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Upper abdominal stopflow perfusion- the surgical technique behind locally high drug concentrations

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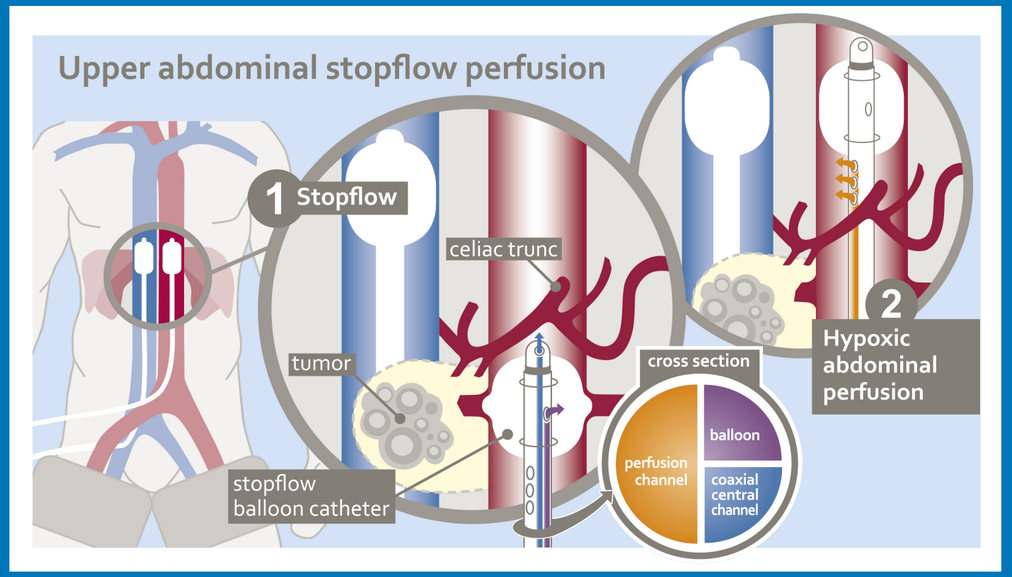
Background: For pancreatic cancer, especially with peritoneal carcinosis, high drug concentrations are needed to achieve a response. An isolated treatment of the tumor site with adequate drug concentrations is eligible.

