Electronic Supplementary Material (ESI) for Lab on a Chip.

Tumor-on-a-chip platform to investigate progression and drug sensitivity in cell lines and patient-derived organoids

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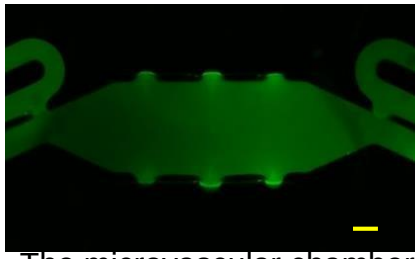

Figure S1. The microvascular chamber of the device can be independently loaded and fed without leakage into the implantation chambers. The microvascular chamber was loaded with fibrin and fluorescently labelled dextran (green) was fed through the left fluidic line. The dextran passes through the microvascular chamber without leakage into the implantation chambers which remain without fluorescence (black). The average pressure drop between the left and right fluidic line was 10 mm H_2O. The scale bar shows 100 μm.

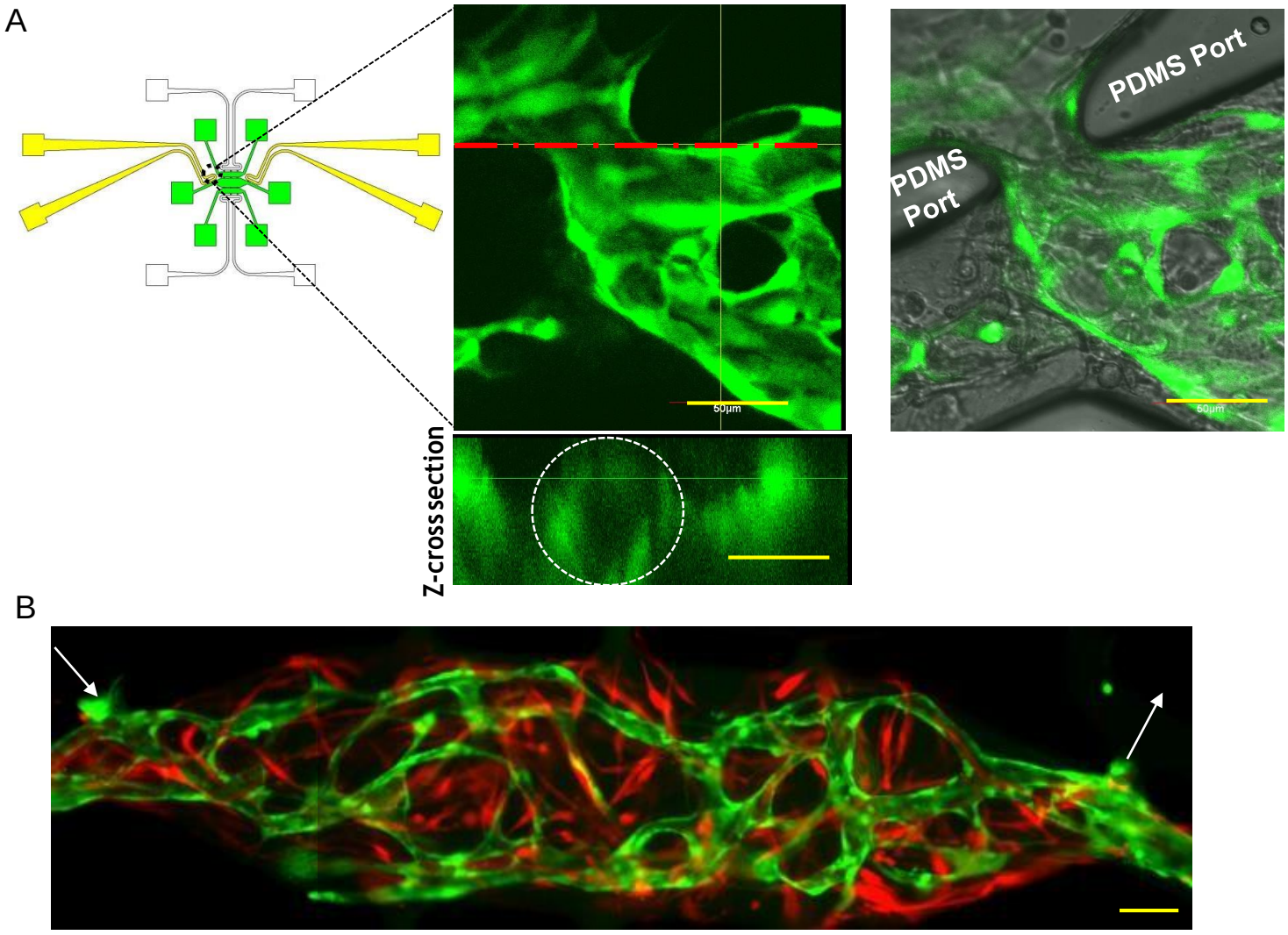

Figure S2. The microvascular network anastomose to the PDMS fluidic lines. A) The endothelial cells (green) and fibroblasts were cultured for seven day in the microvascular chamber. The area near anastomotic point (black circle in left most panel) was imaged by confocal Z-stack. The white dotted circle in the bottom panel shows the cross sectional area of the pore at red line in the top middle panel. The fluorescent image was overlaid on bright field image to show the PDMS port (right most panel). The scale bar shows 50 µm. B) A fully developed microvascular network (green) in the central chamber of the device is anastomosed to the fluidic lines. The arrows show direction of flow from fluidic lines into the lumens of the capillaries. The scale bar shows 100 µm.

