

Table S1. Concentration of mutant *KRAS* multiplex detected in bile.

Patient ID	Concentration of DNA (copies/ml)	Copies/20ul	Positives	Negatives	Accepted Droplets	Allele frequency (%)
NTC	0	0	0	14959	14959	0
NL7	990	19.8	12	14286	14298	0.127
NL12	1300	26	17	15371	15388	0.611
NL13-1	1000	20	12	14773	14785	0.101
NL16-1	810	16.2	11	15897	15388	0.255
CA1	340	6.8	4	13805	13809	0.121
CA2-2	42000	840	434	11950	12384	5.495
CA4	7100	142	85	14020	14105	13.343
CA6	320	6.4	3	10922	10925	0.061
CA7	16800	336	206	14291	14497	2.173
CA8	2200	44	32	16840	16872	0.190
CA9	22400	448	243	12635	12878	4.319
CA10	1100	22	12	12558	12570	0.141
CA11	330	6.6	56	14053	14057	0.028
CA12	39400	788	417	12255	12672	13.150
CA13	7500	150	60	14146	14206	12.79
CA14	720	14.4	9	14611	14620	0.095
CA15	170	3.4	2	13824	13826	0.023
CA16	1400	28	17	13893	13910	0.153
CA17	800	16	9	12943	12952	0.101
CA18-1	15400	308	195	14792	14987	4.210
CA19	200	4	2	11973	11975	0.132
CA20	900	18	10	13637	13647	0.287
CA21	350	7	4	13308	13312	0.069
CA22	130	2.6	2	17715	17717	0.084
CA24	4000	80	53	15475	15528	0.340
CA25	360	7.2	4	13134	13138	0.156
CA27	23500	470	216	10712	10928	3.910
CA28	29000	580	366	14649	15015	2.416
CA29	700	14	8	13298	13306	0.060
CA30	580	11.6	6	12198	12204	0.054
CA31	1600	32	24	17194	17218	0.168
CA32	280	5.6	4	16713	16717	0.514
CA34	66500	1330	700	12036	12736	17.752
CA35	530	10.6	6	13207	13213	0.130
CA36	7900	158	114	10532	10576	0.436
CA37	330	6.6	5	17669	17674	0.215
CA38	1110	22.2	16	17004	17020	0.340
CA39	1800	36	25	16106	16131	0.602
CA41	1400	28	21	17197	17218	0.192
CA43	1400	28	19	15452	15471	0.125
CA44	2400	48	29	15802	15831	0.195
CA46	3500	70	40	13436	13436	0.305
CA47	3300	66	51	17943	117994	0.298
CA48	2000	40	29	17290	17319	0.169
CA49	1000	20	1	15864	17827	0.056

CA50	1600	32	24	17803	17827	0.143
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Concentration of mutant *KRAS* p. G12D detected in bile

Patient ID	Concentration of DNA(copies/ml)	Copies/20ul	Positives	Negatives	Accepted Droplets
NTC	0	0	0	17232	17232
CA2-2	27400	0.548	349	14819	15168
CA4	70	1.4	1	16624	16625
CA7	320	6.4	5	18519	18524
CA8	670	13.4	10	17508	17518
CA9	16800	33.6	262	18243	18505
CA12	35800	71.6	554	17909	18463
CA13	7500	150	103	16086	16189
CA18-1	150	3	2	15210	15212
CA24	420	8.4	7	19505	19512
CA27	3600	72	53	17133	17186
CA28	760	15.2	10	15468	15478
CA31	830	16.6	12	16988	17000
CA34	58200	1164	730	14407	15137
CA36	640	12.8	9	16497	16506
CA39	180	3.6	3	19763	19766
CA44	2400	48	36	17352	17388
CA46	640	12.8	9	16668	16677
CA47	700	14	11	18498	16677
CA48	850	17	13	18075	18088
CA50	410	8.2	6	17240	17246

Concentration of mutant *KRAS* p. G12V detected in bile

Patient ID	Concentration of DNA(copies/ml)	Copies/20ul	Positives	Negatives	Accepted Droplets
NTC	0	0	0	15760	15760
CA2-2	2200	4.4	27	14654	14681
CA4	3100	6.2	47	17671	17718
CA7	0	0	0	17765	17765
CA8	0	0	0	17571	17571
CA9	0	0	0	18754	18754
CA12	190	3.8	3	18764	18767
CA13	0	0	0	14940	14940
CA18-1	14200	28.4	187	15392	15579
CA24	0	0	0	18841	18841
CA27	7500	1.5	97	15140	15237
CA28	270	0.54	4	17165	17169
CA31	80	1.6	1	15266	15267
CA34	0	0	0	8806	8806
CA36	7900	1.58	114	16908	17022

CA39	0	0	0	17305	17305
CA44	0	0	0	17898	17898
CA46	70	1.4	1	16782	16783
CA47	0	0	0	17831	17831
CA48	0	0	0	18274	18274
CA50	0	0	0	17941	17941

Table S2. Concentration of mutant *KRAS* multiplex detected in paired FFPE.

