University of Pennsylvania-Radiology
Small Animal Imaging Facility
Standard Operating Procedure

Title: Guideline for the MRI/MRS Animal Studies at the Small Animal Imaging Facility.

SOP Number: 4.07 Version Number: 4

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Review Date: October 10, 2023

Approval: Stephen Pickup, Director of SAIF Operations

I. Purpose: The purpose is to provide the guidelines for the proper usage of MRI component of the Small Animal Imaging Facility (SAIF).

II. Responsibilities and Scope: All investigators involved in performing MRI/ MRS animal studies must familiarize themselves with this SOP.

III. Definitions: None

IV. Procedures:

A. Principal Investigators (PIs) wishing to use any MRI/MRS imaging instruments at the SAIF must follow the animal transfer SOP (refer to SOP 4.03).

B. All small animals undergoing longitudinal imaging studies must be housed in the SAIF husbandry facilities in either JMB-100 or SCTR-1 following approval by the Animal Oversight Subcommittee (AOS) of the SAIF (refer to SOPs 4.03 and 4.04).

C. PIs are required to sign up for a time slot to use the MRI instrument prior to using these resources.

D. During animal preparation, all researchers must follow the facility guidelines for use of Isoflurane gas anesthesia (refer to SOP 2.04).

E. Before usage of the MRI/MRS instruments, all animal researchers must have a SAIF application that was reviewed and approved by the SAIF Oversight Subcommittee (SAIF SOP 4.05). Proper training in the use of the facility and safety procedures is required. All researchers must clean and disinfect all surfaces that come into contact with the animal in order reduce cross-contamination.

F. Since no animal holding areas are available for the non-longitudinal imaging studies, all survived animals must return to the University of Pennsylvania animal facilities within 12 hours with the approval of ULAR and in accordance with their approved IACUC animal protocols.

G. MRI/MRS user procedures for the Imaging studies.

1. PIs wishing to use MRI/MRS instruments for their studies must adhere to all relevant SOPs (refer to SOPs 4.02, 4.03 & 4.04).

2. Users will make sure that all components of the anesthesia system(s) that will be used for the study are present and functioning properly. All fittings will be checked for good fit (Tape IS NOT A FITTNG) and compatibility with supporting equipment (i.e. induction chamber, nose cone). The seals on induction chambers must be secured and functional. Users will contact SAIF support staff to get replacements for any missing or poorly functioning components. Users will not proceed until all components of the anesthesia system are present and functioning properly.

3. Any activated carbon canisters that will be used for anesthesia scavenging during the animal preparation and/or MRI exam will be weighed before use. If the weight is 50 g or more greater than the original weight, the canister will be replaced. Otherwise, the date and weight will be logged on the canister.

4. The isoflurane level in any vaporizers to be used during the animal preparation and/or MRI exam will be checked. Isoflurane should be refilled as needed prior to turning on the carrier gas while taking precautions to minimize exposure of self and others.

5. The supply lines of the nose cone to be used during MRI and the induction chamber used for animal preparation will be connected to the "Y" tube of the vaporizer. The valve on the induction chamber branch will be opened and the one on the nose cone side will be closed. Note that it may be necessary/desirable to thread the nose cone line through the RF coil to be used prior to attaching it to the vaporizer.

6. The animal to be studied will be placed in the induction chamber, the carrier gas turned on with a flow rate of approximately 0.8 liter/min and the vaporizer set to a level of 1-2% Isoflurane. Excess Isoflurane will be scavenged by attaching either an activated carbon canister or a waist anesthetic gas disposal (WAGD) line to the exhaust port of the induction chamber. Once general anesthesia is induced, the flow of anesthesia to the induction chamber will be turned off, the chamber purged by pressing the purge button on the vaporizer for approximately 10 sec, and the animal will be removed from the induction chamber. The animal will then be secured to suitable nose cone and the supply of anesthesia to the nose cone turned on. The WAGD line will be transferred to the nose cone and activated if the nose cone supports scavenging.

7. Any procedures specific to the protocol (i.e. catheter placement, surgical procedures) should be performed at this stage while maintaining anesthesia. For prolonged procedures core body temperature should be monitored and maintained using either a heat lamp or heating table.

8. A temperature probe lubricated with surgical lubricant will then be inserted into the rectum of the animal and secured to the animal's tail with tape. Any additional vital signs monitoring probes/electrodes should be applied to the animal at this time.

9. The animal will then be positioned and secured in the RF coil/patient bed such that the region of interest is centered in the homogeneous region of the coil. All vital signs leads will be fed to the appropriate end of the coil/patient bed and secured. The air hose used to maintain the animals core

body temperature will then be secured to the coil/patient bed such that it directs air over the animal.

10. The anesthesia and carrier gas will be turned off, the RF coil/patient bed will be transferred from the preparation anesthesia system to the one adjacent to the scanner and the carrier gas, anesthesia and scavenging will turned on as described previously. The RF coil/patient bed will be positioned in the magnet and the warm air hose attached to the regulated air source. The functioning of all vital signs probes will be verified and the regulated air source will be set to 37°C. The user will confirm that the heater is function properly.

11. The MRI/MRS study will be performed.

12. The user will turn off anesthesia, turn off the carrier gas and then remove the RF coil/patient bed from the magnet. The user will return the apparatus to the prep room, remove the animal from the RF coil/patient bed, remove all vital signs probes, return the animal to its cage and observe the animal during recovery from anesthesia.

13. All tape and residue will be removed from MRI equipment and counter. All surfaces that came into contact with the animal will be wiped with CLIDOX, including the RF coil, patient bed, vital signs probes and countertop.

14. All equipment will be returned to its proper storage location. All consumable materials will be disposed of in the proper receptacle.

V. Directions: None

VI. Safety Considerations:

A. No “hot” radioactive materials or animals should ever be brought to the MRI lab.

B. Reminder: Drinking, eating, and open-toe shoes are not allowed under any circumstances in SAIF facilities. Wearing safety glasses is strongly recommended when handling animals.

VII. References:

A. Penn-ULAR-SOP 4.20. Transport of Laboratory Rodents-Philadelphia

B. SOP 4.02 Entry Procedure for the Animal Preparation Rooms in the Small Animal Imaging Facility

C. SOP 4.03 Guideline for Transfer of Mice to SAIF Housing Facilities

D. SOP 4.04 Guideline for the Longitudinal Imaging Studies at the Small Animal Imaging Facility

VIII. Attachments: None

IX. Document History:

Version

Number	Effective Date	Author	Reason
1	November 10, 2005	S. Pickup & I. Lee	New
2	January 20, 2021	WX Liu & S. Pickup	Update
3	March 18, 2022	WX Liu & S. Pickup	Update