A METHOD FOR ACCURATE SPATIAL REGISTRATION OF PET IMAGES AND HISTOPATHOLOGY SLICES

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INTRODUCTION

- An accurate alignment of histopathology sections and PET images is important for radiopharmaceutical validation studies1.
- We developed a method to align PET and histology images obtained in a routine pathology laboratory setting and assessed its accuracy.
- The method can be applied to non-parallel, non-contiguously cut and non-mega-block sized histology slices.

METHODS

- Subjects with head and neck cancer underwent a 18F-FDG PET-CT scan a week before surgery.
- After surgery, sea urchin spines (Figure 1a), which can be identified with CT, were used for registration of in-vivo to ex-vivo CTs was 2.90±0.06mm, and for registration of histology to ex-vivo CT was 1.69±0.70mm.
- The accuracy for registration of in-vivo to ex-vivo CTs was 2.90±0.06mm, and for registration of histology to ex-vivo CT was 1.69±0.70mm.
- The methodology used to align PET and histology is described in Figure 1b.
- From these thick sectioned slices, a subsection of tissue that included tumour and markers was extracted and embedded in paraffin blocks of size 30x21 millimetre (mm).
- Subsequently microtome sectioning and haematoxylin and eosin staining was performed to acquire thin slides and digitised using a microscope.
- The method can be applied to non-parallel, non-contiguously cut and non-mega-block sized histology slices.

RESULTS

- The PET and histology registered to CT ex-vivo are shown in Figure 2.
- The total registration error between PET-Histology for 10 histology samples was 6.39±2.11mm (Table 1).
- The largest error in the PET-Histology registration process is due to the systematic PET-CT registration error.

CONCLUSION

We have developed a semi-automated registration method to align PET and histology images (Figure 2) with a registration accuracy of 6.39mm (Table 1) which is comparable to the PET spatial resolution.

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REFERENCES


TABLE 1: The table shows (from left to right) the registration errors in millimetres for ten histology samples. TRE corresponds to target registration error. L-1-O correspond to leave-one-out. PETin corresponds to position emission tomographic image obtained in-vivo. CTin corresponds to computed tomography image obtained in-vivo. CTEX corresponds to computed tomography image obtained ex-vivo.