

Figure S1. (A) Overall and (B) disease-free survival time analyses of hub genes that did not have a significant effect on patient outcome. $P < 0.05$ was considered to indicate a statistically significant difference. *IL-6*, interleukin 6; *SST*, somatostatin; *CXCL12*, *CXC* motif chemokine ligand 12; *NPY*, neuropeptide Y; *PLA2G1B*, phospholipase A2 group 1B; *PNLIP*, pancreatic lipase.

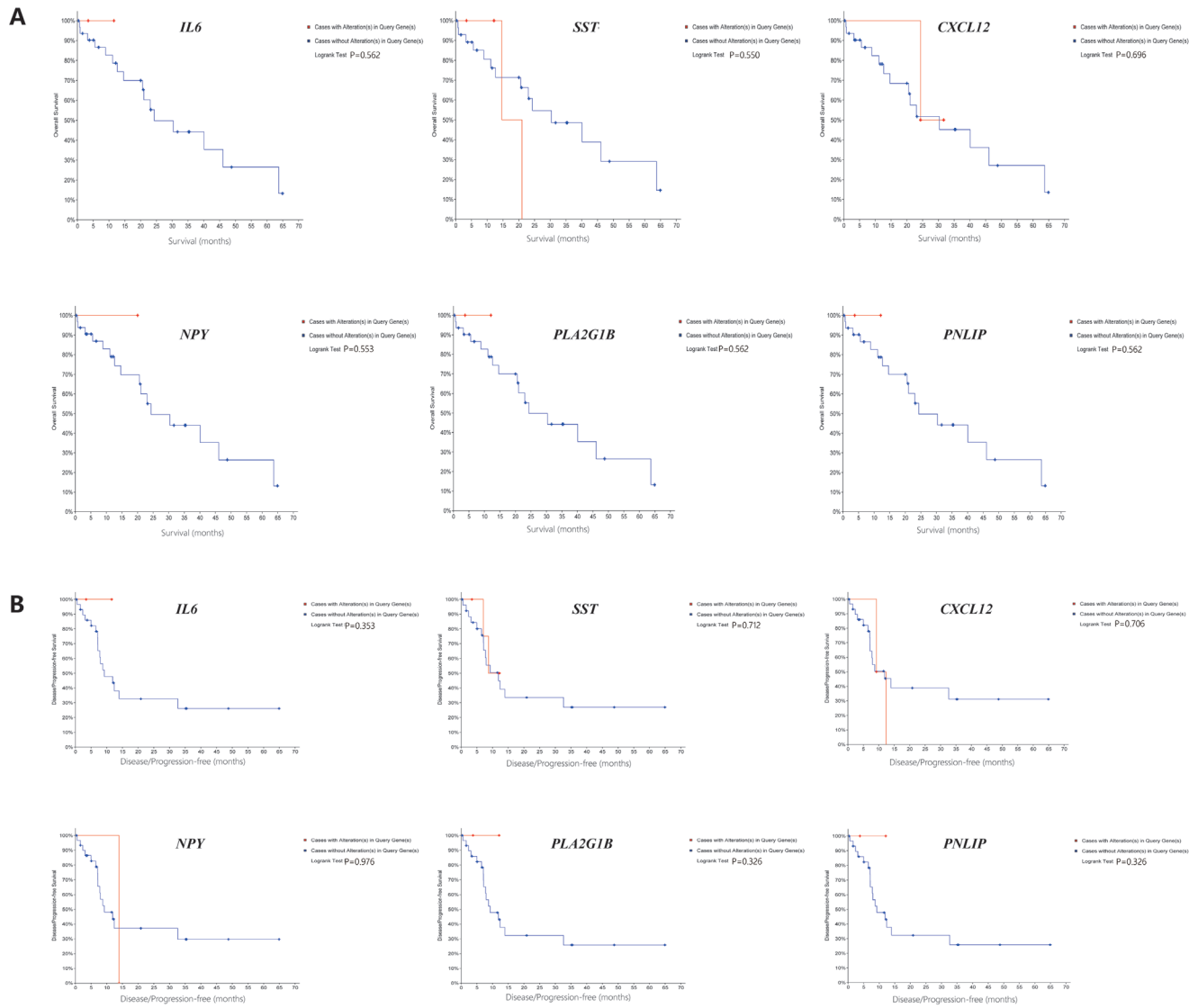


Table S1. Signaling pathway enrichment analysis of the hub genes in cholangiocarcinoma.

