

The organization of subperitoneal connective tissue in the female pelvis

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Summary: The organization of the subperitoneal connective tissue in the female pelvis was studied in 6 cases, aged between 58 and 65, deceased from extrapelvic diseases. The pelvic viscera were removed as a whole with the surrounding subperitoneal tissue using a circular cut performed at the level of the pelvic walls. The specimens were fixed in 5% formalin. The bladder dome, uterine body and rectum, up to the anorectal junction, were removed. In two cases the specimens were dehydrated and embedded in paraffin. Ten micron sections were stained with Haematoxylin-Eosin and Azan-Mallory. In 2 other cases the specimens were plastinated according to Von Hagens E12 technique; the passage in acetone at room temperature lasted 24 hours.

In the remaining 2 cases the plastination with E12 was carried out after a passage in acetone at room temperature which lasted about 15 days in order to fully remove the lipids from the subperitoneal adipose tissue.

The morphological findings demonstrate that the subperitoneal tissue of the female pelvis has an areolar structure with small adipose lobules separated by thin fibrous laminae connected to the vasculo-nervous bundles and to the parietal and visceral layers of the fascia pelvica.

The three dimensional spatial organization of the network of thin connective laminae constitutes an anatomical device with possible supporting properties.

Key words: Female pelvis; Endopelvic fascia; Subperitoneal tissue.

INTRODUCTION

The organization of the subperitoneal tissue in the female pelvis has been the subject of numerous studies since it conditions both the support and stability of the pelvic organs and the surgical access.

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According to some Authors⁽¹⁻⁸⁾ the subperitoneal connective tissue is organized so as to form actual ligament with an antero-posterior (the sacro-recto-genito-vesico-pubic ligaments of Farabeuf) and a transversal (the cardinal ligaments of Mackenrodt in the base of the broad ligament) course. These structures should sustain the pelvic organs particularly the cervix. Other authors⁽¹⁷⁾ have studied the histological structure of the subperitoneal connective tissue in various regions (base of the broad ligament, sacro-uterine ligaments etc.) and showed the absence of

ligamentous structures. Guided dissections were also carried out which failed to show the presence of ligamentous structures⁽¹⁶⁾.

In order to contribute to a better understanding of the organization of the subperitoneal connective tissue of the female pelvis, in this study sections of the pelvic organs and of the connective tissue surrounding them, cut at various levels, were examined using both histological techniques and the E12 plastination method⁽¹⁹⁾.

MATERIALS AND METHODS

The pelvic organs were obtained from 6 females aged between 58 and 65 deceased from extrapelvic diseases. The specimens were removed through a circular cut going from the pubovesical ligaments in front, laterally then backwards, along the line of reflection of the peritoneum towards the median viscera, cutting both the insertion of the broad ligaments on the lateral pelvic wall and that of the sacro-uterine ligaments. The subperitoneal pelvic tissue and the vasculonervous bundles which run through it were sampled together with the pelvic diaphragm and viscera. The bladder was separated from the pelvic urethra, the vagina was cut under the fornix; the rectum was cut immediately above the anorectal junction. Particular care was taken to sample the subperitoneal tissue between the parietal layer of the pelvic fascia and the fascia of the pelvic diaphragm (superior fascia of levator ani).

The visceral blocks were carefully washed in running water and then placed in 5% formalin. After a 10 days fixation the funds and body of the uterus were removed with the tubaric and ovarian folds of the broad ligament. The bladder dome and the part of the rectum immediately above the anorectal junction were also removed. The specimens for the study were formed by the bladder neck, cervix and perineal part of the rectum connected by the vesico-uterine ligaments (sometimes referred to as the anterior ligaments of the uterus) and by the sacro-uterine ligaments (posterior uterine ligaments) and the surrounding subperitoneal tissue situated below the broad ligament.

In 2 cases the specimens were embedded in paraffin and cut into 10 micron sections. The sections were stained with Haematoxylin-Eosin and Azan-Mallory for microscopic examination.

In 4 cases the specimens were cut "in toto" with a slicer to obtain 2-4 mm thick transverse serial slices. The slices were placed in acetone cooled to -25°C to be plastinated with the E12 technique⁽¹⁹⁾. During the dehydration phase the slices of two cases were placed in acetone at room temperature to fully remove the lipids from the subperitoneal adipose tissue. The duration of this step was decided observing the transparency of the slices and the clearness of the bath. After the acetone bath, the slices were impregnated with the E12 and E1 resins. The procedure of plastination was carried out according to the indications of Von Hagens⁽¹⁹⁾.

