Accurate animal tracking: From weaning to necropsy

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Abstract

Research studies usually involve many different people and the collection of several data points. Collection and storing of all of this information can be a monumental task. Using pen and paper or patching together electronic notebooks and files can be cumbersome, inaccurate and limit fast access to study data to those involved in the study.

Using radio frequency identification for passive electronic study tracking, including, but not limited to: animals, surgery, dosing/sampling, necropsy, tissue collection, pathology, data acquisition and management software can improve accuracy, quality and efficiency during toxicology research.

Using programmable RFID microchip technology and software to capture, process and analyze data, researchers can create a complete accurate record for each individual enrolled in the study. Using this technology, we were able to track groups of research animals starting when we received them through to necropsy and tissue collection.

Introduction

+ Accurate documentation is essential for all studies
+ Tracking and linking test subjects, procedures, treatments, and samples
+ Recording all events related to the test subject and personnel completing procedures
+ Contain and store all data in one place accessible to all study related personnel
+ Access to real time data during the study collection
+ Recording and linking all data from the start of a study to the completion of necropsy and pathology

Objectives

+ Efficiencies in the 3R's. Ultimate Goal is Animal Reduction, Refinement of the study process and Replacement of Pen and Paper with passive electronic data recording
+ Compare traditional notebook collection systems with all electronic collection
+ Improve current data collection techniques
+ Control study variables and minimize errors
+ Accessible central notebook for all data
+ Study data follows test subject
+ Improve efficiency, accuracy, and reliability
+ Replace current data collection techniques with Passive RFID data collection

Materials and methods

+ PI suite laboratory software (Figure 1a)
+ RFID microchips (Figure 1b)
+ Male Hsd:Sprague Dawley® SD® rats
+ All animals were maintained on a 12:12 hour light/dark cycle. In accordance with the health surveillance program currently in use, rats were known to be free of common adventitious agents as published on the vendor's monthly health reports available on their website, www.envigo.com
+ Rats were pair housed before surgery and singular after surgery in open, wire-top, polypropylene shoebox cages (11 ½" in width × 10 ½" in length × 7 ½" in height)
+ Rats were fed Teklad Global Diet 2018S, 18% Protein, pelleted food (Teklad, Madison, WI) and water *ad libitum*
+ Rats regularly received a Diamond Twist (Teklad, Madison, WI) as an enrichment item
+ The protocol was approved by the Envigo, RMS IACUC and was performed in accordance with an AAALAC accredited program.

Experimental Design

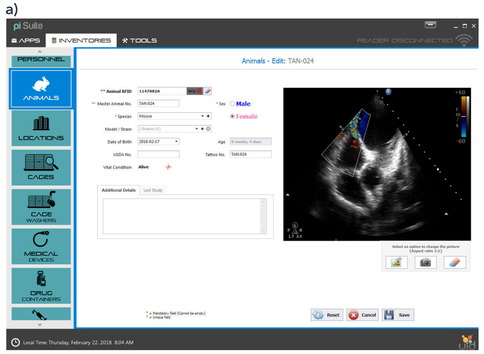
+ Animal model: Sprague Dawley, male rats 200-224g at time of receipt; 225-250g at time of surgery
+ Rats implanted with an RFID microchip on arrival and entered into inventory
+ Study protocol created
  + Surgical Model: Permanent ligation Myocardial Infarction (MI)
  + Animals were housed for 6 months post-surgery
  + Starting at Day 7 animals had weekly echocardiogram to measure ejection fraction
  + Minimal twice per day health and welfare checks
  + Weekly cage changing
+ Recovered rats were placed on study

Cohort 1

+ Study protocol was entered into the PI software
  + Surgery parameters (date of surgery, surgeon, anesthesia regimen, analgesic schedule, recovery schedule)
  + Cage and rack assignment
  + Health checks, study start date, study parameters
  + Study end date, disposition of animals
  + Tissue collection / pathology
  + Reports
+ Rats RFID chips were scanned into the UID software and assigned to the study protocol (Figure 2)
+ RFID cage cards automatically printed when animal assigned to study
+ RFID labels created for sample collection and paperwork, linked to individual animal RFID and printed as needed
+ Laboratory personnel assigned to the study via RFID bracelet (Figure 1b)

Figure 1: a) RFID Software home screen b) RFID Technician ID bracelet c) RFID microchip d) RFID cage card

a)



b)

c)

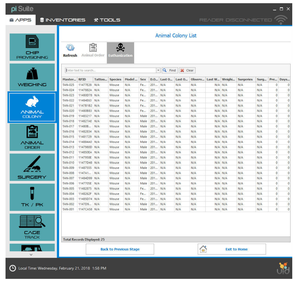
d)

Cohort 2

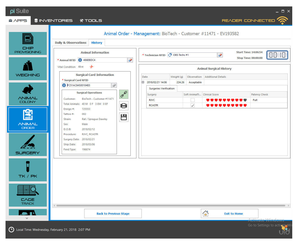
+ Study protocol printed and distributed to assigned lab personnel
+ Animals assigned to the study and permanently identified with a tail number
+ Cage cards prepared manually
+ Study notebooks assigned and data sheets created/printed
+ Centralized paper and shared electronic calendar created for study related tasks
+ Labels created via label program and printed as needed

Figure 2: a) Study entry b) health check screen c) surgery screen

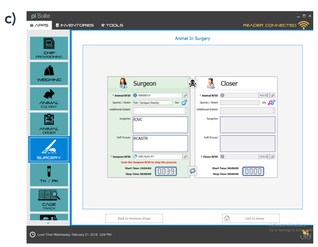
a)



b)



c)



Results

Using laboratory software provided by UID with RFID microchips we were able to increase study efficiency and reduce the number of full time employee hours completing study related tasks. Using the automated software decreases in study related errors, including inaccurate dosing and sampling volumes was achieved.

By using passive data collection from RFID scanners accurate documentation and tracking of weight, animal welfare checks and other procedures were easily performed.

This new method of data collection provided enhanced and immediate access to the individual animal health records on mobile tablets to help identify any issue with the animal on study.

The software was able to complete scheduling reminders for lab procedures and email reminders to the assigned technician and alert the study director if the time period for the procedure was missed, decreasing late and missed procedures.

When an issue on the study arose outside of normal laboratory hours, using the software, real time up to date data and live video and pictures could be accessed off site by study related personnel, including echocardiogram data, to quickly assess the animal and make accurate, effective treatment decisions. At the end of the study all the data was contained in one central database repository, which reduced time collecting all the relevant information from many different sources and expedited the quality review of the study.

Conclusion

Advancements from traditional methods of data collection to using technology to organize, schedule and maintain study data is a huge step and took patience and effort from everyone involved in the study. Initially, during the training period for the software our efficiency suffered but quickly improved as we learned the software and embraced the change. After the study was completed (including arrival, surgery, recovery, health checks, necropsy and pathology) data compilation and data analysis was much easier using the software when compared to gathering and checking notebooks and pulling together all the paperwork from various sources. Many back and forth trips by the technicians to the study director and quality are required to correct missed or incorrect paper entries and clear up inconsistencies and legibility questions. The software completed the checks and balances as the study proceeded and less effort was required at the conclusion of the study. Archival storage was also enhanced by using RFID labeled necropsy jars, samples, and microscope slides for faster and easier inventory tracking and recovery.

By working together, the team achieved improvement in the animal's health status, reduced animal usage, and increased the efficiency and quality of the study for better research outcomes.

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