Group ID	Category	Term	Description	LogP	Log(q-value)	InTerm_InList	Genes	Symbols
L_Summary	Reactome Gene Sets	R-HSA-418594	G alpha (i) signalling events	-6.48369	-2.17232	5/396	1902.4852.5406.6387.6750.3569	LPAR1_NPY,PNLIPCXCL12,SST,IL6
L_Member	Reactome Gene Sets	R-HSA-418594	G alpha (i) signalling events	-6.48369	-2.17232	5/396	1902.4852.5406.6387.6750	LPAR1_NPY,PNLIPCXCL12,SST
L_Member	GO Biological Processes	GO:0032103	Positive regulation of response to external stimulus	-5.31672	-1.65573	4/292	1902.3569.4852.6387	LPAR1_IL6,NPY,CXCL12
L_Member	Reactome Gene Sets	R-HSA-373076	Class A/1 (Rhodopsin-like receptors)	-5.13808	-1.65573	4/324	1902.4852.6387.6750	LPAR1_NPY,CXCL12,SST
L_Member	Reactome Gene Sets	R-HSA-500792	GPCR ligand binding	-4.55029	-1.28031	4/457	1902.4852.6387.6750	LPAR1_NPY,CXCL12,SST
L_Member	GO Biological Processes	GO:010469	Regulation of signaling receptor activity	-4.26079	-1.08156	4/542	3569.4852.6387.6750	IL6,NPY,CXCL12,SST
L_Member	Reactome Gene Sets	R-HSA-375276	Peptide ligand-binding receptors	-4.20903	-1.08156	3/190	4852.6387.6750	NPY,CXCL12,SST
L_Member	GO Biological Processes	GO:0021537	Telencephalon development	-3.90815	-0.99471	3/240	1902.4852.6387	LPAR1_NPY,CXCL12
L_Member	GO Biological Processes	GO:0030900	Forebrain development	-3.36196	-0.63038	3/368	1902.4852.6387	LPAR1_NPY,CXCL12
L_Member	GO Biological Processes	GO:0007420	Brain development	-2.53965	-0.0916	3/709	1902.4852.6387	LPAR1_NPY,CXCL12
L_Member	GO Biological Processes	GO:0060322	Head development	-2.47038	-0.0455	3/750	1902.4852.6387	LPAR1_NPY,CXCL12
2_Summary	GO Biological Processes	GO:0060193	Positive regulation of lipase activity	-5.58758	-1.65573	3/66	1902.5319.5406.1360.4609.3569	LPAR1_PLA2G1B_PNLIP,CPB1_MY C_IL6
2_Member	GO Biological Processes	GO:0060193	Positive regulation of lipase activity	-5.58758	-1.65573	3/66	1902.5319.5406	LPAR1_PLA2G1B_PNLIP
2_Member	GO Biological Processes	GO:0060191	Regulation of lipase activity	-5.166	-1.65573	3/91	1902.5319.5406	LPAR1_PLA2G1B_PNLIP
2_Member	KEGG Pathway	hsa04972	Pancreatic secretion	-5.09604	-1.65573	3/96	1360.5319.5406	CPB1_PLA2G1B_PNLIP
2_Member	GO Biological Processes	GO:0051345	Positive regulation of hydrolase activity	-3.72313	-0.87191	4/746	1902.4609.5319.5406	LPAR1_MYC,PLA2G1B_PNLIP
2_Member	GO Biological Processes	GO:0010876	Lipid localization	-3.3179	-0.60858	3/381	3569.5319.5406	IL6,PLA2G1B_PNLIP
3_Summary	GO Biological Processes	GO:0060326	Cell chemotaxis	-5.34643	-1.65573	4/287	1902.3569.5319.6387.4609.4852.9314	LPAR1_IL6,PLA2G1B_CXCL12_MY C_NPY,KLF4
3_Member	GO Biological Processes	GO:0060326	Cell chemotaxis	-5.34643	-1.65573	4/287	1902.3569.5319.6387	LPAR1_IL6,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0050921	Positive regulation of chemotaxis	-4.76223	-1.45086	3/124	1902.3569.6387	LPAR1_IL6_CXCL12