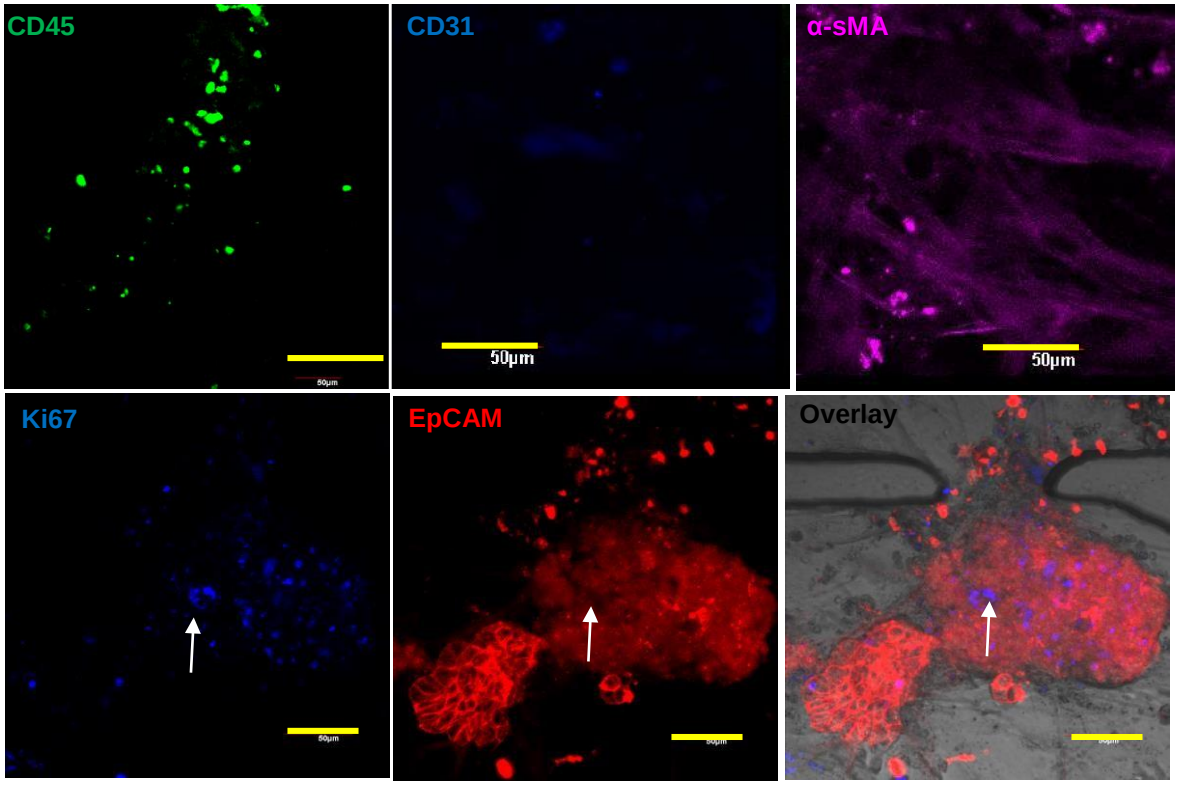

Figure S3. Heterogeneous cell populations are present in the PDTO and the cancer cells proliferate in the device. The PDTO were loaded in the microfluidic device and allowed to grow for 4 days and then stained for various markers. The bottom panels show dual staining of a tissue with Ki67 and EpCAM and the overlay of the two images with a brightfield image. The scale bars indicate 50 µm.

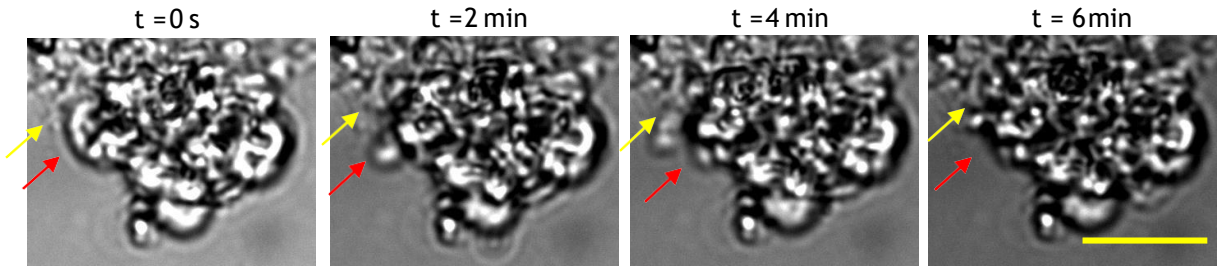

Figure S4. The PDTO remain active in the device. The tumor biopsies were implanted in the device and time lapse imaging of the biopsies was performed after one day of implantation. The arrows indicate protrusions extended retracted from tumors. The scale bar shows 50 µm.