Patient ID	Concentration of DNA (copies/ml)	Copies/20ul	Positives	Negatives	Accepted Droplets	Allele frequency (%)
NTC	0	0	0	16060	16060	0
NL2	0	0	0	16528	16528	0
NL3	0	0	0	16701	16701	0
NL4	4100	82	5	16723	16726	0.460
CA1	4100	82	47	13609	13656	0.526
CA4	27000	456	273	13973	14246	14.035
CA6	1700	34	23	16015	16038	0.309
CA13	44200	884	538	14045	14583	7.094
CA14	0	0	0	17146	17146	0
CA17	5000	100	72	17038	17110	0.756
CA19	3700	74	48	15311	15359	0.438
CA21	2600	52	35	15762	15797	0.524
CA22	54400	1088	728	15383	16111	5.930
CA29	2300	46	31	15574	15605	0.450
CA31	11500	230	173	17552	17725	2.630
CA32	3000	60	43	16571	16614	0.359
CA34	4500	90	47	16512	16575	0.447
CA37	3100	62	47	17989	18036	0.306
CA38	3300	66	49	17639	17688	0.489
CA39	1500	30	25	19277	19302	0.361
CA44	20500	40	21	15545	15566	0.153
CA47	35800	70	38	15705	15743	0.266
CA49	32000	64	32	15216	15248	0.218
CA50	10250	20	12	17620	17632	0.205

Concentration of mutant *KRAS* p. G12D detected in paired FFPE.

Patient ID	Concentration of DNA(copies/ml)	Copies/20ul	Positives	Negatives	Accepted Droplets
NTC	0	0	0	15966	15966
CA4	70	1.4	1	16015	16016
CA13	3400	680	389	13259	13648
CA17	2100	42	26	14316	14342
CA22	49100	982	495	11619	12114
CA31	500	10	8	18647	18655
CA34	2400	48	33	16157	16190

CA44	4860	97.2	5	15422	15427
CA47	890	17.8	1	17876	17877
CA49	0	0	0	17903	17903
CA50	6530	13.6	8	18526	18534

Concentration of mutant *KRAS* p. G12V detected in paired FFPE.

Patient ID	Concentration of DNA(copies/ml)	Copies/20ul	Positives	Negatives	Accepted Droplets
NTC	0	0	0	18450	18450
CA4	27000	540	279	12039	12318
CA13	6900	138	71	12019	12090
CA17	80	1.6	1	15037	15038
CA22	1600	32	16	11645	11661
CA31	10300	206	16	12107	12213
CA34	1800	36	22	14489	14511
CA44	760	15.2	1	18154	18155
CA47	5380	107.6	6	16613	16619
CA49	1790	35.8	2	16402	16404
CA50	860	15.2	1	19023	19024

Table S3. Concentration of mutant *KRAS* multiplex detected in paired plasma.

Patient ID	Concentration of DNA (copies/ml)	Copies/20ul	Positives	Negatives	Accepted Droplets	Allele frequency (%)
NTC	0	0	0	16390	16390	0
NL1	0	0	0	17796	7796	0
NL2	0	0	0	16218	16218	0
CA1	0	0	0	18555	18555	0
CA17	0	0	0	20111	20111	0
CA21	60	1.2	0	19051	19052	0
CA22	0	0	0	18394	18394	0
CA29	0	0	0	15289	15289	0
CA30	70	1.4	1	19051	19052	7.692
CA31	0	0	0	15971	15971	0
CA32	0	0	0	17916	17916	0
CA34	0	0	0	18310	18310	0
CA38	0	0	0	16676	16676	0
CA39	0	0	0	19055	19055	0
CA44	0	0	0	17088	17088	0
CA46	0	0	0	18040	18040	0
CA47	0	0	0	16461	16461	0
CA49	70	1.4	1	16832	16833	1.030
CA50	0	0	0	16138	16138	0

Concentration of mutant *KRAS* p. G12D detected in paired plasma.