3_Member	GO Biological Processes	GO:0006875	Cellular metal ion homeostasis	-4.21157	-1.08156	4/558	1902.4609.5319.6387	LPAR1_MYC,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0097529	Myeloid leukocyte migration	-4.18881	-1.08156	3/193	3569.5319.6387	IL6,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0050920	Regulation of chemotaxis	-4.13641	-1.06348	3/201	1902.3569.6387	LPAR1_IL6_CXCL12
3_Member	GO Biological Processes	GO:0006935	Chemotaxis	-4.08619	-1.06348	4/601	1902.3569.5319.6387	LPAR1_IL6,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0042330	Taxis	-4.08338	-1.06348	4/602	1902.3569.5319.6387	LPAR1_IL6,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0030595	Leukocyte chemotaxis	-4.07383	-1.06348	3/211	3569.5319.6387	IL6,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0030003	Cellular cation homeostasis	-4.02018	-1.04317	4/625	1902.4609.5319.6387	LPAR1_MYC,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0055065	Metal ion homeostasis	-4.01212	-1.04317	4/628	1902.4609.5319.6387	LPAR1_MYC,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0006873	Cellular ion homeostasis	-3.98552	-1.03588	4/638	1902.4609.5319.6387	LPAR1_MYC,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0055080	Cation homeostasis	-3.83451	-0.93811	4/698	1902.4609.5319.6387	LPAR1_MYC,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0098771	Inorganic ion homeostasis	-3.80593	-0.92592	4/710	1902.4609.5319.6387	LPAR1_MYC,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0055082	Cellular chemical homeostasis	-3.67238	-0.85749	4/769	1902.4609.5319.6387	LPAR1_MYC,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0050801	Ion homeostasis	-3.66371	-0.85749	4/773	1902.4609.5319.6387	LPAR1_MYC,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0070482	Response to oxygen levels	-3.45886	-0.70006	3/341	1902.4609.6387	LPAR1_MYC_CXCL12
3_Member	GO Biological Processes	GO:1903532	Positive regulation of secretion by cell	-3.37585	-0.63268	3/364	3569.5319.6387	IL6,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0051047	Positive regulation of secretion	-3.2818	-0.58723	3/392	3569.5319.6387	IL6,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0007015	Actin filament organization	-3.27535	-0.57723	3/394	1902.5319.6387	LPAR1_PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0006816	Calcium ion transport	-3.22186	-0.55394	3/411	4852.5319.6387	NPY,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0006874	Cellular calcium ion homeostasis	-3.15302	-0.49486	3/434	1902.5319.6387	LPAR1_PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0055074	Calcium ion homeostasis	-3.12426	-0.47565	3/444	1902.5319.6387	LPAR1_PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0070838	Divalent metal ion transport	-3.09063	-0.45135	3/456	4852.5319.6387	NPY,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0072511	Divalent inorganic cation transport	-3.07962	-0.45025	3/460	4852.5319.6387	NPY,PLA2G1B_CXCL12
3_Member	GO Biological Processes	GO:0072503	Cellular divalent inorganic cation homeostasis	-3.05521	-0.44338	3/469	1902.5319.6387	LPAR1_PLA2G1B_CXCL12

Table S1. Continued.

