Anaesthetics that compliment radiotracers [68Ga]Ga-DOTA-TATE, [18F]FDG and [68Ga]Ga-PSMA-11 PET/CT Imaging in Rodents

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Introduction

Anaesthetic compounds are routinely used during preclinical imaging investigations to avoid movement artefacts. However these agents can influence tracer uptake and may increase mortality risks during anaesthesia and should thus be investigated thoroughly prior to choosing an anaesthetic agent.

Aim

To summarise the effect of common anaesthetic agents on the expected biodistribution of three radiotracers commonly used in preclinical imaging investigations.[1]

Results

		[18F]FDG	[68Ga]-DOTA-TATE	[68Ga]-PSMA11
Inhalation	Isoflurane			
	Sevoflurane			
Injectable	Ketamine/Xylazine			
	Pentobarbital			
	Propofol			
	Fentanylcitrate fluanisone/Diazepam		n/a	n/a

Table 1. Compatibility of various anaesthetic agents for optimal micro PET/CT imaging of indicated radiotracers.

RED – Contraindicated with high physiological interference regarding tracer uptake and biodistribution

ORANGE
– Increased safety risk to animal with possiblity of morality
– Moderate interference with tracer uptake

GREEN – Low interference with physiological processes and expected tracer uptake

Method

A systemic literature search was performed which was specific to anaesthesia in rodents which was considered to micro PET/CT imaging studies.

Further refinement was included for the following radiotracers:

[^{18}F]FDG (glucose metabolism) (Figure 1)

[^{68}Ga] Ga-DOTA-TATE (somatostatin 2 receptor ligand) (Figure 2)

[^{68}Ga]Ga-PSMA-11 (prostate specific antigen ligand) (Figure 3)

Effects on respiration rate, body temperature, heart rate and glucose metabolism were evaluated with respect to the radiotracer expected/known biodistribution.

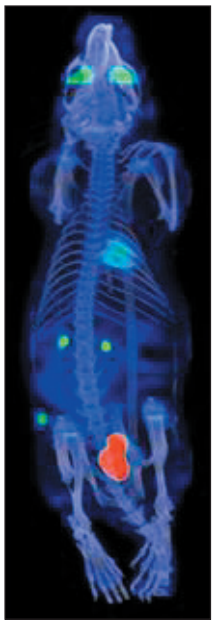

Figure 1.

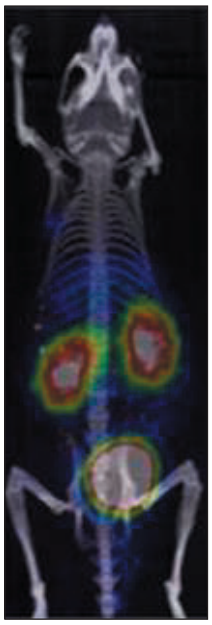

Figure 2.

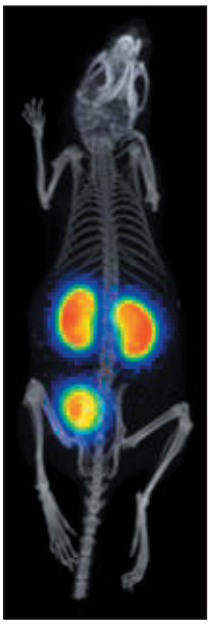

Figure 3.

Conclusion

Anaesthetics used for PET and CT imaging need to match the radiotracer and expected biodistribution to allow for optimal, uninterrupted image acquisition.

Better understanding of the interplay between radiotracers and available anaesthetic agents will improve the standard, performance and outcome of the imaging studies that aim to use radiotracers as a sensitive *in vivo* biomarker i.e. to study drug effects.

This summary can be used as a guideline as part of initial study planning when implementing the 3R principles, ARRIVE and PREPARE guidelines.

Discussion

- Isoflurane is the most optimal inhalation anaesthetic.[1,5]
  - Care should be taken when imaging [^{68}Ga] Ga-DOTA-TATE as this influences glucocorticoid levels and other neuroendocrine abnormalities[2].
  - When compared to Sevoflurane it is also more favourable due to decreased cardiac depression and increased tracer uptake.[3]
- Pentobarbital and Propofol are suitable injectable anaesthetic agents for [^{68}Ga] Ga-DOTA-TATE and [^{68}Ga]Ga-PSMA-11 imaging.
  - Care must be taken with Pentobarbital monitoring the vital signs due to increased respiratory and cardiac depression.
  - Propofol is not suitable for cerebral [^{18}F]FDG imaging due to lowering the glucose metabolism in the brain resulting in decreased cerebral uptake.
- Fentanyl citrate fluanisone/Diazepam is the most suited injectable anaesthetic option for [^{18}F]FDG.
  - Shows the least interference with glucose metabolism which results in optimal tumour imaging.[4]

References

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