Figure S5.

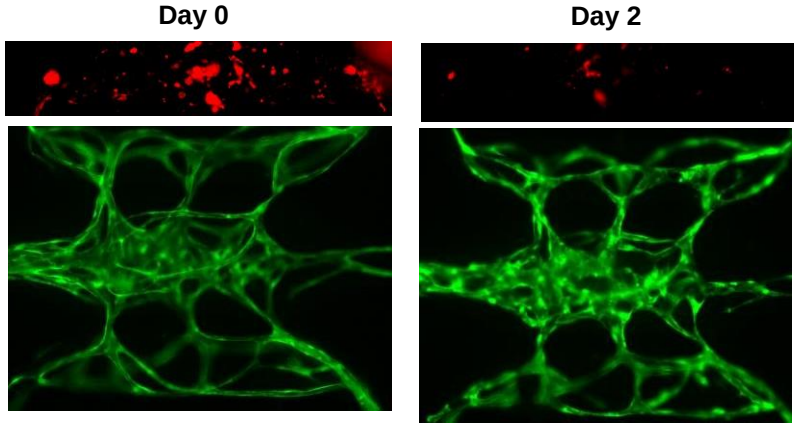

Fig. S5. The paclitaxel treatment of PDTO in the device. The PDTO (red) were implanted in devices, which had a fully developed microvascular network (green) grown for 7 days. The PDTO were grown for two days, and then the devices were treated with paclitaxel at 1 μM concentrations. The images of paclitaxel treated devices were obtained before and after treatment. Un-overlaid images of vasculature in the device and PDTO in the top chamber are shown.

Figure S6.

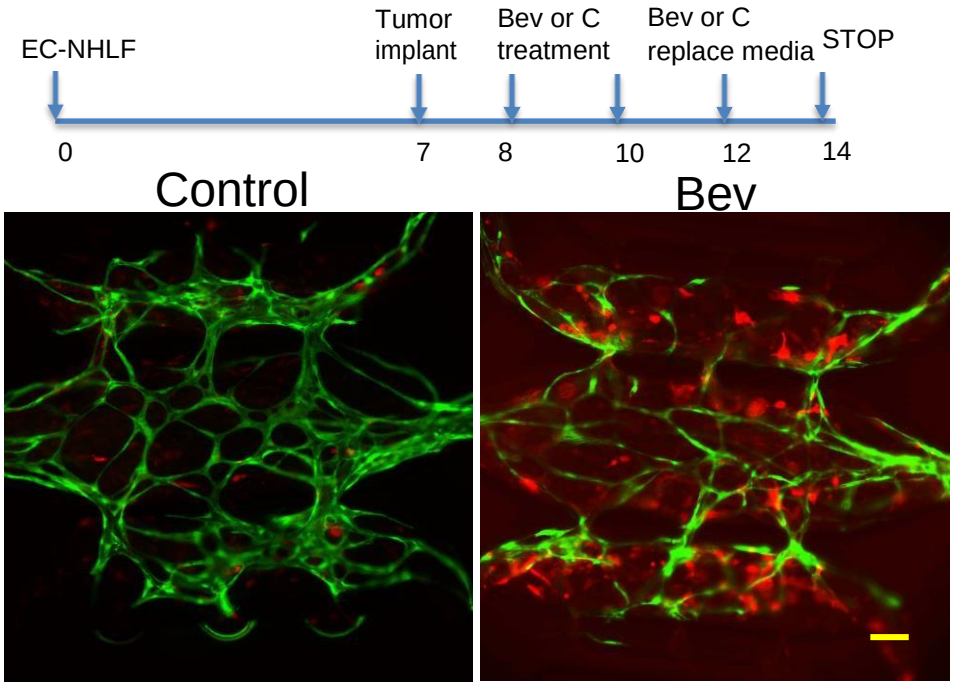

Fig. S6. Anti-angiogenic treatment in the device. The experimental strategy is shown in the line chart. The CRC-268 tumors were implanted into the device on day 7 and the treatment with Bevacizumab or no-drug control was started on day 8 with replacement of media every alternate day. The images were obtained on day 14. The scale bar shows 100 µm.

Videos

S. Video1. A confocal Z-stack of fully developed microvascular network (green) in the central chamber of the device was assembled. The blue shows DAPI.

S. Video2. The perfusion of vessels (green) was tested by perfusing microspheres (blue) through the fluidic lines, which entered into the anastomosed microvessel lumens. The video shows time lapse microscopy.

S. Video 3. The PDTO remain active in the device. The tumor biopsies were implanted in the device and time lapse imaging of the biopsies was performed after one day of implantation. The total duration of the video in real time is 9 hr.