete vs. Complete	1.48 (1.22–1.79)	<0.001	1.15 (0.94–1.39)	0.090
Tumor differentiation	Poor vs. Well or moderate	1.84 (1.52–2.23)	<0.001	1.33 (1.08–1.62)	0.001
Microvascular invasion	Yes vs. No	1.75 (1.54–2.00)	<0.001	1.23 (1.06–1.42)	<0.001
Extent of hepatectomy	Major vs. Minor	1.97 (1.71–2.26)	<0.001	1.28 (1.07–1.52)	<0.001
Type of hepatectomy	Non-anatomical vs. Anatomical	1.54 (1.31–1.80)	<0.001	1.08 (0.90–1.29)	0.306
Resection margin	<1.0 vs. ≥1.0 cm	1.06 (0.93–1.20)	0.390		
Intraoperative blood loss	>600 vs. ≤600 mL	1.38 (1.14–1.68)	<0.001	1.06 (0.86–1.31)	0.939
Intraoperative blood transfusion	Yes vs. No	1.91 (1.60–2.27)	<0.001	1.32 (0.97–1.52)	0.091
Application of Pringle maneuver	No vs. Yes	0.68 (0.55–0.84)	<0.001	0.77 (0.61–0.96)	0.031

ASA, American Society of Anesthesiologists; AFP, alpha-fetoprotein; CI, confidence interval; HBV, hepatitis B virus; HCV, hepatitis C virus; HR, hazard ratio; MV, multivariate; UV, univariate.

Table S4 Univariate and multivariate competing-risks regression analysis of risk factors associated with cancer-specific mortality (CSM) in the PSM cohort

Variables	HR comparison	UV HR (95% CI)	UV P value	MV HR (95% CI)	MV P value
Age	>60 vs. ≤60 years	0.94 (0.75–1.16)	0.570		
Gender	Male vs. Female	1.22 (0.94–1.57)	0.120		
ASA score	>2 vs. ≤2	1.00 (0.76–1.32)	0.980		
HBV (+)	HBV vs. non-HBV	1.05 (0.82–1.34)	0.680		
HCV (+)	HCV vs. non-HCV	1.07 (0.80–1.42)	0.650		
Cirrhosis	Yes vs. No	1.35 (1.13–1.61)	<0.001	1.34 (1.11–1.62)	0.001
Child-Pugh grade	B vs. A	1.19 (0.68 – 2.07)	0.540		
Preoperative hemoglobin	<110 vs. ≥110 g/dL	1.25 (0.86–1.81)	0.230		
Preoperative platelet counts	<100 vs. ≥100×10 ⁹ /L	0.85 (0.69–1.06)	0.160		
Preoperative AFP	>400 vs. ≤400 µg/L	1.44 (1.20–1.73)	<0.001	1.10 (0.91–1.34)	0.300
Maximum tumor size	>5 vs. ≤5 cm	2.16 (1.81–2.57)	<0.001	1.52 (1.17 – 1.98)	0.001
Tumor number	Multiple vs. Solitary	1.83 (1.49–2.25)	<0.001	1.32 (1.03–1.70)	0.026
Satellite nodules	Yes vs. No	2.76 (1.48–2.10)	<0.001	1.29 (1.03–1.61)	0.023
Tumor encapsulation	Incomplete vs. Complete	1.47 (1.15–1.89)	0.002	1.11 (0.86–1.45)	0.400
Tumor differentiation	Poor vs. Well or moderate	2.19 (1.66–2.88)	<0.001	1.60 (1.19–2.14)	0.001
Microvascular invasion	Yes vs. No	1.88 (1.57–2.25)	<0.001	1.26 (1.02–1.55)	0.027
Extent of hepatectomy	Major vs. Minor	2.22 (1.84–2.68)	<0.001	1.41 (1.05–1.88)	0.019
Type of hepatectomy	Non-anatomical vs. Anatomical	1.23 (0.99–1.51)	0.051	0.92 (0.73–1.16)	0.520
Resection margin	<1.0 vs. ≥1.0 cm	1.20 (1.00–1.43)	0.046	1.20 (0.99–1.45)	0.051
Intraoperative blood loss	>600 vs. ≤600 mL	1.33 (1.04–1.70)	0.025	0.90 (0.68–1.19)	0.480
Intraoperative blood transfusion	Yes vs. No	1.90 (1.52–2.37)	<0.001	1.21 (0.92–1.59)	0.160
Application of Pringle maneuver	No vs. Yes	0.73 (0.58–0.92)	0.007	0.73 (0.58–0.92)	0.006

ASA, American Society of Anesthesiologists; AFP, alpha-fetoprotein; CI, confidence interval; HBV, hepatitis B virus; HCV, hepatitis C virus; HR, hazard ratio; MV, multivariate; PSM, propensity score matching; UV, univariate.

