


Teleradiology for Remote Quantitative Analysis of PET

- Omission of Arterial Blood Sampling -

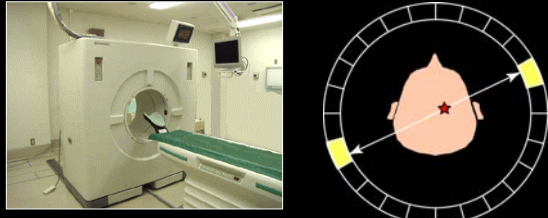
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April 28, 2005



Principle of PET Measurement


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- Tomographic image of a distribution of radioactive pharmaceutical.
 - Functional imaging.



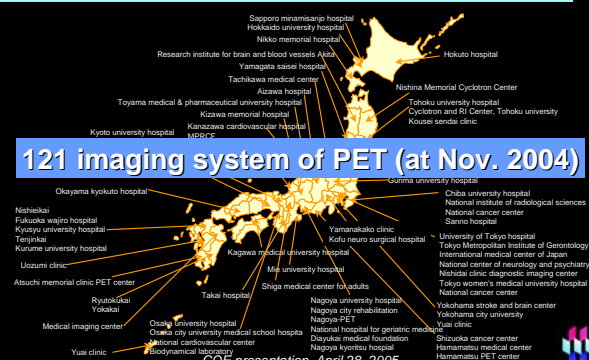
PET

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Growing Number of PET

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121 imaging system of PET (at Nov. 2004)

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Diffusion of Mobile PET

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- Many institutions (in USA), without a PET scanner, started using a mobile PET units 1 or 2 days per week.



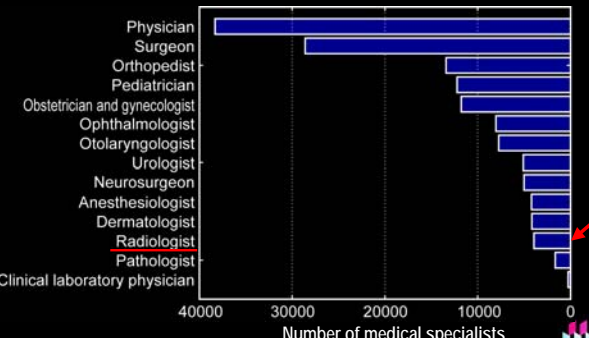
Mobile PET

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Lack of Number of Experts

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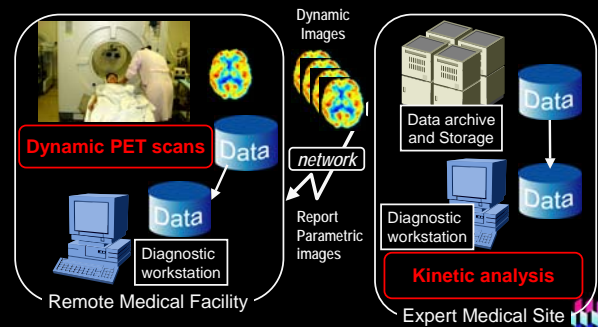
Number of medical specialists

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Proposed Teleradiology System


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Remote Medical Facility

Expert Medical Site

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Kinetic Analysis of Dynamic PET Images 7/14

$$\text{tissue curve} = \frac{K_1}{k_2 + k_3} \left\{ k_3 + k_2 e^{-(k_2 + k_3)t} \right\} \otimes \text{blood curve}$$

time

concentration in plasma

Time

Blood Curve

concentration in tissue

Time

Tissue Curve

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Kinetic Analysis of Dynamic PET Images 8/14

- Physiological parameters are calculated based on mathematical model.

Cerebral metabolic rate of glucose

[mg/min/100g]

11.9

7.92

3.96

0

Time

k_1 k_2 k_3

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Practical issues 9/14

- Arterial blood sampling.
- Huge computation time.

5 secs / 1 voxel

100000 voxels / patient

5-6 days!! / patient

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Dynamic PET Image Model ~ Components 10/14

- Dynamic PET images consist of two components.
- Assumptions.
 - The blood curve is common in whole brain vessels.
 - The shape of the tissue curve is common in whole brain tissues except its scale.

brain tissue

voxel

microvessel

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Dynamic PET Image Model ~ Equation 11/14

time

Blood curve

Blood volume image

Tissue curve

Tissue image

Dynamic PET images

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Estimated blood curve 12/14

concentration [Bq/mL]

time [min]

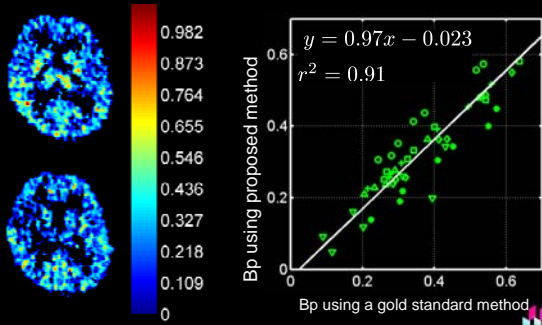
○ : measured arterial blood samples

— : estimated

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Binding potential

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Conclusion

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- Teleradiology system for kinetic analysis of PET images is proposed.
- Kinetic analysis will provide more objective interpretation of PET images, however it requires much computation time and serial arterial blood sampling.
- The proposed method allows arterial blood sampling to be omitted.
 - No assumption on a specific kinetic model.

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