

Pathomorphological characteristics of the supravaginal part of the cervix depending on the echogenicity ratios of the cervix to the uterine body

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ABSTRACT

Aim: To analyze the morphological features of the supravaginal part of the cervix depending on the echogenicity ratios of the cervix to the body of the uterus.

Materials and Methods: In 87 reproductive-age patients (30–40 years) with uterine leiomyoma (>14 weeks gestation), morphological features of the supravaginal cervix were analyzed in 23 hysterectomy specimens based on echogenicity ratios: Group I (n = 10): Cervical echogenicity > uterine body. Group II (n = 8): Cervical echogenicity = uterine body. Group III (n = 5): Cervical echogenicity < uterine body.

Results: Histological analysis revealed that increased cervical echogenicity corresponded to a predominance of collagen fibers over smooth muscle bundles. Conversely, when cervical echogenicity was equal to or lower than the uterine body, smooth muscle bundles dominated. These specimens also exhibited destructive changes, connective tissue disorganization, and dystrophic alterations, which are pathognomonic signs of potential lower uterine segment failure during pregnancy.

Conclusions: 1. Comparative studies show that in cases of excess echogenicity of the cervix over the body of the uterus, pathomorphological changes in the supravaginal part of the cervix were not detected. 2. Equal or reduced cervical echogenicity was associated with connective tissue disorganization and dystrophic changes in smooth muscle, indicating structural inferiority. 3. A change in the ratio of echogenicity of the cervix to the body, which is closely related to the morphological structure of the isthmus of the uterus, can serve as one of the criteria for predicting the failure of the lower segment of the uterus in women.

KEY WORDS: Echogenicity, cervix, uterine body

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INTRODUCTION

The increasing frequency of surgical interventions in the lower segment requires improvement of criteria for assessing the morphofunctional state of this anatomical structure even before pregnancy [1-4].

However, only a few scientific works have been devoted to the study of the morphostructure of the lower uterine segment in comparison with the echogenicity of the cervix and uterine body [5].

At the same time, it is known that one of the main contributing factors to inferiority of the lower uterine segment is pathomorphological changes in the area of the lower edge of the uterine body and isthmus, especially after cesarean section [6, 7].

Some authors have established [8] that in conditions of hypo- or hypercollagenosis, the structure of connective tissue may change, becoming more or less elastic in its structure, which affects its elasticity and echo signal reflectivity during ultrasound scanning [9].

Therefore, there are many outstanding issues in early diagnosis of changes in the structural elements of the isthmus of

the uterus, which does not allow to improve the prediction of lower uterine segment insufficiency and improve measures to prevent scar incompetence, especially after cesarean section.

AIM

To analyze the morphological features of the supravaginal part of the cervix depending on the echogenicity ratios of the cervix and the body of the uterus.

MATERIALS AND METHODS

Sonographic determination of echogenicity ratios of the tissues of the cervix and uterine body before surgery and pathomorphological examination of the removed uterus and its isthmus after hysterectomy in women of reproductive age (30-40 years) who were diagnosed with uterine leiomyoma > 14 weeks of gestation. According to the ratio of echogenicity of the cervix to the body, three representative study groups were identified in terms of age and uterine pathology:

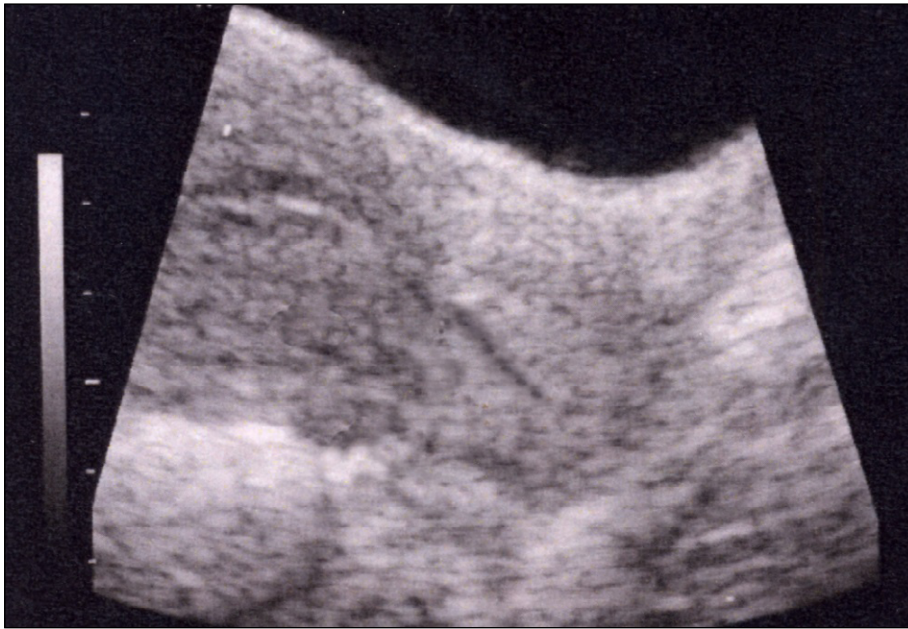


Fig. 1. Echogram of the uterus. The echogenicity of the cervix is higher than the echogenicity of the body of the uterus.

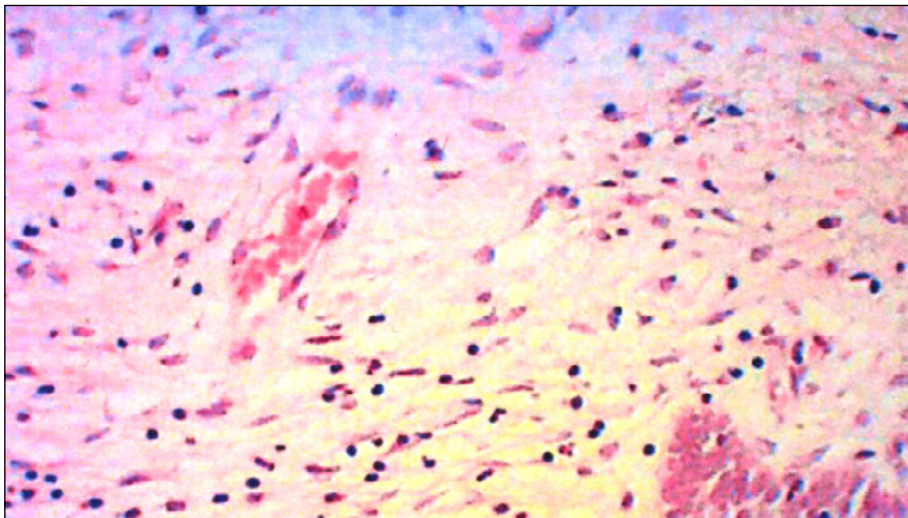


Fig. 2. Biopsy sample supravaginal part of the cervix (isthmus). *Hematoxylin and eosin staining. Predominance of connective tissue (collagen fibers) over smooth muscle bundles. Enlargement: oculus 10, lens 20.



Fig. 3. Echogram of the uterus. The echogenicity of the cervix is the same as the echogenicity of the body of the uterus.

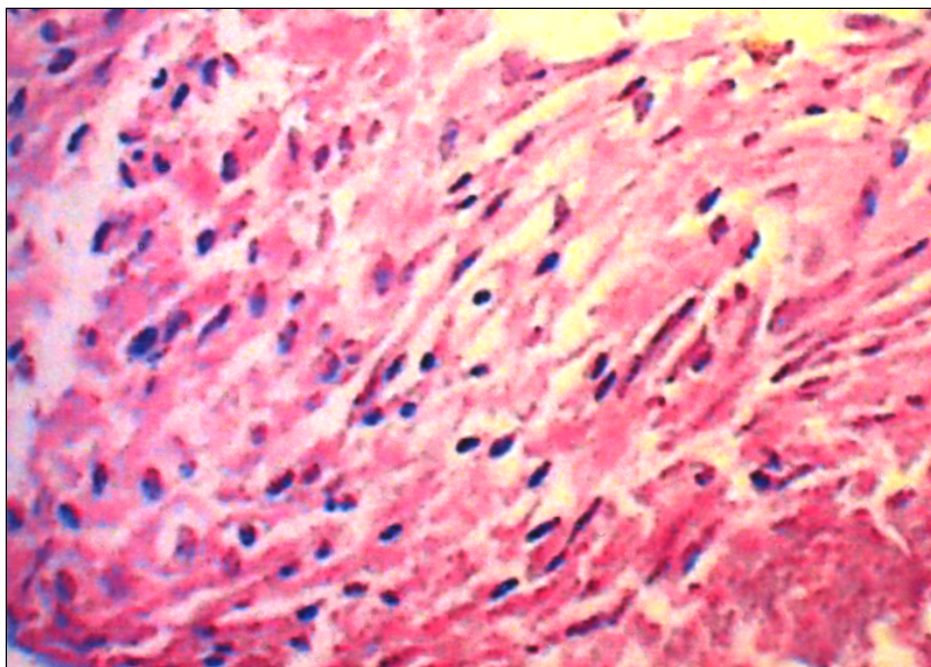


Fig. 4. Biopsy sample supravaginal part of the cervix (isthmus). Staining with hematoxylin and eosin. There is an increase in smooth muscle components over connective tissue components. Enlargement: oculus 15, lens 20.