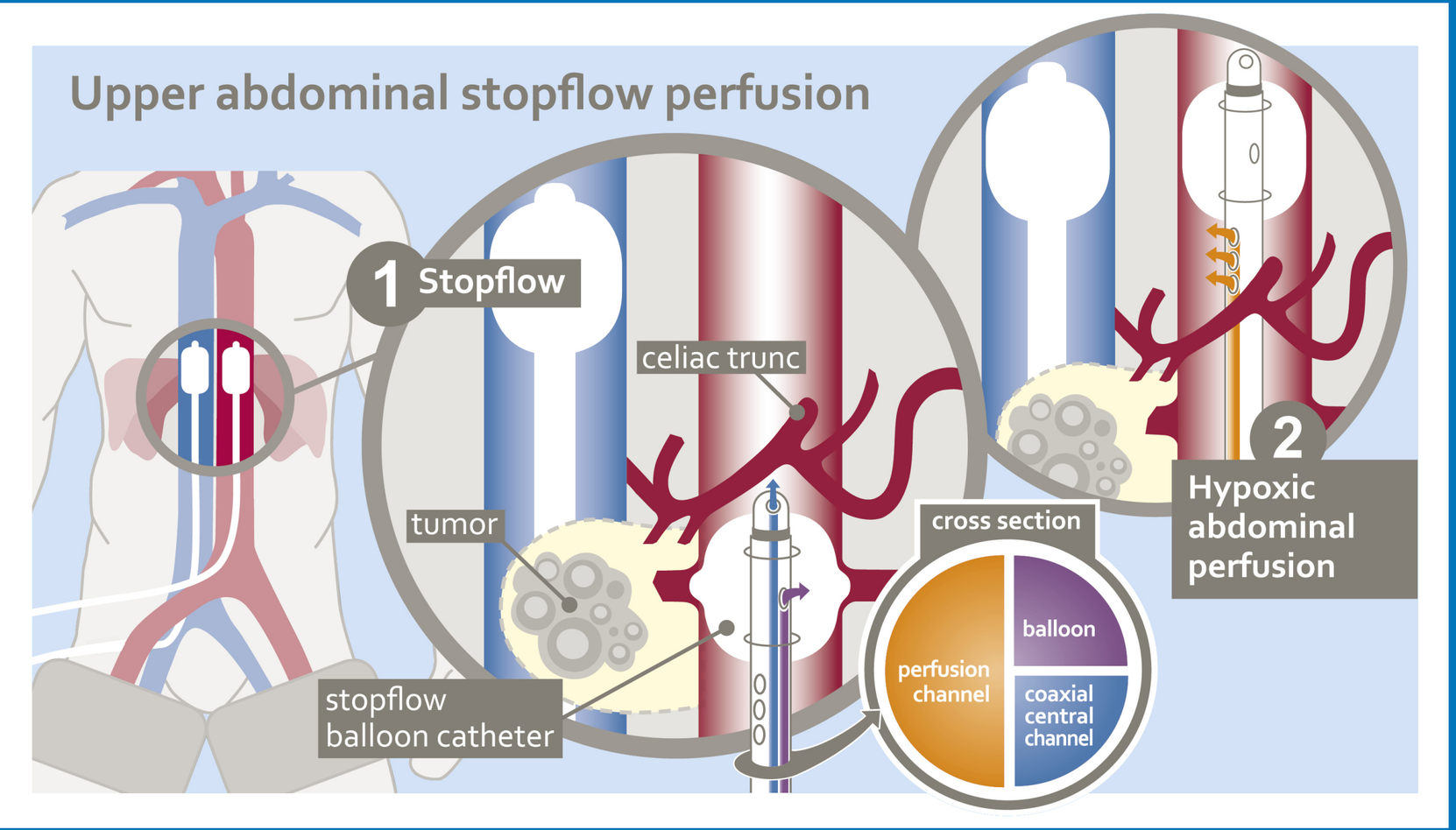
Methods: We developed a new technique, upper abdominal perfusion (UAP) with stopflow balloon catheters in aorta and vena cava. UAP enables high local drug concentrations at the tumor site while keeping systemic drug concentrations next to zero. UAP is a method performed in two steps, where the first step is the stop-flow procedure and the second step is the isolated hypoxic abdominal perfusion. Both steps are performed with stop-flow balloon catheters in the vena cava and aorta. For the first step (stop-flow), the aortic balloon is positioned beneath the celiac trunc and above it, the chemotherapy is infused for one minute while an outflow-block of the liver veins is contemporarily established by inflating the venous balloon beneath the diaphragm. Thereafter, the aortic balloon is immediately slipped upstream in the aorta and placed right beneath the diaphragm (second step). The isolated hypoxic abdominal perfusion runs for 10 minutes with high drug concentrations in the whole abdominal region.



Results: For stage III pancreatic cancer, median survival rates of 13 months and 21.5 months were reached for UAP and UAP/TACE treatment. For stage IV pancreatic cancer with up to five distinct metastatic sites and peritoneal carcinosis, median survival of 8 months was reached with UAP.

Conclusions: Upper abdominal perfusion is a feasible technique for advanced staged, unresectable cancer, even if highly metastasized including peritoneal carcinosis.

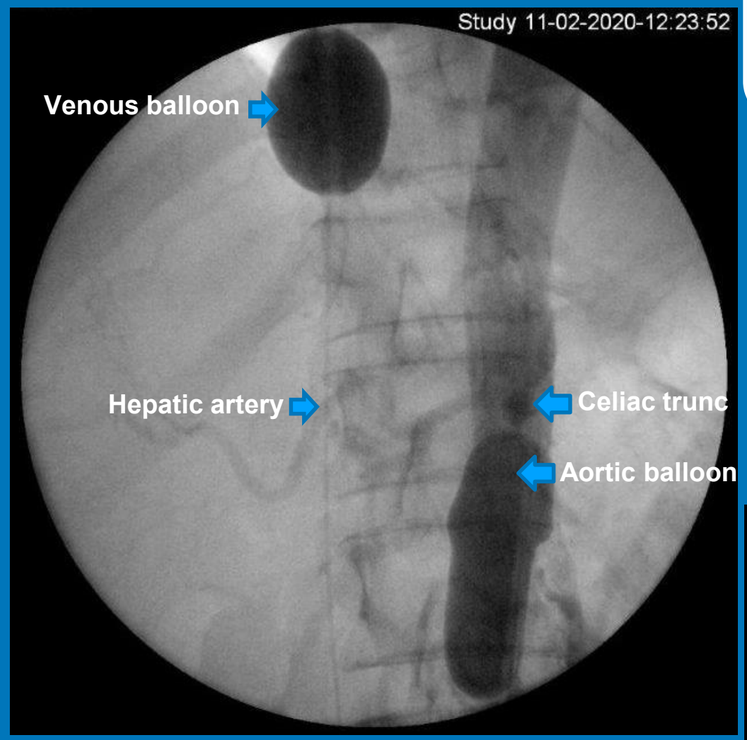
Upper Abdominal Stopflow Perfusion - the 2 steps method



