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THE FAT COMPONENT OF THE UROGENITAL DIAPHRAGM IS AN IMPORTANT DETERMINANT OF THE SUCCESS OF A CONVENTIONAL ANTERIOR WALL REPAIR.

Hypothesis / aims of study

The anterior compartment is involved in pelvic organ prolapse in 78% of the cases and thus repre-sents the most frequent reason for surgical intervention. Because of its substantial reconstructive results and the low recurrence rate, the use of mesh material has been suggested in first line surgery. However, referring to the limited evidence to date, these procedures have to be considered experi-menttal. Recently, the FDA issued a public health notification regarding serious complications asso-ciated with surgical mesh devices (1). Hence the traditional techniques are still of importance. The considerable failure rate of conventional surgery, in 40 - 60% of the procedures (2), poses a challenge to analyzing factors for their prognostic impact. The aim of the present pilot study was to relate the histological structure of the supportive layer which is created by a conventional anterior wall repair to the clinical outcome.

Study design, materials and methods

In eleven patients, aged between 31 and 74 years, suffering from a cystocele POP Q stage II and III, a conventional repair of the anterior compartment was done by means of reconstruction of the urogenital diaphragm. After midline incision bilateral dissection of the vaginal flaps was extended laterally to the ischiopubic ramus on each side. Following repositioning the descended bladder, the deviated parts of the urogenital diaphragm were exposed bilaterally and subsequently plicated in the midline by 6 to 7 absorbable 2-0 sutures, thus rebuilding a solid layer between the posterior wall of the bladder and the vagina. Before tying the sutures, 5mm punch biopsies were taken from both parts of the diaphragm for histologic analysis. Three µm thick paraffin sections of formalin fixed tissue were stained with Masson's trichrome. The relative composition of connective tissue, fat cell, and muscle areas was determined and related to the total tissue area with the Leica Qwin morphometry system (Leica, Cambridge, UK). Data analysis was done using nonparametric tests and by linear and nonlinear re-gression.

Results

The mean diameter of the particular punch biopsies was 4,5 $\pm$ 1,3 and 4,6 $\pm$ 2,1 mm, respectively, reflected in a mean surface area of 36,3 $\pm$ 28,2 mm^2 per total diaphragm. The surface area of the biopsies was correlated to the total surface area of the histologic slices ($n = 11$, $r = 0,83$, $p < 0,01$). The spreading of tissue fractions resulted in 24% $\pm$ 10% collagen, 24% $\pm$ 16% muscle and 13% $\pm$ 15% fat. The percentage of collagen decreased with increasing age ($n = 11$, $r = 0,68$, $p < 0,05$). Four of the eleven patients presented with a relapse of cystocele. They were followed significantly lon-ger than the other seven patients. All recurrent descents were at or beyond the hymenal ring (Ba 0 to +5cm). Age, BMI and parity did not differ between patients with and without relapse, respectively. In the relapse group, the anterior wall repair was combined with a sacrospinous fixation procedure in 3/4 cases compared to 2/7 cases in the group without relapse (table 1).

Corresponding to the more frequent sacrospinous fixation in the relapse group, the mean descent of the middle compartment was more marked compared to the other group. The preoperative assess-ment of Ba did not differ between the groups. The mean re-displacement of the vaginal wall as a result of the anterior repair (Ba shift) was less extensive in the relapse group than in the other patients. The difference was however not statistically significant (table 2).

Concerning the relative contribution of the individual tissue components to the composition of the dia-phragm no difference between the groups was detected for collagen. The fraction of fat tissue was significantly increased in the group of successful surgery compared to the relapse group whereas the mean fraction of muscle tissue was decreased, though not significantly. As a result, the ratio of fat to muscle tissue fraction was significantly elevated in patients without relapse (table 3). Additionally, in the total group minor values of Ba shift (i.e. actual re-displacement) were correlated to low fractions of muscle tissue ($n = 11$, $r = 0,61$, $p < 0,05$). Within the slices, the percentage of muscle was correlated inversely to the fraction of fat (figure 1). No relation was found between BMI and percentage of fat tissue.