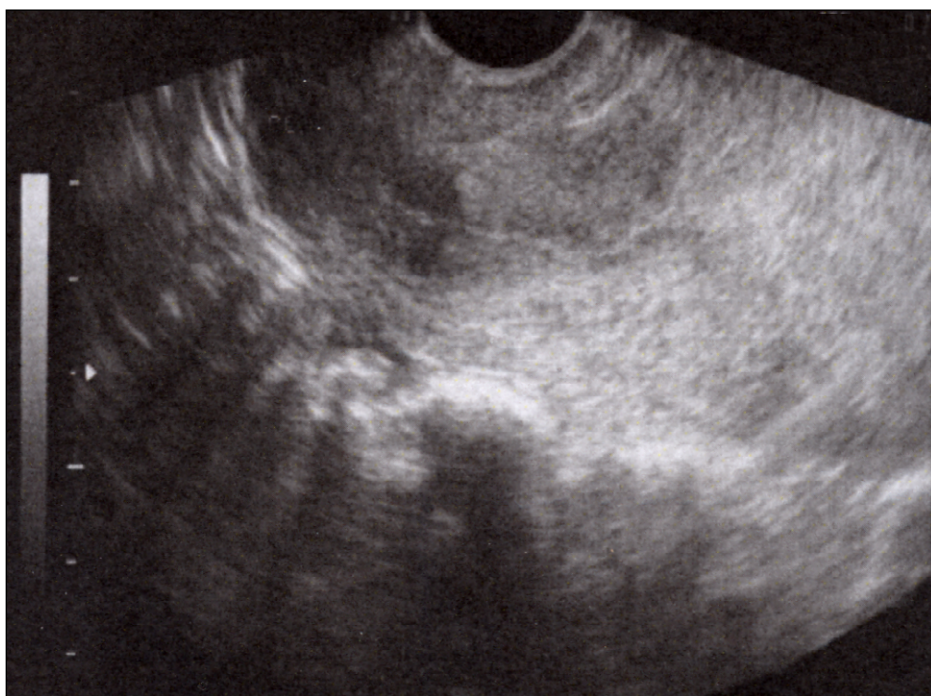


Fig. 5. Echograms of uterine leiomyoma. The echogenicity of the cervix is lower than the echogenicity of the uterine body.

Group I (n = 10) patients whose echogenicity of the cervix prevailed over the echogenicity of the uterine body;

Group II (n = 8), where the echogenicity of the cervix and uterine body coincided with each other;

Group III (n = 5), patients whose echogenicity of the cervix was lower than that of the body.

For the purpose of pathomorphological examination, a biopsy specimen was taken from the supravaginal part of the cervix from the removed uterus. The obtained material was fixed in a 10 percent solution of neutral buffered formalin (pH 7.9) for 24-36 hours, followed by embedding in paraffin blocks.

Features of the morphological structure of the uterine isthmus were studied in histological sections stained with

hematoxylin and eosin depending on the echogenicity ratios of the cervix and uterine body in patients after hysterectomy. uterine leiomyomas. To assess the connective tissue component, sections were additionally stained according to Van Gieson and Masson (Trichrome Stain Kit).

RESULTS

In the first observation group with increased echogenicity of the cervix above the body of the uterus (Fig. 1), in hysterosalpingograms (Fig. 2) of the supravaginal part of the cervix, smooth muscle bundles were found in the form of a thin layer or individual cellular elements.