1. **STOPFLOW:** arterial balloon beneath celiac trunc, chemotherapy infusion

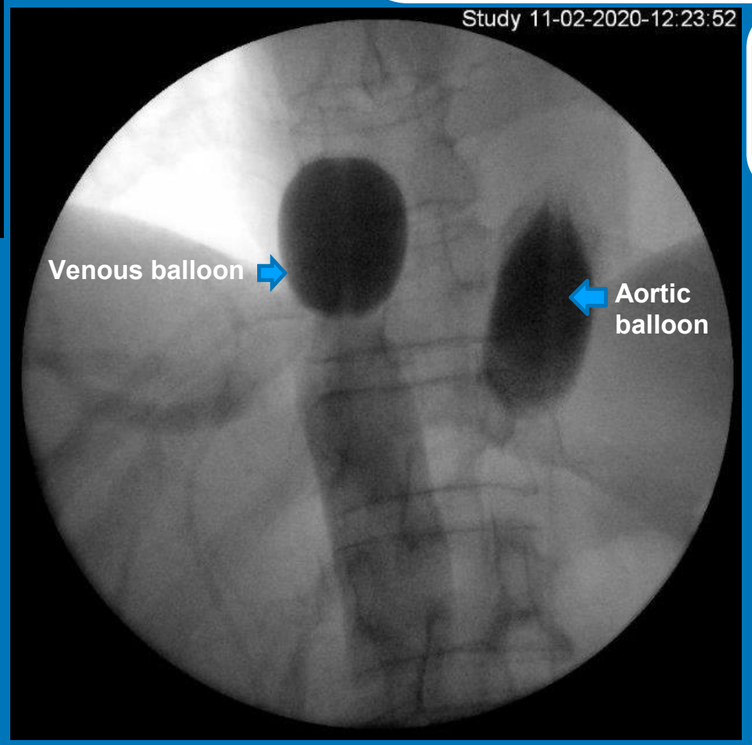
2. **HYPOXIC ABDOMINAL PERFUSION:** arterial balloon beneath diaphragm

Upper Abdominal Stopflow Perfusion - the 2 steps method



1. Stopflow

- venous catheter: balloon beneath diaphragm
  arterial catheter: balloon beneath celiac trunc
- chemotherapy infusion above inflated arterial balloon inflating of venous balloon (1 min)
- immediate positioning of arterial balloon above celiac trunc
- 5 min blocking (stopflow procedure)



2. Perfusion

- 5 min hypoxic abdominal perfusion
- 5 min chemofiltration
- deflating of balloons - further chemofiltration

Study on 74 patients - unresectable pancreatic cancer

Pancreatic cancer 2007-2017

Stage III	13 patients
Stage IV	61 patients

Metastasis

1 metastatic location	15 patients
2 metastatic locations	25 patients
3 metastatic locations	14 patients
4 + metastatic locations	7 patients

