Acellular Collagen Constructs For Reconstruction Of Congenital Diaphragmatic Hernia: Evaluation of Four Different Candidates in an Adult Rat Model

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Objective
To assess the biomechanical properties of 4 different acellular collagen cross-linked matrices (ACM) in a rat model for primary repair of fascial defects, using native healthy young rat musculature (diaphragm, rectus abdominis, latissimus dorsi) as a reference.

Materials and Methods
35 adult Wistar male rats were randomly assigned to undergo primary repair of a standardized full thickness abdominal wall defect (3.5x2 cm). We used either a fenestrated dermal ACM widely used in urogyneacology (n=8; group1), or 3 modifications of an investigational ACM (group2,3&4, n=9 each). 2 ACM were implanted in each rat. After 30, 60 and 90d, the implant with and without neighbouring tissue (explant/implant resp.) were harvested and measured. Stress-strain plots and location of disruption were determined with Zwicki-tensiometer. Reference values were obtained in growing rats of 1, 4, 8 and 12 postnatal weeks (n=4 each age). Mann-Whitney-U and Kruskal-Wallis tests were used.

Results
Implants 2,3&4 became progressively more resistant to tensiometric forces over time (fig.1), whereas resistance of implant 1 remained stable.

Fig. 1. Implants tensiometric evaluations 30, 60 and 90 days after implantations compared to rat diaphragm

Explant 1 was less strong than all the other explants at any time (fig.2). Except for explants 1 with a mesh disruption rate increasing from 0% at 30d up to 75% 90d after implantation, the majority of the explants gave way at the interface. However all reconstructions were stronger than any muscle type at any time.

Fig. 2. Explants tensiometric evaluations 30, 60 and 90 days after implantations compared to rat diaphragm

Discussion and Conclusions
In this experiment, all 4 investigational ACM fascial repairs resisted tensile forces beyond the strength of native muscles. The tensiometric capacities of Product 1 were related closest to these of diaphragmatic muscles from the control animals.

Acknowledgments
This work is supported by a grant of the European Commission (LSHC-CT-2006-037409)

Disclosures
No conflict of interest