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SSAT Career Development Grant Update

Summary

The primary aim of this grant was to develop and pilot the use of an MRI compatible box that would allow precise radiographic-pathologic correlation of resected operative specimens. This has recently been accomplished and is the basis of a newly submitted patent application. Further, now that we have a well constructed and reliable device and have demonstrated the ability to localize very small lesions in a larger specimen with precision, we are ready to seek additional funding to begin to clinical studies.

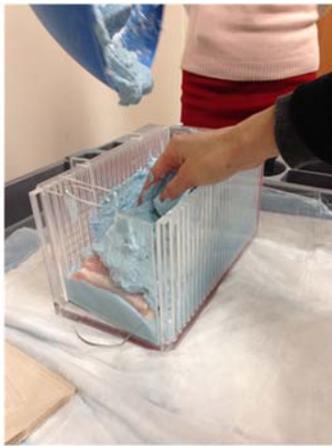
Box development

In summary, the box is made of acrylic with grids in each of three dimensions and slicing guides to allow for precise identification of 1 cubic centimeter cubes. The largest hurdle that needed to be overcome during the box construction was the difficulty with selecting a material with which to fill the grids that was MRI visible with high fidelity but also durable. We began by using gadolinium, but noted that after several weeks, it began to leech into the acrylic. After several adaptations to try to minimize this phenomenon, we then sought a different material with which to fill our grids. After several trials of a variety of materials, we chose to use a colored silicone which ideally met the requirements of the box. See picture below for picture of constructed box.

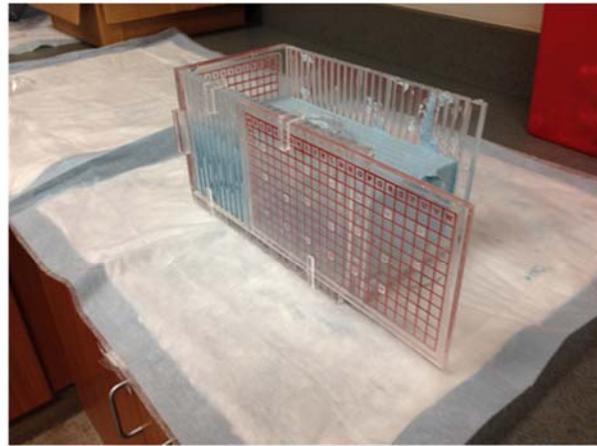


Demonstration of precise radiographic-pathologic correlation

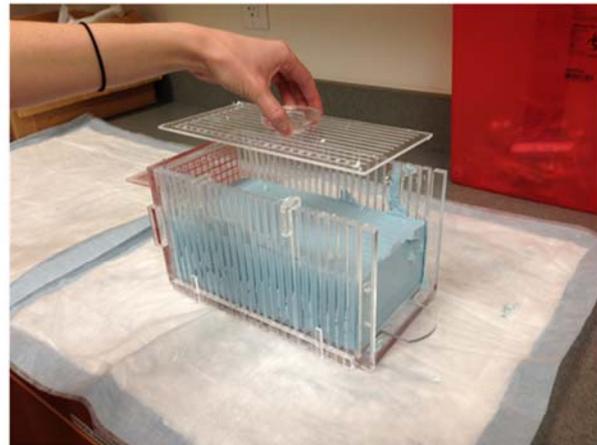
After demonstrating that the grids were well seen by MR imaging and that we could manipulate those images in three dimensions, we then proceeded to demonstrate precise radiographic-pathologic correlation using simulated lesions. In order to allow the specimen to be supported in the box for slicing, we trialed many potential materials and selected alginate as the optimal material as it did not have any heat generated by its mixing and it set during the time required for imaging, to allow for immediate slicing. Once the tissue is embedded and imaged, it is then sliced along in up to three planes (see images below).