RESULTS

The slices stained with Haematoxylin-Eosin and Azan-Mallory, taken from the level of the isthmus of the uterus to the vaginal fornix showed that:

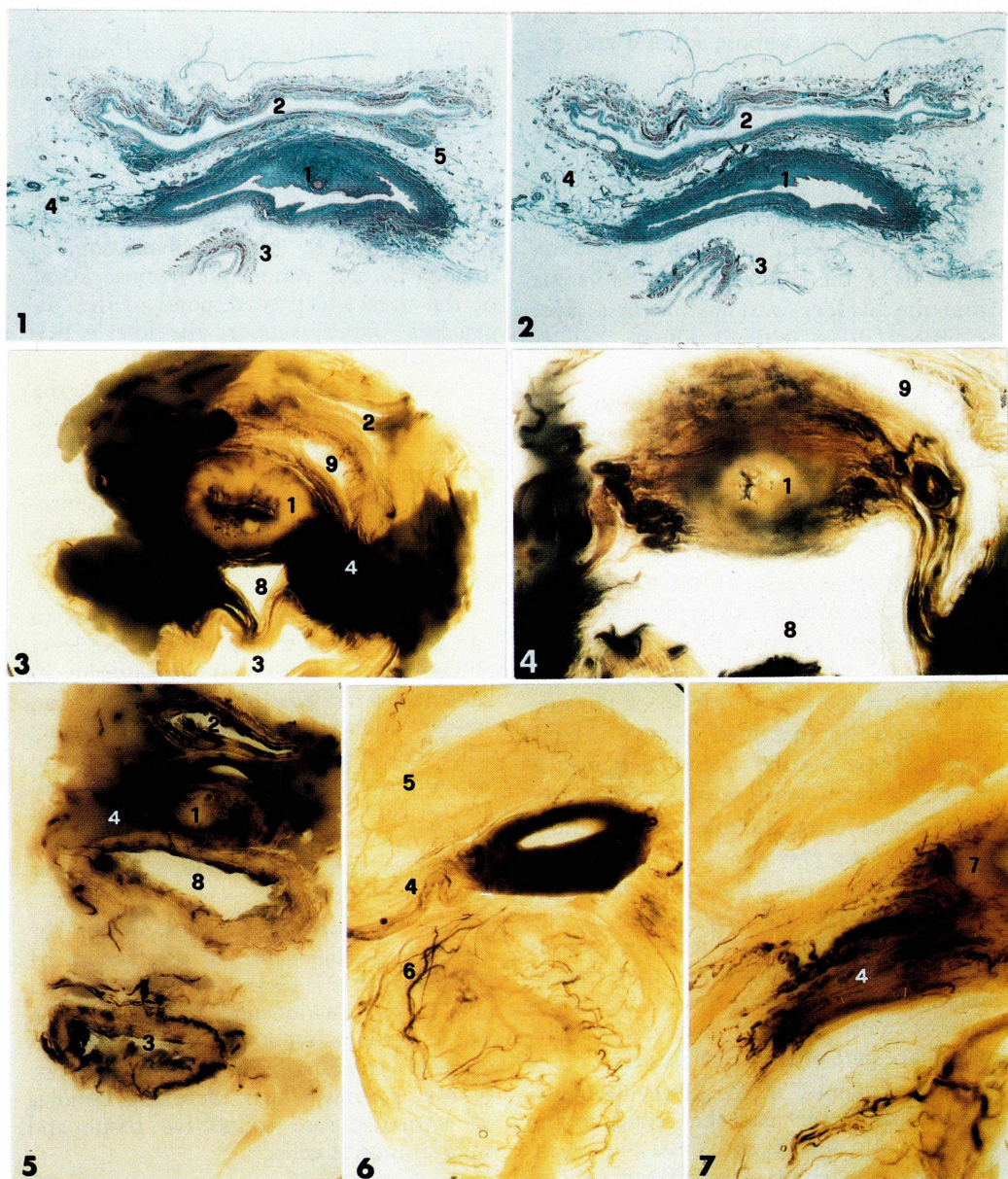
a) the vascular and nervous structures situated in the lateral visceral spaces were surrounded by a variable amount of adipose tissue divided into small lobules by thin connective laminae;

b) between the vagina and rectum and between the bladder neck and the vagina, where the visceral adventitiae tend to blend, only a thin layer of connective tissue could be identified.

In the slices plastinated with E12 after dehydration in acetone at -25°C for 24 hours it was observed that:

a) in proximity to the broad ligament, both in the sections taken at the level of the cervix and in those taken at the vagina no vascular or nervous structures were visible for the presence of numerous adipose lobules, which constitute the structure of the visceral fascia. Around the cervix and the vagina there was a connective fascia with a compact structure and scarce adipose lobules;

b) in proximity to the ligaments which link the cervix and the vagina were numerous adipose lobules, separated by connective bundles which constitute the structure of the visceral fascia (endopelvic fascia). Behind it there was a continuity



Figures. — Transverse sections of the pelvic viscera and subperitoneal tissue at the level of the cervix. Figs. 1-2. — Azan-Mallory. Figs. 3-4. — Slices plastinated with Biodur™ E12 after 24 hours acetone bath at room temperature. Figs. 5-6-7. — Slices plastinated with Biodur™ E12 after 15 days acetone bath at room temperature.