Table 5 Univariate and multivariate regression analysis of risk factors associated with recurrence in the IPTW cohort

Variables	HR comparison	UV HR (95% CI)	UV P value	MV HR (95% CI)	MV P value
Age	>60 vs. ≤60 years	0.91 (0.74–1.13)	0.417		
Gender	Male vs. Female	1.52 (1.12–2.07)	0.007	1.47 (1.10–1.95)	0.007
ASA score	>2 vs. ≤2	0.89 (0.70–1.12)	0.345		
HBV (+)	HBV vs. non-HBV	0.92 (0.74–1.15)	0.490		
HCV (+)	HCV vs. non-HCV	1.05 (0.79–1.38)	0.719		
Cirrhosis	Yes vs. No	1.25 (1.05–1.51)	0.013	1.26 (1.05–1.51)	0.011
Child-Pugh grade	B vs. A	0.92 (0.51–1.67)	0.794		
Preoperative hemoglobin	<110 vs. ≥110 g/dL	1.31 (0.87–1.97)	0.181		
Preoperative platelet counts	<100 vs. ≥100×10 ⁹ /L	0.95 (0.74–1.22)	0.725		
Preoperative AFP	>400 vs. ≤400 µg/L	1.30 (1.03–1.65)	0.025	1.13 (0.91–1.39)	0.243
Maximum tumor size	>5 vs. ≤5 cm	1.37 (1.13–1.66)	0.001	1.26 (1.01–1.52)	0.046
Tumor number	Multiple vs. Solitary	1.62 (1.26–2.08)	<0.001	1.21 (0.93–1.58)	0.138
Satellite nodules	Yes vs. No	1.70 (1.40–2.06)	<0.001	1.31 (1.06–1.62)	0.012
Tumor encapsulation	Incomplete vs. Complete	1.36 (1.07–1.73)	0.011	1.14 (0.90–1.45)	0.258
Tumor differentiation	Poor vs. Well or moderate	1.41 (1.10–1.82)	0.006	1.07 (0.84–1.37)	0.541
Microvascular invasion	Yes vs. No	1.80 (1.48–2.19)	<0.001	1.38 (1.11–1.71)	0.002
Extent of hepatectomy	Major vs. Minor	1.54 (1.26–1.89)	<0.001	1.14 (0.86–1.51)	0.319
Type of hepatectomy	Non-anatomical vs. Anatomical	1.25 (0.98–1.59)	0.068	1.03 (0.80–1.32)	0.829
Resection margin	<1.0 vs. ≥1.0 cm	1.27 (1.07–1.50)	0.004	0.98 (0.81–1.18)	0.849
Intraoperative blood loss	>600 vs. ≤600 mL	1.40 (1.01–1.94)	0.041	1.15 (0.89–1.50)	0.263
Intraoperative blood transfusion	Yes vs. No	1.32 (0.97–1.80)	0.074	1.01 (0.78–1.30)	0.916
Application of Pringle maneuver	No vs. Yes	0.80 (0.66–0.98)	0.035	0.80 (0.66–0.97)	0.029

ASA, American Society of Anesthesiologists; AFP, alpha-fetoprotein; CI, confidence interval; HBV, hepatitis B virus; HCV, hepatitis C virus; HR, hazard ratio; IPTW, inverse probability of treatment weight; MV, multivariate; UV, univariate.

Table S6 Univariate and multivariate regression analysis of risk factors associated with CSM in the IPTW cohort