Group ID	Category	Term	Description	LogP	Log(q-value)	InTerm_InList	Genes	Symbols
3_Member	GO Biological Processes	GO:0050900	Leukocyte migration	-3.04718	-0.44338	3/472	3569,5319,6387	IL6,PLA2G1B,CXCL12
3_Member	GO Biological Processes	GO:1901652	Response to peptide	-3.03392	-0.43855	3/477	5319,6387,9314	PLA2G1B,CXCL12,KLF4
3_Member	GO Biological Processes	GO:0072507	Divalent inorganic cation homeostasis	-3.01041	-0.42331	3/486	1902,5319,6387	LPAR1,PLA2G1B,CXCL12
3_Member	GO Biological Processes	GO:0030335	Positive regulation of cell migration	-2.99498	-0.416	3/492	1902,3569,6387	LPAR1,IL6,CXCL12
3_Member	GO Biological Processes	GO:2000147	Positive regulation of cell motility	-2.94985	-0.37884	3/510	1902,3569,6387	LPAR1,IL6,CXCL12
3_Member	GO Biological Processes	GO:0051272	Positive regulation of cellular component movement	-2.9135	-0.35031	3/525	1902,3569,6387	LPAR1,IL6,CXCL12
3_Member	GO Biological Processes	GO:0040017	Positive regulation of locomotion	-2.8759	-0.3204	3/541	1902,3569,6387	LPAR1,IL6,CXCL12
3_Member	GO Biological Processes	GO:0043410	Positive regulation of MAPK cascade	-2.84169	-0.29374	3/556	1902,3569,5319	LPAR1,IL6,PLA2G1B
3_Member	GO Biological Processes	GO:0030036	Actin cytoskeleton organization	-2.67418	-0.16215	3/636	1902,5319,6387	LPAR1,PLA2G1B,CXCL12
3_Member	GO Biological Processes	GO:0097435	Supramolecular fiber organization	-2.63387	-0.14858	3/657	1902,5319,6387	LPAR1,PLA2G1B,CXCL12
3_Member	GO Biological Processes	GO:1903530	Regulation of secretion by cell	-2.58581	-0.11954	3/683	3569,5319,6387	IL6,PLA2G1B,CXCL12
3_Member	GO Biological Processes	GO:0030029	Actin filament-based process	-2.51383	-0.07169	3/724	1902,5319,6387	LPAR1,PLA2G1B,CXCL12
3_Member	GO Biological Processes	GO:0051046	Regulation of secretion	-2.49357	-0.06301	3/736	3569,5319,6387	IL6,PLA2G1B,CXCL12
4_Summary	GO Biological Processes	GO:0043408	Regulation of MAPK cascade	-5.06402	-1.65573	5/770	1902,3569,4609,5319,9314,6387	LPAR1,IL6,MYC,PLA2G1B,KLF4,CXCL12
4_Member	GO Biological Processes	GO:0043408	Regulation of MAPK cascade	-5.06402	-1.65573	5/770	1902,3569,4609,5319,9314	LPAR1,IL6,MYC,PLA2G1B,KLF4
4_Member	KEGG Pathway	hsa05200	Pathways in cancer	-4.79884	-1.45086	4/395	1902,3569,4609,6387	LPAR1,IL6,MYC,CXCL12
4_Member	GO Biological Processes	GO:0051347	Positive regulation of transferase activity	-3.93105	-0.99989	4/659	1902,4609,5319,9314	LPAR1,MYC,PLA2G1B,KLF4
4_Member	KEGG Pathway	hsa04151	PI3K-Akt signaling pathway	-3.45513	-0.70006	3/342	1902,3569,4609	LPAR1,IL6,MYC
4_Member	GO Biological Processes	GO:0043065	Positive regulation of apoptotic process	-2.70584	-0.1798	3/620	1902,3569,4609	LPAR1,IL6,MYC
4_Member	GO Biological Processes	GO:0043068	Positive regulation of programmed cell death	-2.69387	-0.17489	3/626	1902,3569,4609	LPAR1,IL6,MYC
4_Member	GO Biological Processes	GO:0010942	Positive regulation of cell death	-2.59126	-0.11954	3/680	1902,3569,4609	LPAR1,IL6,MYC