Legend: 1) cervix; 2) bladder; 3) rectum; 4) base of the broad ligament; 5) vesico uterine ligament; 6) sacro-uterine ligament; 7) visceral fascia of the cervix; 8) cul de sac of Douglas; 9) vesico-uterine pouch.

of the ligaments with the visceral fascia which had fewer adipose lobules and envelops the rectum;

c) in proximity to vesico-uterine ligaments which connect the cervix and the vagina to be bladder neck there was a condensation of adipose tissue which did not allow any other structure to be seen;

d) the space which separates the anterior wall of the cervix and of the vagina from the bladder was filled with a layer of fibrous tissue without adipose lobules or blood vessels.

In the sections plastinated with E12 after a prolonged time in acetone at room temperature it was seen that:

a) in proximity to the base of the broad ligament, both in the sections taken at the level of the cervix and in the superior part of the vagina, there were numerous vessels surrounded by fibrous bundles. In some sections there appeared a long vessel which, for its course lateromedially to the lateral margin of the uterus, might be identified as the uterine artery. Next to the lateral margin of the cervix many small vessels, with a tortuous course, were identified as the utero-vaginal venous plexus;

b) in proximity of the ligaments which link the cervix and the vagina to the rectum numerous small tortuous vessels were seen, accompanied by thin fibrous bundles. Some of these vessels were continuous with those, also clearly visible, which are part of the rectal fascia;

c) in proximity of the ligaments which connect the cervix and the vagina to the bladder, thin vessels continued the course of those which pass through the visceral fascia of this organ;

d) the space which separates the anterior wall of the cervix and of the vagina from the bladder is filled with a fibrous lamina which seemed lacking in blood vessels.

DISCUSSION

The study of the subperitoneal connective tissue of the female pelvis, conducted using sections of different thickness and with different methods of inclusion allows a histo-topographic evaluation of its structure. The morphological findings demonstrate the existence of an areolar tissue formed by small adipose lobules divided by thin connective laminae in all of the sites which correspond to the "ligaments" which support the female pelvic organs.

According to several authors⁽¹⁻⁸⁾ the so-called visceral pelvic fascia (endopelvic fascia) would consist of a system of fibrous connective bundles having an antero-posterior course, the sacrorectal-genitovesico-pubic lamina, and by a system with a trasversal course, the cardinal ligaments of Mackenrodt.

The examination of these regions in our sections, has shown that at the level of the vesico-uterine and sacro-uterine ligaments, it is possible to find only an areolar connective tissue. This tissue, when deprived of the lipids contained in the adipose lobules, is constituted of connective laminae which form a three dimensional net connected with the connective sheaths of the regional vascular and nervous ramifications.

This structure corresponds, as for the sacro-uterine ligaments, to that shown by Blaisdell (1917), Campbell (1950), Brizzi (1970) and Bastide and Soutoul (1973). These authors hypothesized that the "ligament" corresponds to the hypogastric plexus, around which there are bundles of areolar-adipose connective tissue and smooth muscle cells.

Even in the area corresponding to the base of the broad ligament, an areolar-adipose connective tissue was found. This tissue after the removal of the lipids demonstrated a fibrillar structure. The vessels which are more numerous and packed along the lateral margin of the uterus we-

re also shown. It was not possible to reveal the presence of fibrous tissue forming "ligaments" in any zone around the cervix and the superior part of the vagina, corresponding to the zone surrounded by the "paracervix" and the "paravagina (paracolpos)".

Therefore our observations can be interpreted as saying that ligaments, septa or bundles, do not exist as morphologically defined fibrous structures with an individual distinct anatomy, in the subperitoneal tissue of the female pelvis, but only as connective tissue, rich in adipose lobules, which moulds itself to envelop the organs (visceral pelvic fascia of the cervix, of the vagina etc.) or vessels and nerves which pass through the pelvis (vasculo-nervous connective sheaths) or which coat the pelvic walls (parietal pelvic fascia).

In this sense our findings are in accordance with those of other authors, who, using histology and dissection have studied the subperitoneal pelvic tissue.

As regarding the function of support attributed to this tissue, particularly to the sacro-recto-genito-vesico-pubic laminae and the base of the broad ligament, our findings are in contrast with the existence of autonomous ligamentous structures with an individual anatomy and seem to exclude this function.

On the other hand Goff (1931), Koster (1933), Berglas and Rubin (1953) and Range and Woodburne (1964) argued against this function, saying that the subperitoneal connective tissue only has a role in filling the spaces crossed by pelvic vessels and nerves.

These authors sustain that the connective and blood vessels are able, passively, to support the cervix, and, consequently, the uterine body, in its normal position.

As we see it, it is not possible to rule out that, in the absence of real ligaments, the subperitoneal connective-adipose pel-

vic tissue tone and from the transmission of the muscular tensions of the pelvic floor and the organs which pass through it.

In this prospective, the three dimensional spatial organization of the network of thin connective laminae, which intercept the small adipose lobules, and which connect the visceral adventitiae to the connective sheaths of the vasculo-nervous bundles and the pelvic wall, constitutes an anatomical device which, passing the functional limits of any individual ligament, has elastic supporting properties.

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