Variables	HR comparison	UV HR (95% CI)	UV P value	MV HR (95% CI)	MV P value
Age	>60 vs. ≤60 years	0.95 (0.70–1.27)	0.738		
Gender	Male vs. Female	1.69 (1.15–2.47)	0.006	1.54 (1.07–2.20)	0.018
ASA score	>2 vs. ≤2	0.90 (0.63–1.25)	0.550		
HBV (+)	HBV vs. non-HBV	1.01 (0.73–1.40)	0.909		
HCV (+)	HCV vs. non-HCV	0.86 (0.58–1.27)	0.461		
Cirrhosis	Yes vs. No	1.42 (1.13–1.79)	0.003	1.56 (1.23–1.98)	<0.001
Child-Pugh grade	B vs. A	1.05 (0.59–1.86)	0.865		
Preoperative hemoglobin	<110 vs. ≥110 g/dL	1.01 (0.99–1.01)	0.732		
Preoperative platelet counts	<100 vs. ≥100×10 ⁹ /L	1.06 (0.76–1.49)	0.714		
Preoperative AFP	>400 vs. ≤400 µg/L	1.71 (1.32–2.22)	<0.001	1.27 (1.01–1.59)	0.044
Maximum tumor size	>5 vs. ≤5 cm	2.23 (1.76–2.81)	<0.001	1.98 (1.44–2.71)	<0.001
Tumor number	Multiple vs. Solitary	1.96 (1.45–2.62)	<0.001	1.13 (0.84–1.52)	0.404
Satellite nodules	Yes vs. No	2.43 (1.93–3.07)	<0.001	1.70 (1.32–2.19)	<0.001
Tumor encapsulation	Incomplete vs. Complete	1.51 (1.06–2.15)	0.021	1.02 (0.73–1.42)	0.872
Tumor differentiation	Poor vs. Well or moderate	2.19 (1.47–3.26)	<0.001	1.34 (0.91 – 1.98)	0.130
Microvascular invasion	Yes vs. No	2.62 (2.08–3.27)	<0.001	1.68 (1.31–2.15)	<0.001
Extent of hepatectomy	Major vs. Minor	2.21 (1.74–2.81)	<0.001	1.31 (0.96–1.79)	0.086
Type of hepatectomy	Non-anatomical vs. Anatomical	1.57 (1.12–2.21)	0.008	0.99 (0.70–1.39)	0.970
Resection margin	<1.0 vs. ≥1.0 cm	1.43 (1.15 – 1.77)	<0.001	0.89 (0.70–1.13)	0.367
Intraoperative blood loss	>600 vs. ≤600 mL	1.44 (1.06 – 1.97)	0.019	0.89 (0.65–1.22)	0.478
Intraoperative blood transfusion	Yes vs. No	1.74 (1.29–2.33)	<0.001	1.15 (0.88–1.51)	0.286
Application of Pringle maneuver	No vs. Yes	0.75 (0.57–0.99)	0.043	0.76 (0.59–0.98)	0.044

ASA, American Society of Anesthesiologists; AFP, alpha-fetoprotein; CI, confidence interval; HBV, hepatitis B virus; HCV, hepatitis C virus; HR, hazard ratio; IPTW, inverse probability of treatment weight; MV, multivariate; UV, univariate.

