# Telerobotic interventions from a distance: an initial experience in 3D phantom mapping

S. Ailoaei[1], P. Wright[1], S. Griffiths[1], M. Jansen[1], S. Ernst[2]

*[1]Royal Brompton and Harefield Hospital, Cardiology, London, United Kingdom; [2]Royal Brompton Hospital Imperial College London, London, United Kingdom*

**Funding Acknowledgement:** Type of funding sources: None.

**Introduction:** The current COVID-19 pandemic has fostered several accelerations in "remote" patient care such as video and telephone clinics, as well as multidisciplinary collaborations using online platforms with experts consulting the local teams from a distance. The next logical step would be to also offer remote-controlled interventions which the expert operator not on site, but in support of the local team. This is especially valuable for complex interventions when either patient or expert operator can not be present at the same place.

**Purpose:** We aimed to demonstrate that an expert operator located at far distance (Austria) could directly interact with the remote magnetic navigation system in London (UK) whilst mapping a 3D phantom using an electroanatomical mapping system.

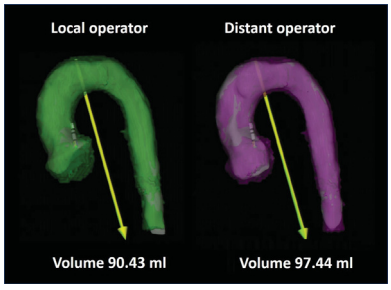
**Method:** Two experienced operators of the magnetic navigation system were tasked with creating fast anatomic maps (FAM) of the atrial and ventricular chambers of a 3D phantom using remote magnetic navigation in combination with 3D electroanatomical mapping. One was located in the control room of the magnetic catheter lab (UK) and the second one was in Tirol, Austria and connected through a secure remote desktop connection (via high speed fibre optic cable). Using a solid tip magnetic catheter connected to a mechanical drive, all interactions with the system were carried out via the Odyssey platform. Acquisitions for right and left atrium, as well as right and left ventricles plus aorta was compared with regards to mapping duration, map completeness (as judged by the average distance of surface points from 3D CT scan reconstruction), total 3D map volume and need for additional radiation exposure during the mapping process.

**Results:** Mapping time and map completeness when performed by the distant operator was not inferior to the local operator and both did not require any additional radiation exposure during the mapping process. Table 1 demonstrates the mean parameters for each chamber, respectively. Figure 1 depicts the matched data for chamber completeness as compared for the LA (green= local operator, pink= distant operator) using a contrast CT scan as the gold standard.

**Conclusion:** Telerobotic 3D mapping of a 3D phantom from a distance was equally fast delivered from the control room as compared to an operator located 1200 km away without compromising on map completeness. This demonstrates the feasibility of telerobotic interventions and stress the need for remote collaboration which is especially valuable when travel of patients and/or physician experts is restricted.

| | RA | | LA | | RV | | LV | | Aorta | |
|---|---|---|---|---|---|---|---|---|---|---|
| Average surface match (mm) | 1.68 ± 1.26 | 1.66 ± 1.25 | 2.58 ± 1.94 | 2.27 ± 1.89 | 1.79 ± 1.69 | 2.28 ± 1.6 | 2.34 ± 2.53 | 3.89 ± 3.02 | 5.61 ± 11.98 | 1.5 ± 1.31 |
| Volume mapped (ml) | 80.94 | 75.26 | 63.29 | 67.48 | 106.97 | 96.61 | 73.86 | 89.74 | 90.43 | 97.44 |
| Time (min) | 21:09 | 14:54 | 20:03 | 16:30 | 26:54 | 29:05 | 14:45 | 18 | 22:56 | 21:20 |

*Table 1.* Mean parameters for each chamber mapped; white= on-site operator; grey= distant operator.




Matched data for aorta