IJAE
Vol. 123, n. 1 (Supplement): 65, 2018
ITALIAN JOURNAL OF ANATOMY AND EMBRYOLOGY

3D virtual morphometry of human myometrium and uterine fibroids performed by Synchrotron Radiation-based Microtomography

Pasquapina Ciarmela[1], Stefania Greco[1], Giuliana Tromba[2], Serena Pacilè[2], Alessandro Zannotti[1], Giovanni Delli Carpini[3], Stefano Raffaele Giannubilo[3], Andrea Ciavattini[3] and Alessandra Giuliani[3]

[1] Università Politecnica delle Marche, Dipartimento Medicina Sperimentale e Clinica, Ancona
[2] Elettra, Sincrotrone Trieste S.C.p.A., Trieste
[3] Università Politecnica delle Marche, Dipartimento di Scienze Cliniche, Ancona

Uterine leiomyomas, or fibroids, are the most common gynecological tumors originating inside the myometrium. Leiomyomas bulk is caused by a disorder of fibrosis, characterized by production of large amount extracellular matrix (ECM) and by its disruption (1-3).

The ECM can be easily detected by histochemical methods. However, conventional microscopy techniques are limited to two-dimensional images hampering the quantitative analysis or requiring digital 3D reconstruction of serial stained sections.

The impact of the microtomography (microCT) technique, performable with third-generation synchrotron light sources, has been revolutionary, enabling the observation of internal sample details with unprecedented definition, high resolution up to 0.2 mm and allowing the calculation of different morphometric parameters.

We performed microCT experiments on paraffin embedded leiomyoma and myometrial biopsy at the Italian Synchrotron Facility, ELETTRA (Basovizza-TS), using phase-contrast settings optimized for non-mineralized biological tissues. For each biopsy, several subvolumes were analyzed: each of them was a 3D portion fully included in the sample bulk and the complete set of them allowed to achieve the whole retrieved sample mapping. The quantitative analysis was based on the structural indices usually measured for bone samples: Collagen-Fibers-specific-volume, Collagen-Fibers-specific-surface, Mean Collagen Fiber thickness, Mean Collagen Fiber number and Mean Collagen Fiber spacing. Furthermore, as Collagen Fibers could vary their orientation depending on the pathology, we also extracted information about the anisotropy of the collagen structure, i.e. the presence of preferential orientation. The anisotropy degree index measures the similarity of a fabric to a uniform distribution and varies between 0 (all observation confined to a single plane or axis) and 1 (perfect isotropy). Finally, the morphometric analysis was also applied in order to derive a descriptor for the interconnectivity between the structures.

This preliminary investigation opened new methodologic possibilities for future studies to evaluate the ECM in soft tissues.

References

[1] Protic et al. (2016) Cell Tissue Res.;364:415-27.
[2] Protic et al. (2017) Semin Reprod Med. 35:499-509.
[3] Islam et al. (2018) Hum Reprod Update.;24: 59-85.

Key words

Myometrium, leiomyoma, morphometry, microtomography, synchrotron radiation.