Cardiac and respiratory function supported by abdominal muscles in muscular dystrophy

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The muscular dystrophies are known to target various muscle groups differentially. In addition to making limb muscles weak, muscular dystrophy (MD) can also lead to decreased function of specific muscles involved in respiration causing breathing difficulties as well as leading to cardiac problems.

Using mouse models, researchers found that abdominal muscles may be severely involved in the muscular dystrophy process. The abdominal muscles are important to provide respiratory support when the diaphragm muscle has been damaged by the disease, so that additional abdominal muscle involvement can worsen the respiratory situation considerably. They further demonstrated that abdominal muscles are useful and accessible muscles to study in preclinical models as they reflect cardiopulmonary pathology. These findings are of great importance for understanding the progression of cardio-respiratory failure in the human disease. This report appears in the current issue of the Journal of Neuromuscular Diseases.

In heart failure respiratory function is critically important. In MD where both breathing muscles and cardiac muscles are affected, this interdependence can lead to accelerated pathology. Normally, the diaphragm muscle drives about 50% of respiratory force, but other muscles provide the remainder. In MD, that balance is changed once the diaphragm becomes damaged. As the disease progresses, the abdominal muscles take over more of the respiratory function, but little is known about how the abdominal muscles themselves are affected by the

progression of the disease, and whether these changes in abdominal muscle function correlate to underlying cardiopulmonary pathology.

Two mouse models helped researchers study the effects of Duchenne Muscular Dystrophy (DMD) and Limb Girdle Muscular Dystrophies (LGMD): the mdx mouse and the Sgcg mouse, respectively. The Sgcg mouse has a genetic mutation that results in similar pathology as observed in humans including significant diaphragm muscle damage. Using Sgcg mice, researchers performed echocardiography to determine cardiac function and then analyzed different muscle groups histologically in a comparative manner to determine disease progression and the correlation among these distinct features of MD.

In discussing the implications for human muscular dystrophy, lead investigator Elizabeth M. McNally, MD, PhD, Director, Center for Genetic Medicine, Northwestern University Feinberg School of Medicine, explained, "Supporting and maintaining proper cardiopulmonary function in neuromuscular disease is a mainstay of therapy. Maintaining diaphragm health has been the focus of many studies in both humans and mice with muscular dystrophy, but few studies have focused on supporting and evaluating the accessory muscles of respiration such as the abdominal muscles. Therapies that spare or protect the muscles of respiration in muscular dystrophy have been shown to slow down overall disease progression and prolong life. The accessory muscles of respiration, whether in human patients or animal models, may prove a viable target especially for therapy directed at specific muscle groups."

More information: "Cardiac function in muscular dystrophy associates with abdominal muscle pathology," by Brandon B. Gardner, Kayleigh A. Swaggart, Gene Kim, Sydeaka Watson, and Elizabeth M. McNally (DOI: 10.3233/JND-140062), Journal of Neuromuscular Diseases, Volume 2,Issue 1 (February 2015) published by IOS Press.