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Invitation to a Lecture within the LEAD Project on "Aortic Dissection"

Standardized Visual Representations of Radiological Surveillance Data with Application to Chronic Aortic Dissections

Dr. Gabriel Mistelbauer
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In this talk, I mainly present visualization approaches to analyze patients with chronic aortic dissections. As these are characterized by a growth of the aortic diameter, patient suffering from dissections require lifelong aortic imaging surveillance. Aortic diameters at well-defined landmarks are routinely measured by experienced 3D imaging staff on baseline and all follow-up imaging. Besides the absolute aortic diameters at a certain timestamp, especially the aortic evolution over time is of high prognostic relevance. Along a specific aortic visualization plot I demonstrate how patients at high risk and need for surgical intervention can easily be identified along their diameter changes over time. All survivors of acute aortic dissections require long-term surveillance with CT imaging to monitor aneurysmal degeneration, false lumen progression and organ malperfusion, which are common late adverse events.
Several imaging features of aortic dissections in the acute phase are associated with a high risk of future adverse events. These include among others the initial aortic diameter and the blood supply (outflow) to aortic branch vessels from the true and false lumen. I explain how significant CT imaging features that are predictive of adverse events in patients with type B aortic dissections can be illustrated in a visual risk calculator. With this, patients with a high risk for adverse events can be identified during follow-up examinations. In this talk, I demonstrate how these heterogeneous surveillance data (aortic diameter, blood outflow, intervention type, and risk) can be combined into a single concise overview visualization.
To support physicians understanding the temporal aspect of the aortic diameter development, I present a concept that uses conventional 3D rotation to navigate through the aortic surveillance data. When assessing malformations of specific organs in 3D, complex interactions are necessary to mentally compare suspicious or pathological regions. A standardized visual representation would help in such cases, especially if patients are under surveillance as these organs have to be compared over time or with each other.
In this talk, I additionally present such visualizations in two different medical scenarios. The assessment of rib bone fractures and lesions consists of many images that have to be thoroughly inspected slice-by-slice and rib-by-rib. I present a rib unfolding strategy that considers the cross-sectional shape of each rib individually and independently. This leads to shape-adaptive slices through the ribs. By aggregating these slices into a single image, radiologists get a concise overview visualization of the entire rib cage for fracture and lesion assessment. The second scenario is related to the human placenta, which is essential for the supply of the human fetus. I present a visualization technique that displays the fetal and maternal side of the placenta in a standardized way. This approach allows physicians to assess the placenta even in utero and establishes the basis for a comparative analysis of multiple placentas.

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Place: Stremayrgasse 16/III, Room BMT03094