



US DEPARTMENT OF DEFENSE BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Blast Injury Outcomes

Developing an Evidence Base to Refine the Decision-making and Clinical Management of Veterans and Service Members with Retained Embedded Metal Fragments from Blasts

Researchers at the University of Maryland (Baltimore, MD) are conducting a complementary set of animal and human studies to assess the health effects of blast injury and embedded metal fragments. These four unique projects address specific knowledge gaps that challenge the care of patients exposed to improvised explosive devices (IEDs) or other high kinetic energy weapons where embedded fragments were retained in the body. Specifically: (1) the Health Effects of Embedded Fragments of Military-Relevant Metals project examines the absorption and effects of embedded fragments in tissue. In this study, animals implanted with toxic metals commonly used in the battlefield were assessed weekly for multiple health variables. Preliminary findings show that some implanted metals have resulted in rapid tumor formation near the implantation site. (2) The Identification of Biomarkers for the Early Detection of Adverse Health Effects Resulting from Embedded Metal-Fragment Wounds project aims to identify early biomarkers of tissue injury that may signal the need for fragment removal. Skeletal muscle samples collected from animals implanted with metals at different timepoints after injury were analyzed for changes in gene activity. Early results show that tissue exposed to nickel and lead had different gene activity after one month of exposure; cobalt exposure resulted in changes in gene activity after three months. (3) The Biomarker Assessment of Kidney Injury from Metal Exposure in Toxic Embedded Fragment (TEF) Registry Veterans project aims to assess biomarkers of early kidney damage in Veterans registered in the VA TEF registry and injured with a fragment. (4) The Respiratory Health in a Cohort of TEF Registry Veterans Exposed to Blasts and Metals study aims to examine lung function and insult from both metal inhalation and blast effects from the traumatic injury in this same VA-TEF Registry cohort (Figure 1). Participant recruitment and data collection for projects three and four are underway.

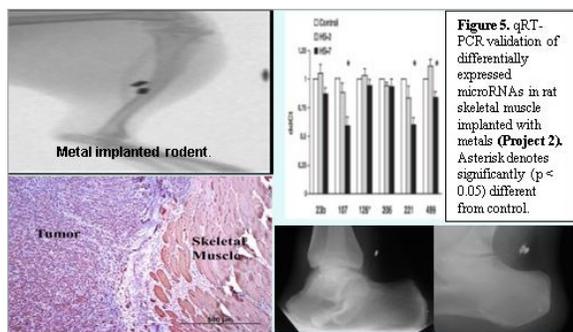


FIGURE 7-25: Top Left: Metal implantation in rodent, Bottom Left: Desmin-staining of tumor tissue following metal implantation in rodent Top Right: Validation of different microRNA activity in rat skeletal muscles implanted with metals compared to animals without implants. Asterisk denotes significantly ($p < 0.05$) different from control. Bottom Right: X-ray of Veteran with embedded metal fragment de-forming. (Figure used with permission from the authors)

Figure 5. qRT-PCR validation of differentially expressed microRNAs in rat skeletal muscle implanted with metals (Project 2). Asterisk denotes significantly ($p < 0.05$) different from control.

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