Interpretation of results

The supportive layer created by plicating the deviated parts of the urogenital diaphragm consists of equal amounts of connective and muscle tissue as well as of fat tissue, to a smaller amount. The age related decrease of the collagen fraction has no impact on the rigidity of the layer. The failure rate after conventional anterior repair (36%) is slightly beneath the known range. The high percentage of muscle tissue in the relapse group and the inverse relation between the fraction of muscle and the shift of point Ba indicate that the presence of muscle per se does not contribute to the support of the bladder. A functional impairment due to earlier delivery-related muscular damage may be a reason (3). In con-trast, the high fraction of fat tissue and the elevated fat-muscle ratio in non-failing procedures reveal that fat is no inferior component of the supportive layer. Given the relation between the percentages of muscle and fat, it is tempting to suggest that muscle tissue of the urogenital diaphragm might be re-placed by fat.

Concluding message

The rigidity of the urogenital diaphragm and the success of surgical repair is a function of fat tissue rather than connective or muscular tissue.

Table 1. Demographic data of patients

	Relapse of cystocele n = 4	No relapse of cystocele n = 7	p-values
Age (years)	63 ± 10	58 ± 14	0,648
BMI (kg/m^2)	26 ± 2	25 ± 4	0,788
Parity	2,0 ± 0,0	2,6 ± 0,8	0,164
Concurrent sacrospinous fixation	3/4	2/7	0,133
Follow up (weeks)	25 ± 5	11 ± 7	0,024

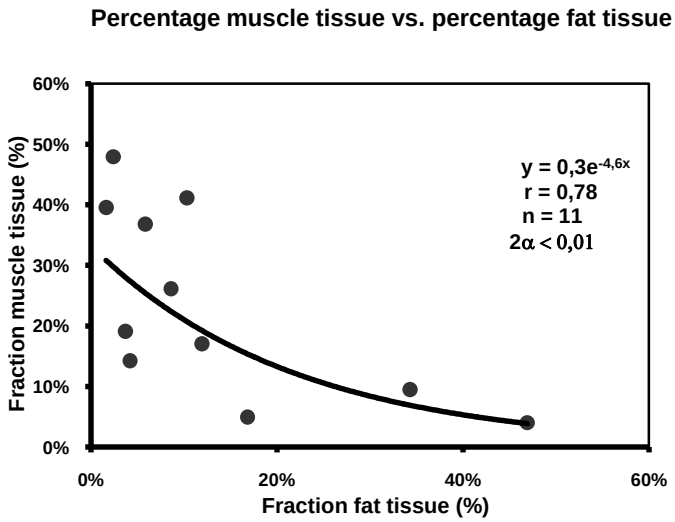
Table 2. POP Q data

C before surgery (cm)	-1,8 ± 2,2	-4,4 ± 1,8	0,164
C after surgery (cm)	-5,0 ± 0,8	-5,5 ± 0,9	0,527
Ba before surgery (cm)	3,8 ± 0,5	3,1 ± 2,4	0,927
Ba after surgery (cm)	1,8 ± 2,4	-2,3 ± 0,8	0,006
Ba shift (cm)	-2,0 ± 2,2	-5,4 ± 2,7	0,109

Table 3. Data of the biopsies from the urogenital diaphragm

Surface area of biopsies (mm^2)	60 ± 36	23 ± 9	0,073
Relative fraction of collagen (%)	23,4 ± 0,8	24,3 ± 12,9	0,648
Relative fraction of muscle (%)	34,6 ± 14,4	17,4 ± 13,2	0,164
Relative fraction of fat (%)	3,5 ± 1,9	19,0 ± 15,7	0,024
Ratio fat / muscle	0,1 ± 0,1	2,9 ± 4,2	0,024

Figure 1



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Is this a clinical trial?	**Yes**
Is this study registered in a public clinical trials registry?	**No**
Is this a Randomised Controlled Trial (RCT)?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**No**
This study did not require eithics committee approval because	**In the Netherlands, for retrospective chart review, no ethical review board approval is required.**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**No**