Patient ID	Concentration of DNA(copies/ml)	Copies/20ul	Positives	Negatives	Accepted Droplets
NTC	0	0	0	15286	15286
CA21	0	0	0	16386	16387
CA30	70	1.4	1	19337	19337
CA49	0	0	0	15286	15286

Concentration of mutant *KRAS* p. G12V detected in paired plasma.

Patient ID	Concentration of DNA(copies/ml)	Copies/20ul	Positives	Negatives	Accepted Droplets
NTC	0	0	0	13728	13728
CA21	60	1.2	1	20320	20321
CA30	60	1.2	1	19707	19708
CA49	70	1.4	1	16786	16787

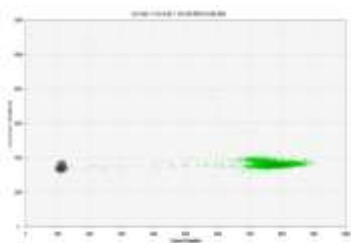
Table S4. *KRAS*-associated signaling oncogenes, including *RAS* and *RAF*, with transcripts per million read (TPM) values for the bile, tissue, and plasma samples ('0' indicates that TPM > 10).

Gene_Symbol	Description	Bile_mRNA	Tissue_mRNA	Plasma_mRNA
MRAS	muscle RAS oncogene homolog	0	-	-
RAB10	RAB10, member RAS oncogene family	0	0	0
RAB11A	RAB11A, member RAS oncogene family	0	0	0
RAB11B	RAB11B, member RAS oncogene family	0	0	0
RAB12	RAB12, member RAS oncogene family	0	0	-
RAB13	RAB13, member RAS oncogene family	0	0	0
RAB14	RAB14, member RAS oncogene family	0	0	0
RAB15	RAB15, member RAS oncogene family	0	-	-
RAB17	RAB17, member RAS oncogene family	0	0	-
RAB18	RAB18, member RAS oncogene family	0	0	0
RAB1A	RAB1A, member RAS oncogene family	0	0	0
RAB1B	RAB1B, member RAS oncogene family	0	0	-
RAB20	RAB20, member RAS oncogene family	0	0	-
RAB21	RAB21, member RAS oncogene family	0	0	0
RAB22A	RAB22A, member RAS oncogene family	0	0	-
RAB24	RAB24, member RAS oncogene family	0	0	0
RAB25	RAB25, member RAS oncogene family	0	0	-
RAB26	RAB26, member RAS oncogene family	0	-	-
RAB27A	RAB27A, member RAS oncogene family	0	0	0
RAB27B	RAB27B, member RAS oncogene family	0	0	0
RAB28	RAB28, member RAS oncogene family	0	0	-
RAB29	RAB29, member RAS oncogene family	0	-	-
RAB2A	RAB2A, member RAS oncogene family	0	0	0
RAB2B	RAB2B, member RAS oncogene family	0	0	-
RAB30	RAB30, member RAS oncogene family	0	-	0
RAB31	RAB31, member RAS oncogene family	0	0	0
RAB32	RAB32, member RAS oncogene family	0	-	0
RAB33A	RAB33A, member RAS oncogene family	0	-	0
RAB33B	RAB33B, member RAS oncogene family	0	0	-
RAB34	RAB34, member RAS oncogene family	0	0	-
RAB35	RAB35, member RAS oncogene family	0	0	0
RAB36	RAB36, member RAS oncogene family	0	-	-
RAB37	RAB37, member RAS oncogene family	0	-	-
RAB38	RAB38, member RAS oncogene family	0	-	0
RAB39A	RAB39A, member RAS oncogene family	0	-	-
RAB3A	RAB3A, member RAS oncogene family	0	-	0
RAB3B	RAB3B, member RAS oncogene family	0	-	-
RAB3D	RAB3D, member RAS oncogene family	0	0	-
RAB40A	RAB40A, member RAS oncogene family	0	-	-
RAB40B	RAB40B, member RAS oncogene family	0	-	-
RAB40C	RAB40C, member RAS oncogene family	0	-	-
RAB42	RAB42, member RAS oncogene family	0	-	-
RAB42P1	RAB42, member RAS oncogene family, pseudogene 1	0	-	-
RAB43	RAB43, member RAS oncogene family	0	-	-
RAB44	RAB44, member RAS oncogene family	0	-	-
RAB4A	RAB4A, member RAS oncogene family	0	0	0
RAB4B	RAB4B, member RAS oncogene family	0	-	0
RAB5A	RAB5A, member RAS oncogene family	0	0	0
RAB5B	RAB5B, member RAS oncogene family	0	0	0
RAB5C	RAB5C, member RAS oncogene family	0	0	0
RAB6A	RAB6A, member RAS oncogene family	0	0	0
RAB6B	RAB6B, member RAS oncogene family	0	-	0
RAB6C	RAB6C, member RAS oncogene family	0	-	-
RAB7A	RAB7A, member RAS oncogene family	0	0	0
RAB8A	RAB8A, member RAS oncogene family	0	0	0
RAB8B	RAB8B, member RAS oncogene family	0	0	0
RABL2A	RAB, member of RAS oncogene family like 2A	0	-	-
RABL2B	RAB, member of RAS oncogene family like 2B	0	-	-
RABL3	RAB, member of RAS oncogene family like 3	0	-	-
RABL6	RAB, member RAS oncogene family like 6	0	0	0
RAN	RAN, member RAS oncogene family	0	0	0
RAP1A	RAP1A, member of RAS oncogene family	0	0	0
RAP1B	RAP1B, member of RAS oncogene family	0	-	0
RAP2A	RAP2A, member of RAS oncogene family	0	0	0
RAP2B	RAP2B, member of RAS oncogene family	0	0	0
RAP2C	RAP2C, member of RAS oncogene family	0	0	-