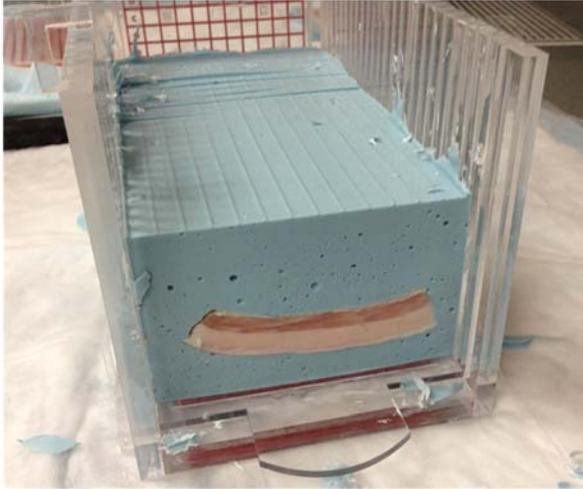
Pouring alginate



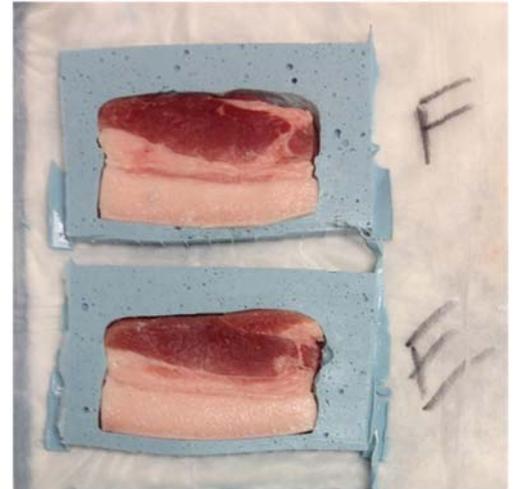
Removing side grid prior to cutting



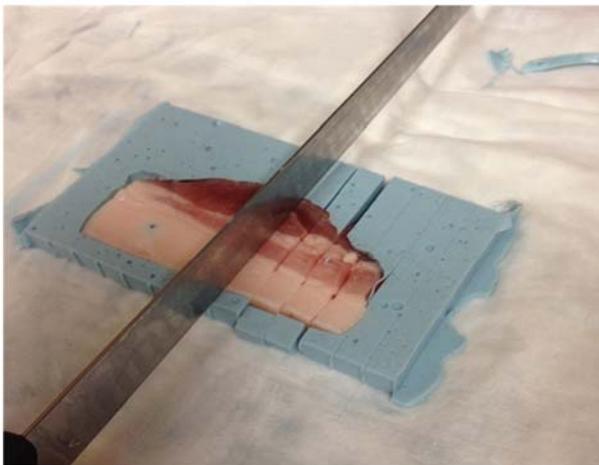
Removing superior plate prior to cutting



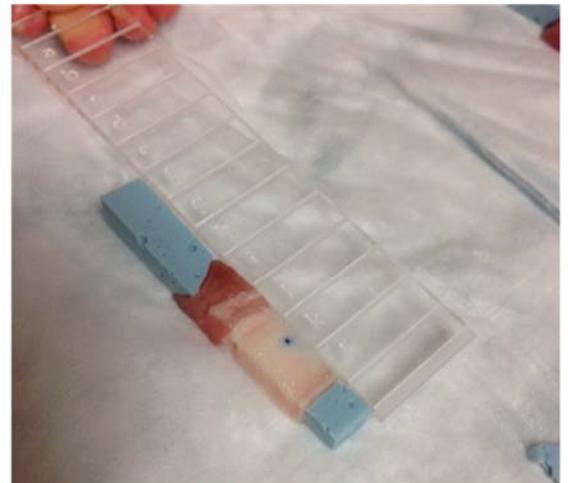
Initial sectioning to reveal embedded tissue



Slices resulting from initial sectioning



Sectioning each slice in the second dimension

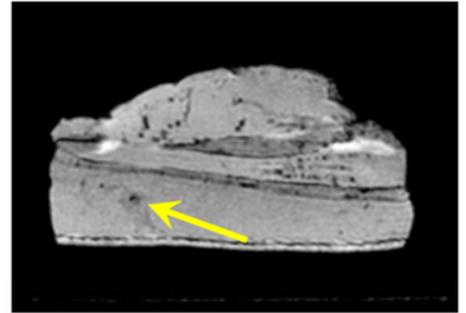
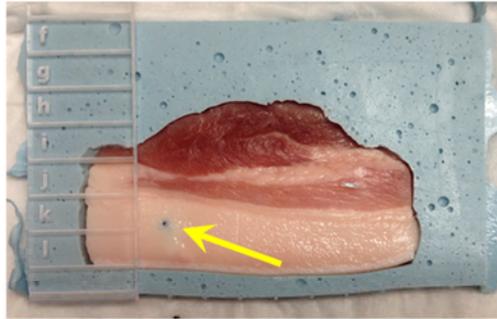


Using the guide for the third dimension

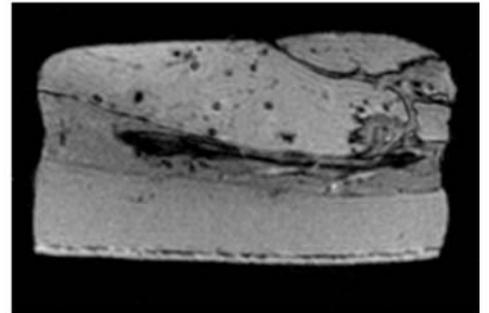
Simulated Lesions

Simulated lesions were then created by the injection of methylene blue dye mixed with gadolinium into store bought cuts of meat. These were then localized on the MR images and then sectioned using the three dimensional code to find each simulated lesion. For example, we found one lesion at position A2d on the images and then sectioned the block according to the methods given above and identified slice A in plane 2 at position d. Doing this with multiple lesions, we were able to properly identify them and show the correlates as below. The lesions are indicated with yellow arrows.

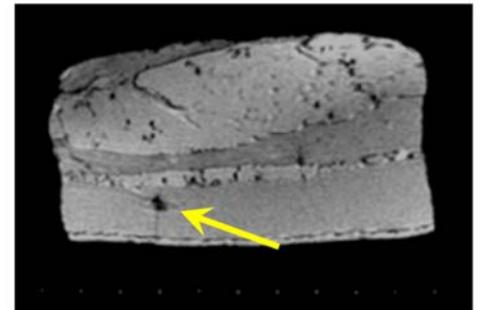
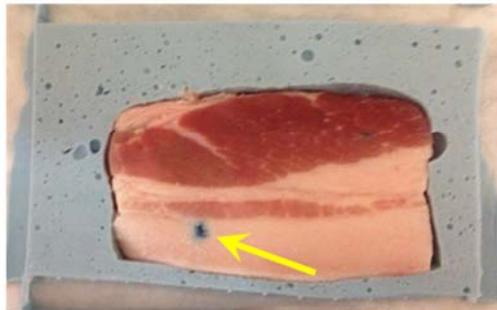
Slice C



Slice E



Slice J



* Arrows = methylene blue injection site