

# Investigation of Rectus Sheath Fascia in Patients with and without Inguinal Hernias with the use of various imaging techniques

Wojciech Szczęsny; Andrzej Tretyn<sup>1)</sup>; Paweł Żuchowski<sup>2)</sup>, Jacek Fisz<sup>2)</sup>, Janusz Niedojadło<sup>3)</sup> Stanisław Dąbrowiecki; Jakub Szmytkowski  
Dept. of General and Endocrine Surgery CM of Nicolaus Copernicus University in Torun. <sup>1)</sup> Dept. of Biotechnology; <sup>2)</sup>Depts. of Technical Physics and <sup>3)</sup> Cell Biology  
Ul. Marii Skłodowskiej – Curie 9 85-094 Bydgoszcz, Poland; +4852 5854016 ;  
e-mail: [wojszcz@interia.pl](mailto:wojszcz@interia.pl)

**BACKGROUND:** Despite over 150 years of modern herniology, the problem of the etiopathogenesis of this common condition has not been completely solved. In the last decade, attention has been brought to alterations in the connective tissue ultrastructure and function as the probable etiological factor. These abnormalities can lead to alterations in tissue structure, which in turn cause its weakening and the formation of hernias. Investigations of connective tissue ultrastructure may provide in - depth knowledge on the etiology of hernias and indirectly influence the choice of the proper treatment option.

**PURPOSE:** The study utilizes various histological techniques and fluoroscopy to assess the differences in rectus muscle sheath ultrastructure in patients with and without inguinal hernia.

**METHODS:** The study group included 5 patients with primary inguinal hernia and another 5 posted for emergency appendectomy with no history of hernia (control group). Specimens, measuring 1x1cm were harvested from the rectus muscle sheath and fixed in 4% glutaraldehyde. The specimens underwent staining by the Masson, H-E and methylene blue techniques and assessed by light microscopy. The remaining part of the specimen was prepared for analysis by scanning electron microscopy and by spectrofluorometry and fluorescent microscopy.

**RESULTS:** Both scanning and light microscopy have shown significant differences in the rectus sheath ultrastructure. They included altered architecture, placement and quantity of collagen and elastic fibers, differences in the caliber of individual fibers and disrupted ground matter to fiber ratio. In patients with hernias, chaotic arrangement of collagen fibers was seen, as well as their thinning and a decrease in the general amount of elastic fibers. In those cases the fibers were replaced by ground matter. The thickness of the fibers was assessed with the help of Image J software, and the results were subjected to statistical analysis with the use of the following tests: Mann-Whitney, Shapiro-Wilk and Kolomogorov-Smirnov. With the use of both techniques significant differences were documented both in the fluorescence spectra and the respective maps of fluorescence intensity for both types of specimens. The spectra for control specimens were almost identical, while the hernia specimens yielded two types of spectra, located at a certain distance from the controls.

**CONCLUSIONS:** Our research has shown significant differences in the structure of the rectus muscle sheath between patients with hernias and healthy individuals. This corroborates the theory linking connective tissue alterations with the etiology of hernia and stating that these alterations include connective tissue of the whole organism, as the rectus sheath itself does not form a hernial defect.