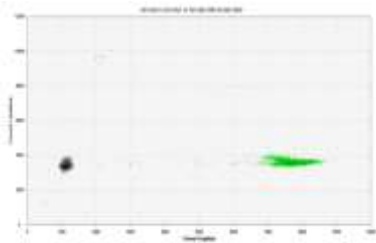
Figure S1. mutant *KRAS* multiplex in bile, FFPE, plasma

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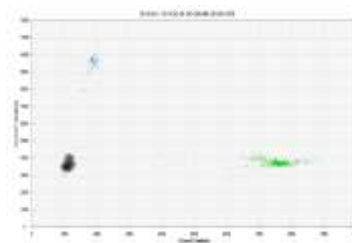
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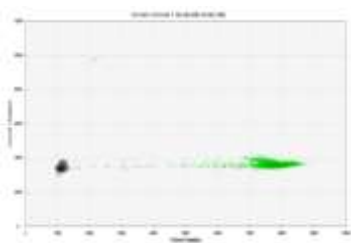
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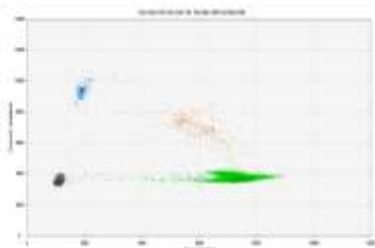


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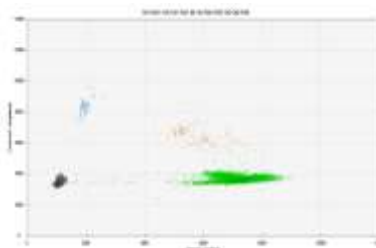


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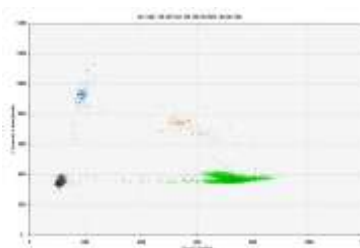
- mutant *KRAS* multiplex detected in BTC bile.