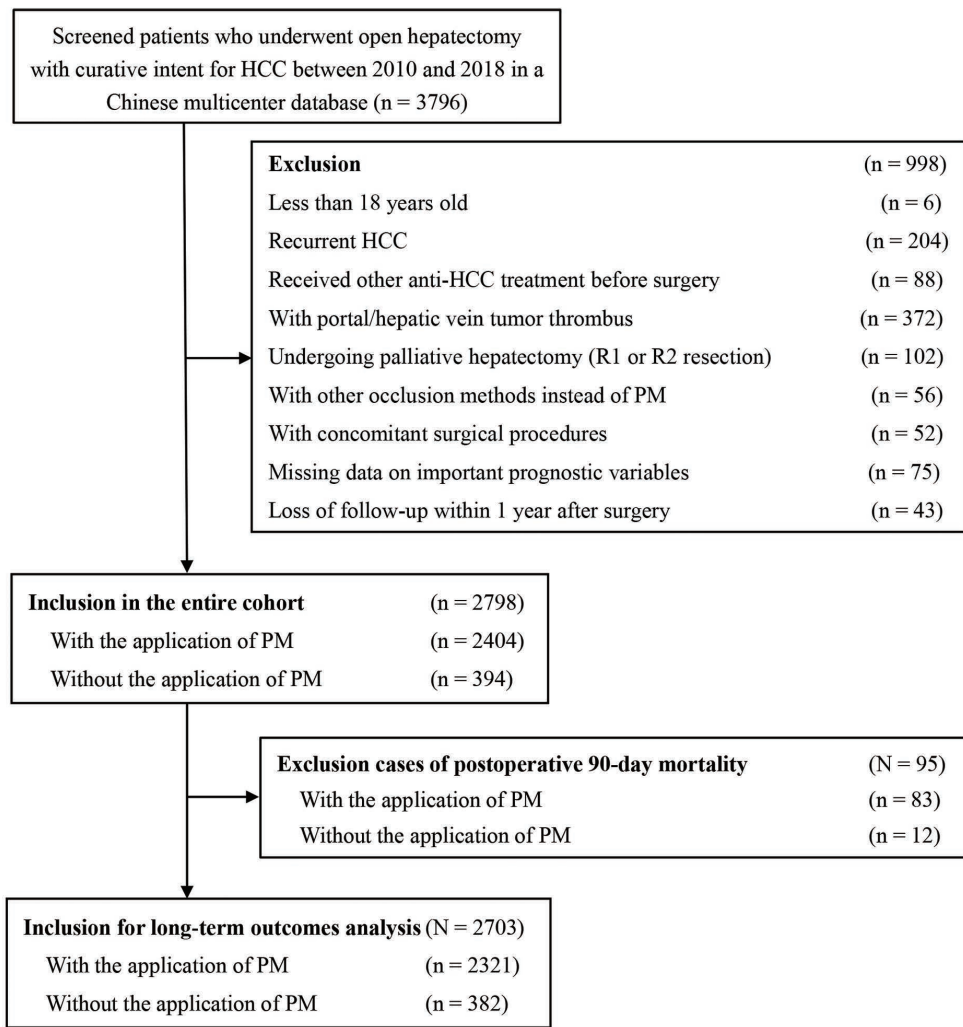


Figure S1 Study flowchart. HCC, hepatocellular carcinoma; PM, Pringle maneuver.

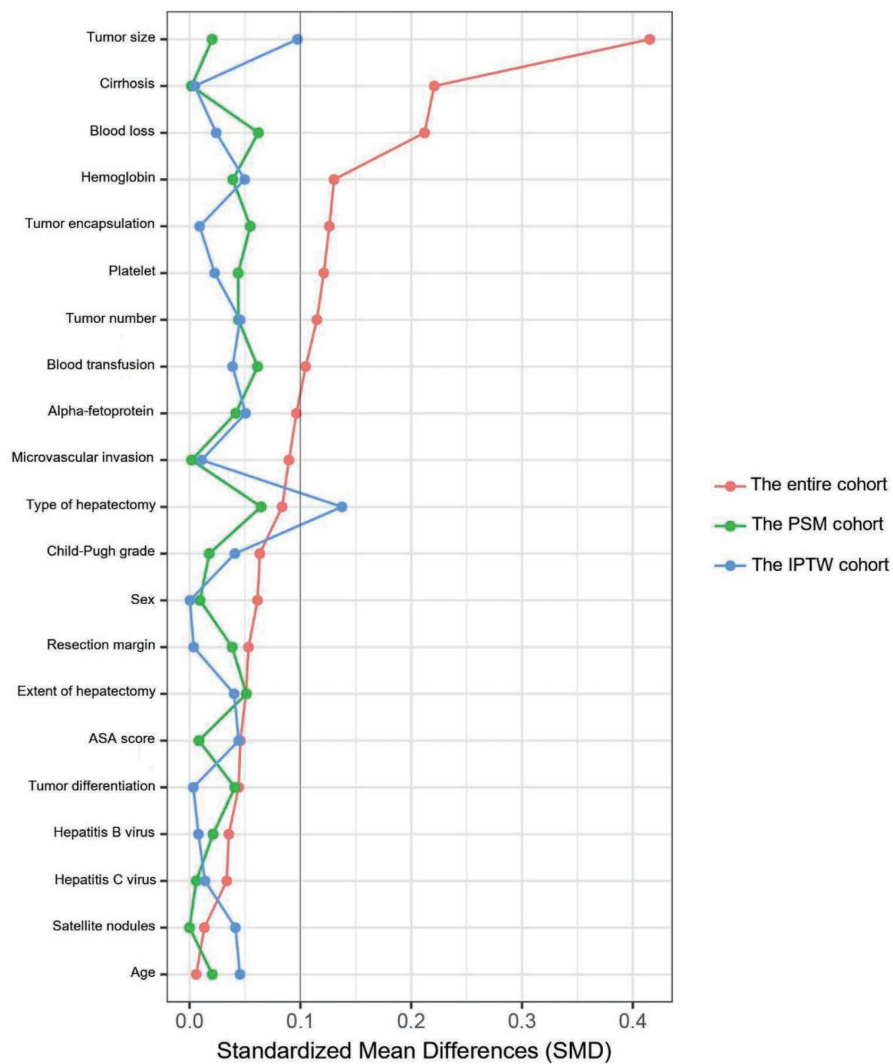


Figure S2 Comparisons of standardized mean difference of clinical variables between patients with and without the application of Pringle maneuver in the entire cohort (red dots), in the PSM cohort (green dots), and in the IPTW cohort (blue dots), respectively. ASA, American Society of Anesthesiologists; IPTW, inverse probability of treatment weight; PSM, propensity score matching.