A novel method for the in vivo isolation of circulating tumor cells from peripheral blood of cancer patients using a functionalized and structured medical wire.

The isolation of circulating tumor cells (CTCs) from the blood of patients afflicted with solid malignant tumors becomes increasingly important as it may serve as a 'liquid biopsy' with the potential of monitoring the course of the cancer disease and its response to cancer therapy, with subsequent molecular characterization. For this purpose, we functionalized a structured medical Seldinger guidewire (FSMW), normally used to obtain safe access to blood vessels and other organ cavities, with a chimeric monoclonal antibody directed to the cell surface expressed epithelial cell surface adhesion molecule (EpCAM). This medical device was optimized in vitro and its biocompatibility was tested according to the regulations for medical devices and found to be safe with no noteworthy side effects. Suitability, specificity and sensitivity of the FSMW to catch and enrich CTCs in vivo from circulating peripheral blood were tested in 24 breast cancer or non-small cell lung cancer (NSCLC) patients and in 29 healthy volunteers. For this, the FSMW was inserted through a standard venous cannula into the cubital veins of healthy volunteers or cancer patients for the duration of 30 min. After removal,
CTCs were identified by immuno-cytochemical staining of EpCAM and/or cytokeratins and staining of their nuclei and counted. The FSMW successfully enriched EpCAM-positive CTCs from 22 of the 24 patients, with a median of 5.5 (0-50) CTCs in breast cancer (n=12) and 16 (2-515) CTCs in NSCLC (n=12). CTCs could be isolated across all tumor stages, including early stage cancer, in which distant metastases were not yet diagnosed, while no CTCs could be detected in healthy volunteers. In this observatory study, no adverse effects were noted. Evidently, the FSMW has the potential to become an important device to enrich CTCs in vivo for monitoring the course of the cancer disease and the efficacy of anticancer treatment.