NAVIGATION SYSTEM WITH CONTACT FORCE ASSESSMENT TO GUIDE PULMONARY VEIN ISOLATION PROCEDURES

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I. INTRODUCTION

The common option for treatment of paroxysmal atrial fibrillation (AFib), once pharmacotherapy fails, is the electrically isolation of the pulmonary veins. Recent studies have emphasized the relevance of catheter tip-to-tissue contact force for quality of ablation points [1], [2]. In these studies, the average contact force per patient was found to be correlated with the AFib recurrence rate. However, none of the previous studies explored if there is a relationship between the spatiotemporal force distribution and clinical outcome.

During electrophysiology (EP) procedures, visual guidance by either mapping systems and/or fluoroscopy systems is needed. Fluoroscopy enables the physician to get live images of the catheters during the procedure. Since soft-tissue resolution in X-ray images is very low, additional information, e.g., a model of the anatomical structure can be superimposed [3].

II. METHODS

The force output of the TactiCath^{TM} catheter (Endosense, Geneva, Switzerland), has been integrated into a 3-D augmented fluoroscopy prototype (Siemens AG, Healthcare Sector, Forchheim, Germany). It has been designed for a biplane C-arm fluoroscopy system and enables localization and reconstruction of 3-D points, e.g., the catheter tip, from two 2-D X-ray views [4].

The Endosense system provides an interface to share the force information with other systems in the EP lab, e.g., mapping systems or recording systems. This interface provides an analog output with two channels sending the current force, as well as a force-derived parameter, the force-time-integral [5].

The analog signal is digitized with a commonly available AD-converter from PicoTechnology (St Neots, Cambridgeshire, United Kingdom) and connected to the prototype workstation via USB. For each lesion created by the physician, force values are collected over time and stored as a vector. Each force vector can be evaluated individually. Due to the 3-D catheter localization feature of the augmented fluoroscopy prototype, it is possible to associate the force vector with the 3-D location of the ablation lesion.

The main advantages of the integrated system are live visualization of the catheter contact force on the fluoroscopy images as well as extended evaluation possibilities about contact force applied during the procedure.

III. OUTLOOK

The integrated system allows a detailed evaluation of catheter tip-to-tissue contact during the ablation procedure taking into account the 3-D position of each lesion created. It will be a helpful tool to carry out further studies to verify and investigate the impact of catheter contact force during ablation procedures. The first patient is to be treated shortly.

IV. ACKNOWLEDGMENTS

This work has been supported by the German Federal Ministry of Education and Research.

V. REFERENCES

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