Treatment

UAP	44 patients
UAP+Embo	23 patients
Embo	4 patients
ia infusion	3 patients

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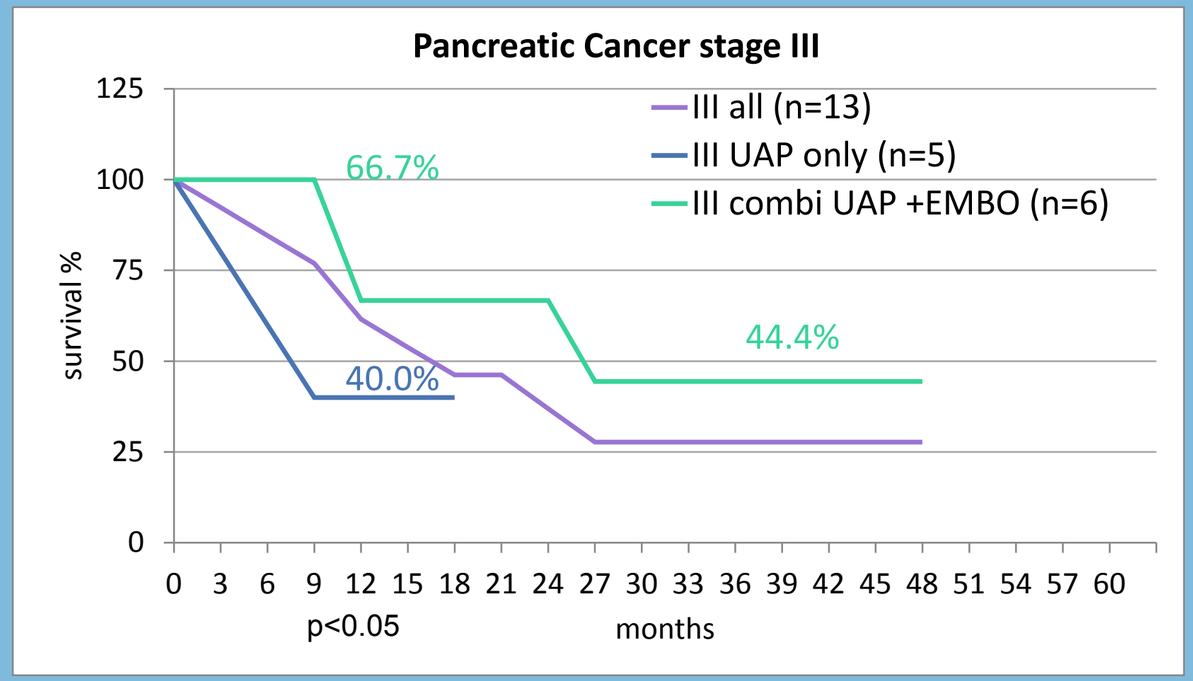
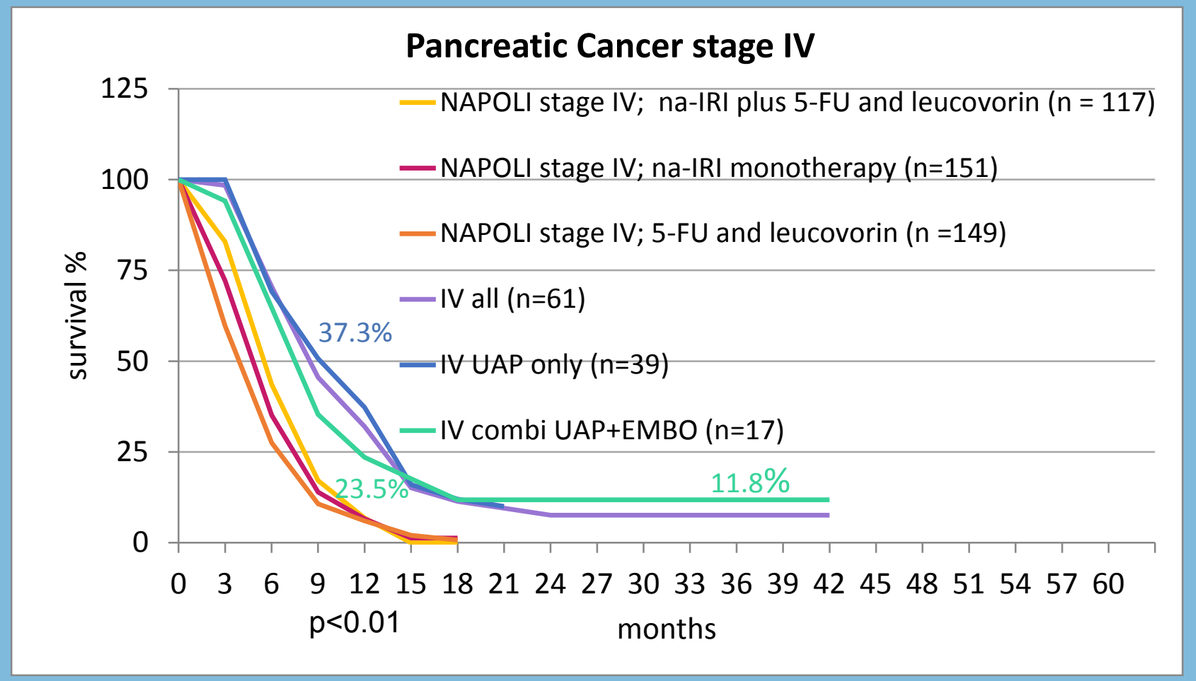
Unresectable Pancreatic Cancer