4_Member	GO Biological Processes	GO:0045596	Negative regulation of cell differentiation	-2.53965	-0.0916	3/709	1902,3569,4609	LPAR1,IL6,MYC
4_Member	GO Biological Processes	GO:0019221	Cytokine-mediated signaling pathway	-2.50366	-0.06735	3/730	3569,4609,6387	IL6,MYC,CXCL12
5_Summary	GO Biological Processes	GO:1902532	Negative regulation of intracellular signal transduction	-4.35726	-1.12507	4/512	1902,4609,6387,9314,3569,6750,5319	LPAR1,MYC,CXCL12,KLF4,IL6,SST,PLA2G1B
5_Member	GO Biological Processes	GO:1902532	Negative regulation of intracellular signal transduction	-4.35726	-1.12507	4/512	1902,4609,6387,9314	LPAR1,MYC,CXCL12,KLF4
5_Member	GO Biological Processes	GO:0008285	Negative regulation of cell proliferation	-3.72089	-0.87191	4/747	3569,4609,6750,9314	IL6,MYC,SST,KLF4
5_Member	GO Biological Processes	GO:1903037	Regulation of leukocyte cell-cell adhesion	-3.66999	-0.85749	3/289	3569,6387,9314	IL6,CXCL12,KLF4
5_Member	GO Biological Processes	GO:0007159	Leukocyte cell-cell adhesion	-3.53191	-0.73905	3/322	3569,6387,9314	IL6,CXCL12,KLF4
5_Member	GO Biological Processes	GO:0035690	Cellular response to drug	-3.45886	-0.70006	3/341	3569,4609,9314	IL6,MYC,KLF4
5_Member	GO Biological Processes	GO:0022407	Regulation of cell-cell adhesion	-3.32457	-0.60858	3/379	3569,6387,9314	IL6,CXCL12,KLF4
5_Member	GO Biological Processes	GO:0051090	Regulation of DNA-binding transcription factor activity	-3.24047	-0.56257	3/405	3569,5319,9314	IL6,PLA2G1B,KLF4
5_Member	GO Biological Processes	GO:0010975	Regulation of neuron projection development	-3.07143	-0.45025	3/463	1902,6387,9314	LPAR1,CXCL12,KLF4
5_Member	GO Biological Processes	GO:0071396	Cellular response to lipid	-2.77394	-0.23342	3/587	1902,3569,9314	LPAR1,IL6,KLF4
5_Member	GO Biological Processes	GO:0045664	Regulation of neuron differentiation	-2.71187	-0.1798	3/617	1902,6387,9314	LPAR1,CXCL12,KLF4
5_Member	GO Biological Processes	GO:0030155	Regulation of cell adhesion	-2.65289	-0.15444	3/647	3569,6387,9314	IL6,CXCL12,KLF4
5_Member	GO Biological Processes	GO:0120035	Regulation of plasma membrane bounded cell projection organization	-2.65289	-0.15444	3/647	1902,6387,9314	LPAR1,CXCL12,KLF4
5_Member	GO Biological Processes	GO:0031344	Regulation of cell projection organization	-2.63387	-0.14858	3/657	1902,6387,9314	LPAR1,CXCL12,KLF4
5_Member	GO Biological Processes	GO:0080135	Regulation of cellular response to stress	-2.62261	-0.14374	3/663	4609,6387,9314	MYC,CXCL12,KLF4

Table S1. Continued.

Group ID	Category	Term	Description	LogP	Log(q-value)	InTerm_InList	Genes	Symbols
5_Member	GO Biological Processes	GO:0001816	Cytokine production	-2,55719	-0,09708	3/699	3569,5319,9314	IL6,PLA2G1B,KLF4
5_Member	GO Biological Processes	GO:0050767	Regulation of neurogenesis	-2,45734	-0,03806	3/758	1902,6387,9314	LPAR1,CXCL12,KLF4
5_Member	GO Biological Processes	GO:0098609	Cell-cell adhesion	-2,43009	-0,01635	3/775	3569,6387,9314	IL6,CXCL12,KLF4