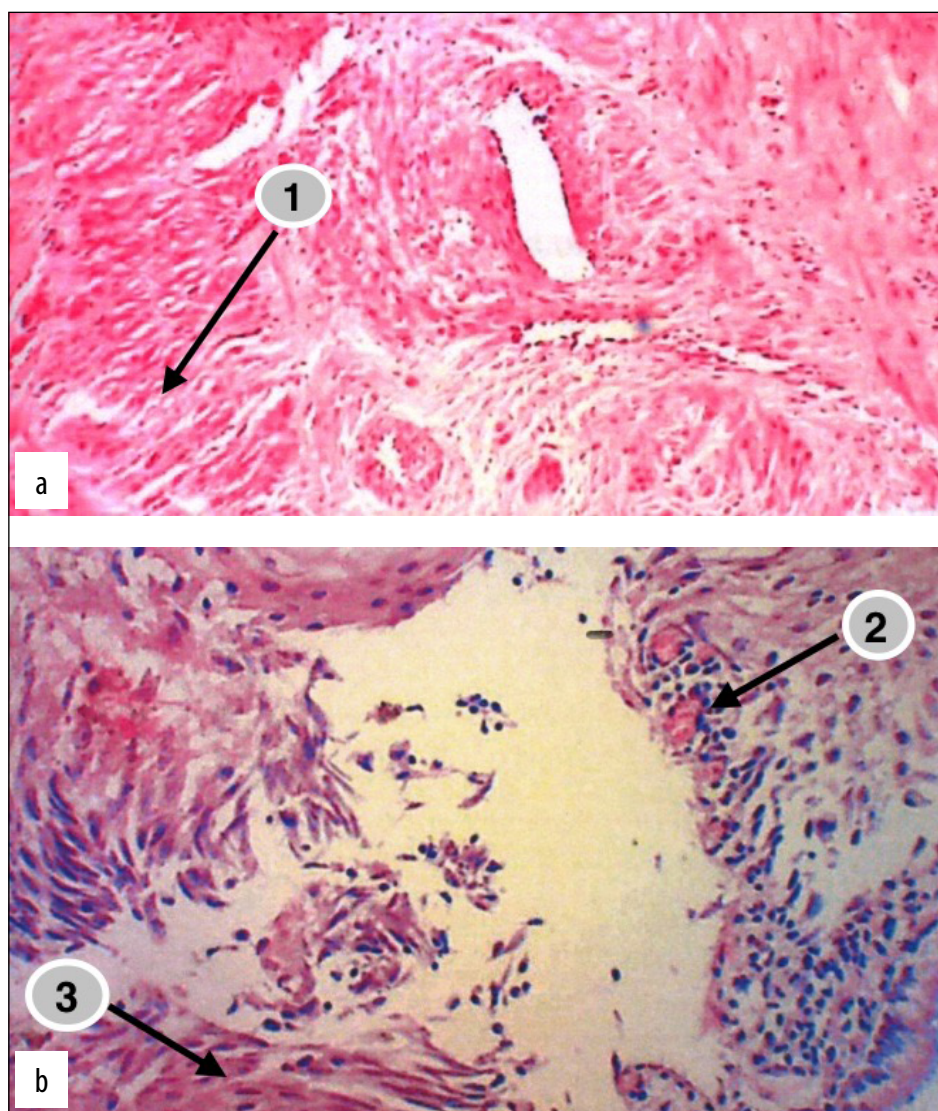


Fig. 6. a, b. Biopsy sample supravaginal part of the cervix with a violation of the morphological structure of the connective tissue in the form of an increase in the spaces between collagen fibers (1), hyperemia of the vessels of the connective tissue with the presence of foci of angiogenesis (2) and a significant number of smooth muscle fibers (3). Staining with hematoxylin and eosin. Enlargement: oculus 10, lens 20.

