Registration Technique of Endoscopic Scintillator on MRI Using Optical Position Sensor for Early Detection of Gastrointestinal Stromal Cancer

H. Sato[1], H. Watabe[2], N. Teramoto[2], K. Koshino[2], A. Yamamoto[2], J-I. Enmi[2], T. Goto[3], Y. Iwadate[3], T. Tsukamoto[3], H. Iida[2]

[1]Diagnostic Solution, National Cardiovascular Center Research Institute, Suita, Osaka, Japan, [2]Investigative Radiology, National Cardiovascular Center Research Institute, Suita, Osaka, Japan, [3]Japan Applied Science Lab., GE Yokogawa Medical Systems, Hino, Tokyo, Japan

Introduction

The advantages of combining diagnostic imaging modalities has been highlighted recently. Particularly, the introduction of clinical PET-CT system (1) has demonstrated the importance of registration of biological function on anatomical structure in a integrated system. The idea of combined PET-MR system implies difficulty in practical development due to interference of a strong magnetic field. With an eye to the promising advantage of MRI, such as better soft tissue contrast and non-radiation, several integrated solutions has been proposed(2). Those developments are massive and fail to detect small gastrointestinal stromal cancer due to lack of resolution of PET. Our cost-effective approach to registering functional information on MR images has been to give up simultaneous acquisition of each image and to adopt optical sensor (Polaris) for tracking endoscopic scintillator to find small cancer with its location.

Materials and Methods

Instead of using developed endoscopic scintillator (must be discussed in other presentation), dummy probe (Fig.1) with point signal source (0.4ml, green tea: T1=1.5s for MRI, ^{18}F solution: 1-36MBq for PET) was intubated into the esophagus of a swine (Fig.2, 18kg, 3month, n=1) and a simulated phantom (Fig.3, n=5) to evaluate accuracy and repeatability of actual locations in MRI (FSPGR, 3D, TR=6.3ms, TE=1.3ms, Resolution>1.5mm) and PET fusion imaging. Passive infrared reflectors (Fig.4) were located on each subject and gantry and detected by stereo-cameras (CCD). Pre-calibration with 13 reflectors at known locations was performed to calculate transformation matrix for each scanner coordinate system(3).

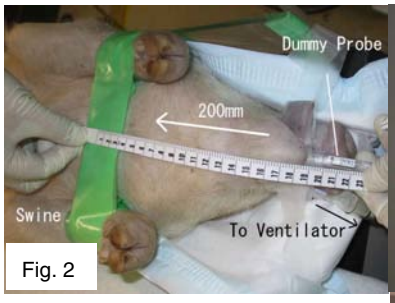

Fig. 2

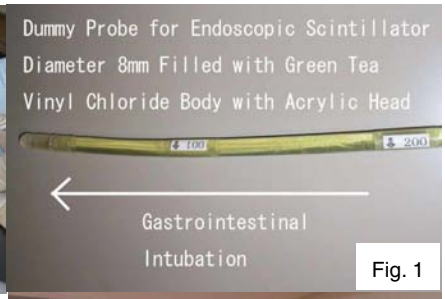

Fig. 1

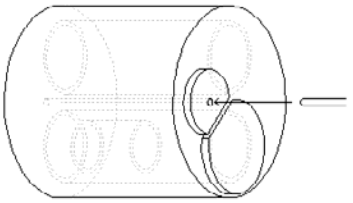
Fig. 3

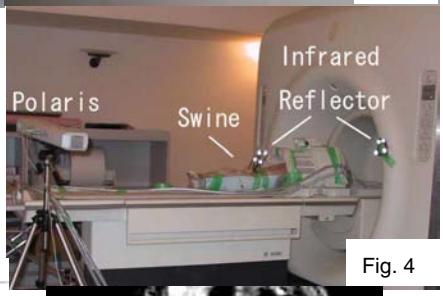

Fig. 4

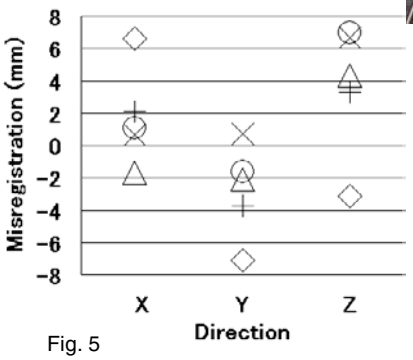

Fig. 5

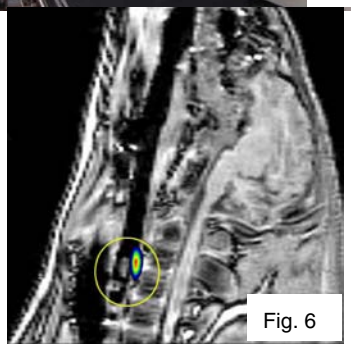
Fig. 6

Results and Discussion

Misregistrations of probe's head location between PET and MRI images for a phantom were plotted on Fig.5 and fusion image of a swine was shown on Fig.6. Maximum S.D. of 4mm indicated proposed approach should be feasible for phantom experiment and ready to further repeatability and reproducibility study for animals.

References and Acknowledgement

1)Beyer et al, J.Nucl.Med., 41(8):1369-1379, 2000 2)Garlick et al, NMR in Biomedicine, 10(3):138-142, 1997 3)Koshino K et al, Quantitation in Biomedical Imaging with PET and MRI, Elsevier Science, pp 106-110, 2004. This research was supported by the Ministry of Health, Labor and Welfare and the New Energy and Industrial Technology Development Organization.