Preliminary accuracy assessment of bifurcation vessel-based US-to-CT rigid-registration for percutaneous liver tumour ablation - Appendix

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1. PATIENT INFORMATION

Table 1. Patients general imaging information

Patient number	Tumor type	Tumor visible in CT	Tumor visible in US	Time between imaging	Liver vessels visible in US	Enough vessel information?	Liver segment during US Scan
PX1	HCC	No	Yes	4 months	PV and HV	Yes	Right Lobe Segment VI
PX2	HCC	Yes	Yes	2 months	None (too small)	No	Left Lobe Segment III
PX3	HCC	Yes	No	1 month	PV	Yes	Right Lobe Segment VI
PX4	HCC	Yes	Yes	4 months	PV and HV	No	Right Lobe Segment V-VIII
PX5	HCC	Yes	Yes	2 months	PV	No	Left Lobe Segment III)
PX6	MET	Yes	Yes	2 months	PV and HV	Yes	Right Lobe Segment V
PX7	MET	Yes	Yes	6 months	PV and HV	Yes	Left Lobe Segment III
PX8	HCC	Yes	No	3 months	None	No	Right Lobe Segment VI-VII
PX9	MET	Yes	Yes	2 months	PV	Yes	Right Lobe Segment VIII
PX10	HCC	Yes	Yes	2 months	None	No	Right Lobe Segment VIII
PX11	MET	Yes	Yes	2 months	PV and HV	Yes	Right Lobe Segment V

Patient trial cases information. Where PV stands for Portal vein, and HV stands for Hepatic Vein.

From the eleven patients imaged, six were chosen to perform the registration and accuracy analysis. The exclusion criteria relied on the ability to see sufficient vessel information in the US image to be able to perform

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the registration. Of those six patients, two did not present visible tumours in US, so were not included in the evaluation of Target Registration Error (TRE) but included in the evaluation of the Fiducial Registration Error (FRE). Table 1 shows the patient information and specifications of their volumes (e.g. tumours and vessels visibility in each imaging modality).

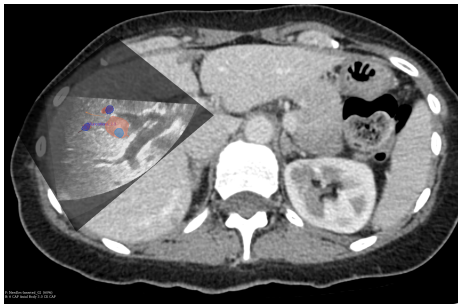
2. REGISTRATION RESULTS

In 2 is shown the FRE and TRE results for each case (phantom and patient trial). *PX7 preprocedural imaging is MRI. PV Stands for portal vein, and HV stand for Hepatic vein.

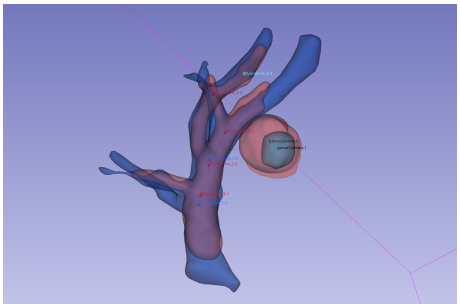
Table 2. Patients registration information

Case number	Vessel used	Bifurcation points used	FRE (mm) (RMS)	TRE (mm) Euclidean distance
Ph-p1	PV	4	1.48	T1 = 1.69
				T2 = 0.59
				T3 = 2.55
				T4 = 2.01
				T5 = 1.47
Ph-p2	PV	3	2.94	T1 = 1.86
				T2 = 2.62
PX1	PV	3	4.62	NA
PX3	PV	3	0.84	NA
PX6	HV	4	1.56	4.64
PX7*	PV	3	1.6	11.40
PX9	PV	3	2.11	8.72
PX11	PV	4	3.42	4.16

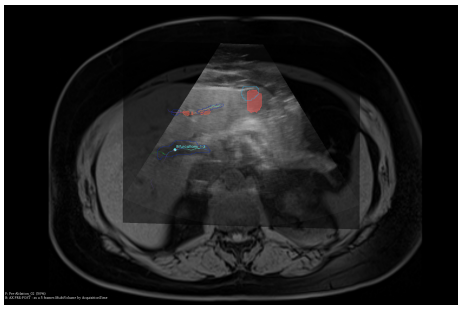
Figure 1 shows all the patients registration with tumours visible in both imaging modalities.



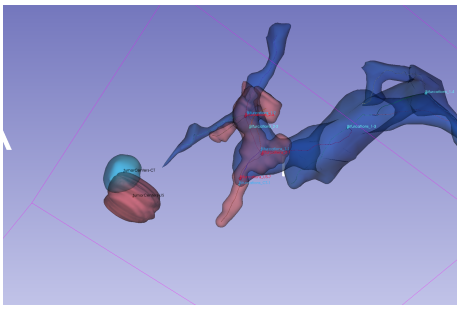
(a) PX6 Volumes (US-to-CT) superimposed.



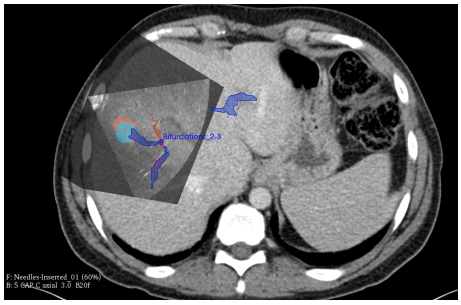
(b) PX6 3D models (vessels and tumour) superimposed.



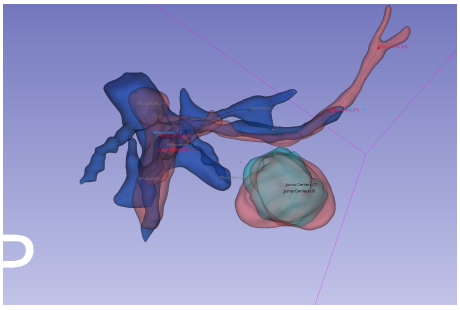
(c) PX7 Volumes (US-to-MRI) superimposed.



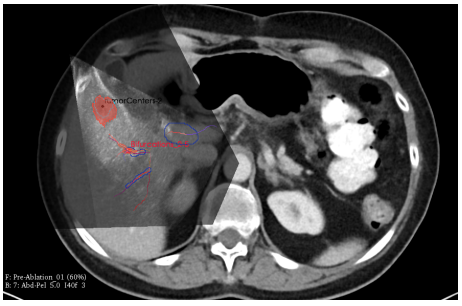
(d) PX7 3D models (vessels and tumour) superimposed.



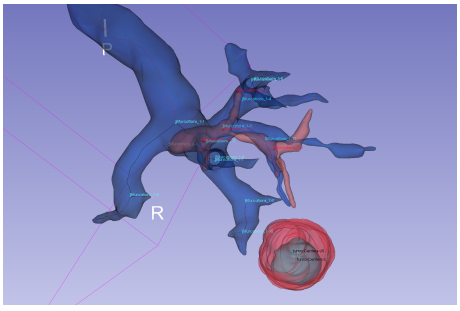
(e) PX9 Volumes (US-to-CT) superimposed..



(f) PX9 3D models (vessels and tumour) superimposed.



(g) PX11 Volumes (US-to-CT) superimposed.



(h) PX11 3D models (vessels and tumour) superimposed.

Figure 1. Patient trial registration results.