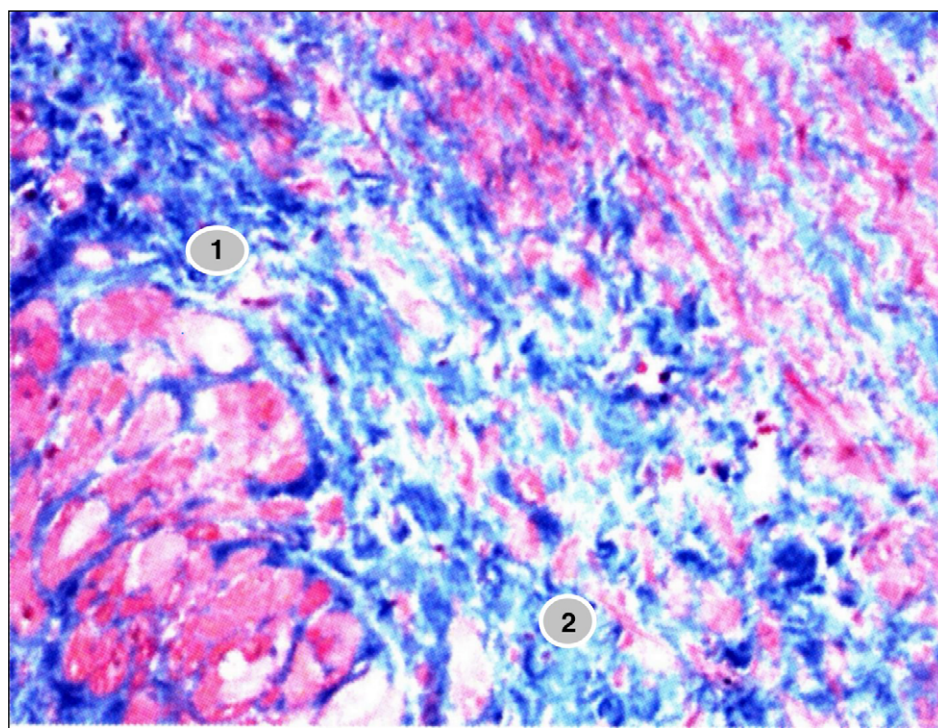


Fig. 7. Biopsy sample supravaginal part of the cervix from a multiparous patient. The histopathology shows a chaotic arrangement of connective tissue fibers with heterogeneous areas of hypochromia (1) and hyperchromia (2) and foci of degeneratively altered smooth muscle bundles. Staining according to Van Gieson and Masson. Enlargement: oculus 10, lens 20.

Smooth muscle bundles were separated by connective tissue fascia, where connective tissue elements predominated, creating a typical paravasal environment through which the functional activity of myocytes is ensured [10].

According to the results of the study, in the second group, both the cervix and the body of the uterus had the same echogenicity (Fig. 3).

Histomorphological data indicate a relative increase in the muscle component over the connective tissue component of collagen and elastic fibers, which predominated by 20-25% over smooth muscle bundles (Fig. 4).

In women of group III with echogenicity of the cervix less than the echogenicity of the uterine body (Fig. 5), on histological specimens. In the supravaginal part of the cervix, there is disorganization of the connective tissue with the presence of individual smooth muscle fibers, hyperemia of the connective tissue, and the presence of angiomas (Fig. 6).

In this case, the collagen tissue of the supravaginal part of the uterus, especially in multiparous patients, is stained heterogeneously with individual areas of hypo- and hyperchromia with the presence of foci of altered smooth muscle bundles (Fig. 7).

DISCUSSION

The results of our study indicate that in the supravaginal part of the cervix, when the echogenicity of the tissues of the cervix exceeds that of the body, the predominance of the muscular component over the connective tissue component is noted. In this case, the smooth muscle bundles are supported by connective tissue, which creates a typical paravasal environment between the muscle bundles, through which the functional activity of myocytes are ensured [10, 11].

In all women with the same echogenicity of the cervix relative to the body of the uterus or lower, disorganization of connective tissue was noted in histological preparations and dystrophic changes were observed in the cells of smooth muscle bundles, which changed the

reflective activity of the echo signal by the structural elements of the cervix and body of the uterus and isthmus. The obtained data are consistent with the literature [11].

In some studies, there is evidence indicating that under conditions of chronic hypoxia, the processes of both collagenogenesis and lithogenesis are disrupted. Therefore, the disorganization of connective tissue and dystrophic changes in the cells of smooth muscle bundles that we have discovered, especially in multiparous patients, indicate the consequence of hypoxia in structural reorganization after traumatization of the lower uterine segment during childbirth.

In the literature there are some scientific works [11,12], which indicate that the intensity of collagen synthesis and the formation of collagen fibers occurs due to autoregulation of the processes of collagen synthesis and breakdown. This can be realized in two ways: pathological, when collagen fibers appear inside the cells in the cytoplasm of fibroblasts and myofibroblasts or by replacing damaged smooth muscle cells in bundles with connective tissue in case of impaired reparative processes [12], which is confirmed by histomorphological changes in histological specimens of multiparous women.

CONCLUSIONS

1. Comparative studies show that in cases of excess echogenicity of the cervix over the body of the uterus, pathomorphological changes in the supravaginal part of the cervix are not detected.
2. With the same or reduced echogenicity of the cervix compared to the body of the uterus, disorganization of connective tissue and dystrophic changes in the smooth muscle bundles of the supravaginal part of the cervix were observed in histological specimens.
3. A change in the ratio of echogenicity of the cervix to the body, which is closely related to the morpho-structure of the isthmus of the uterus, can serve as one of the criteria for predicting the failure of the lower uterine segment in women.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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