III (n=13) Median OS 13 months

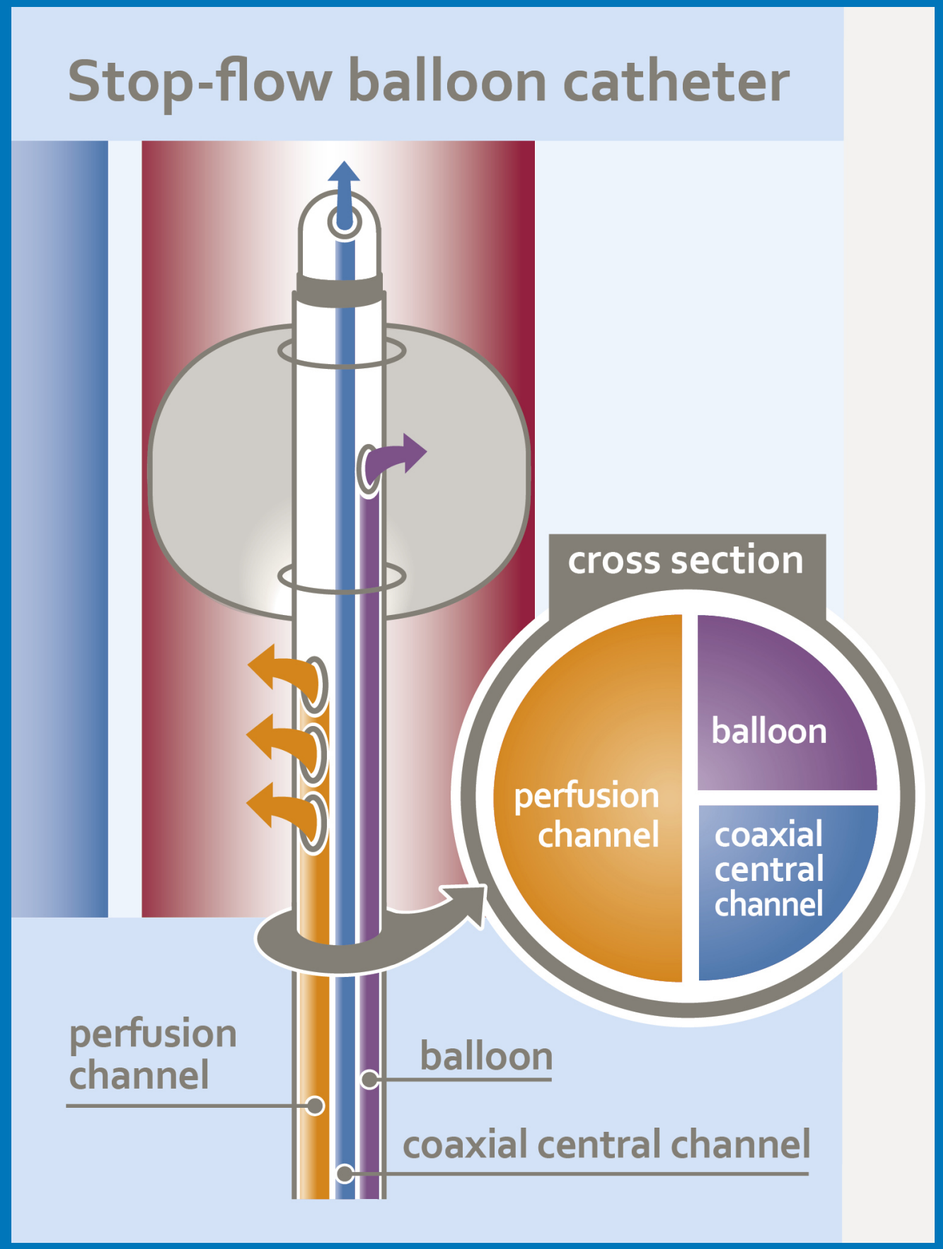


IV (n=61) Median OS 7 months



Overall Survival (III+IV)

	UAP+ EMBO	UAP	EMBO	ia infusion	UAP+ EMBO	UAP	EMBO	ia infusion	
n	6	5	0	2	17	39	4	1	74
median OS [months]	21,5	7	-	14,5	7	8	7	6	



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Conclusions

- UAP yields high survival rates in pancreatic cancer
- UAP in combination with embolization is superior in stage III pancreatic cancer
- UAP reaches high amounts of long term survivors