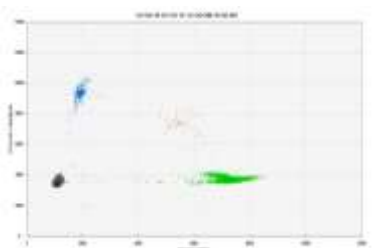
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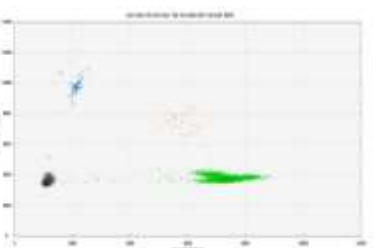
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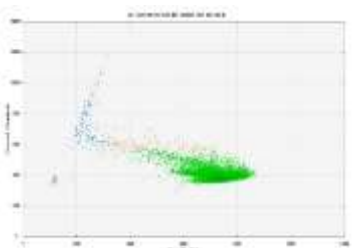
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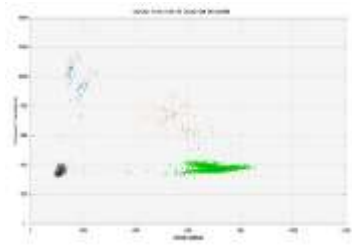
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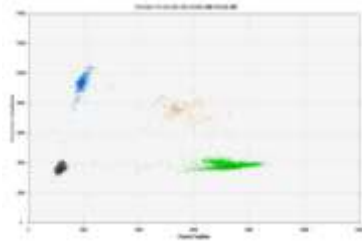
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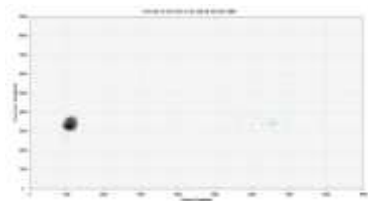
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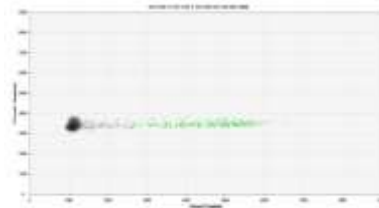
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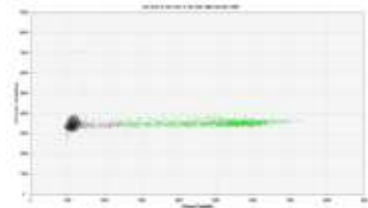
- mutant *KRAS* multiplex detected in non-tumor area of FFPE.



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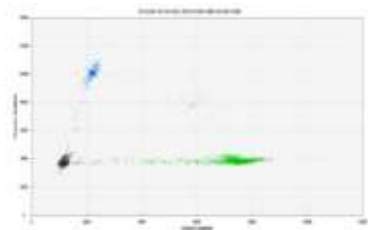


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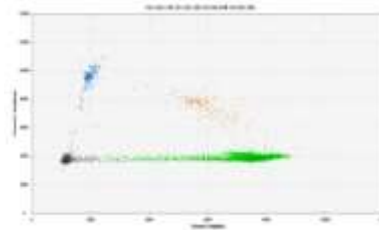


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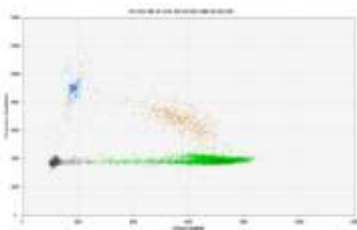
- mutant *KRAS* multiplex detected in BTC FFPE.



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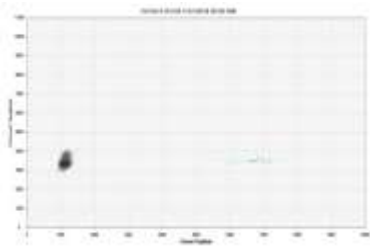
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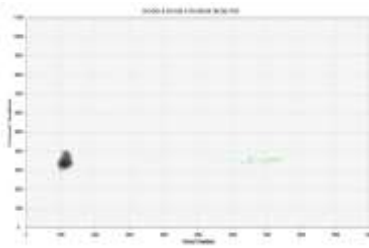
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<Plasma>

mutant *KRAS* multiplex detected in control plasma.

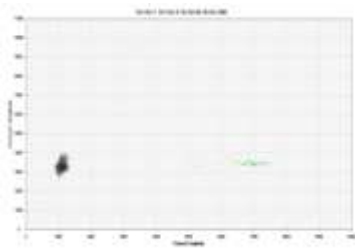


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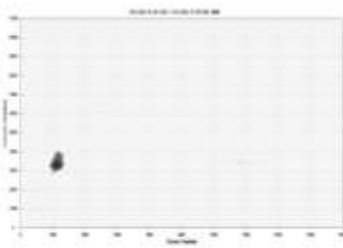


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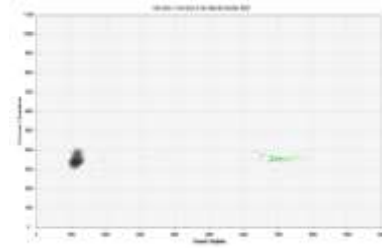
- mutant *KRAS* multiplex detected in BTC plasma.



<CA21>



<CA30>



<CA49>

