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EDITORIAL

Dear Reader;

Pelviperineology Journal, which is one of the journals with the shortest article evaluation and publication period in the world, is in front of you once again with a full scientific content which would satisfy you.

The editorial by Prof. Peter Petros is a game-changing article and should be taken into account. Because; the article has been heralding the starting of a new era. Personally, as a follower of Integral Theory System and applying the Theory into my clinical practice have experienced that the future of surgeries on pelvic floor will definitely depend on non absorbable sutures and they will replace the mesh.

The original articles, review and case reports are all shedding lights to the most intriguing problems of the pelvic floor and each worth reading carefully.

Our ISPP's 10th International Congress on Pelviperineology will be held in the ancient city of İstanbul, Türkiye between the dates of 24th-26th of November 2023 (www.pelviperineologycongress.com). The abstracts which will be accepted as oral presantations will also be published in the forthcoming issue of our journal. I recommend that you do not miss this scientific feast.

Best regards,

Prof. Dr. A. Akin SIVASLIOGLU

Editor-in-Chief

INSTRUCTIONS TO AUTHORS

Pelviperineology is a quarterly published, international, double-blind peer reviewed journal dedicated to the study and education of the pelvic floor as one integrated unit. The publication frequency is 3 times a year (April, August, December) in every 4 months. The core aim of Pelviperineology is to provide a central focus for every discipline concerned with the function of the bladder, vagina, anorectum, their ligaments, muscles and female cosmetic surgery.

Pelviperineology publishes original papers on clinical and experimental topics concerning the pelvic floor diseases in the fields of Urology, Gynaecology and Colo-Rectal Surgery from a multidisciplinary perspective. In the published articles, the condition is observed that they are of the highest ethical and scientific standards and not have commercial concerns. Studies submitted for publication are accepted on the condition that they are original, not in the process of evaluation in another journal, and have not been published before. All submitted manuscripts must adhere strictly to the following Instructions for Authors.

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Review Articles: Extent investigation writings including the latest national and worldwide literature about pelvic floor diseases. The review article should be qualified to shed light on a new or controversial area. The journal editor may request the author or authors for review writing. At most include 6000 words, 10 tables and 30 references should be included.

Original Articles: Original articles report the results of fundamental and clinical studies or clinical trials. References and summary are required (see writing preparation section). At most 4000 words, 6 tables and/or figures, additionally abstract and references. Ethics committee approval should be mentioned in the study.

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Systematic reviews and meta-analyses: PRISMA guidelines

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7. Data items
8. Risk of bias in individual studies
9. Summary measures
10. Synthesis of results
11. Section/topic
12. Risk of bias across studies
13. Additional analyses

- **RESULTS**

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2. Study characteristics
3. Risk of bias within studies
4. Results of individual studies
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* Materials and Methods: One or two sentences reporting the methods;

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Wide-bore polyester suture ligament repair- a low-cost solution to the aged incontinence crisis?

Peter PETROS

School of Mechanical and Mathematical Engineering, University of Western Australia, Perth, WA, Australia

Citation: Petros P. Wide-bore polyester suture ligament repair- a low-cost solution to the aged incontinence crisis?. Pelviperineology 2023;42(2):48-50

In every developed nation, the population is ageing rapidly, notably in Japan.[1] Ageing brings collateral medical problems including pelvic organ prolapse and incontinence.[2] The result is poor quality of life and escalating community and government health costs. Bladder/bowel dysfunctions are said to be responsible for 50% of all admissions to nursing homes.

The crisis is in full sight. The prevalence of urinary incontinence is now up to 70% in care homes.[3] The prevalence of nocturia in women aged 60 to 70 years is between 11% and 50%. At 80 years, prevalence rises to 80-90%.[4] Hip fractures can occur in 4.6% of nocturia women, occurrence increasing with age.[4] Inability to empty can occur in up to 59% of women.[5] In a survey of women greater than 40 years of age, the prevalence of faecal incontinence is 24%.[6]

To solve this ageing incontinence crisis, it is first necessary to understand the pathogenesis of bladder/bowel dysfunctions. Learned bodies, gynaecology, urology, coloproctology, state and teach, that these conditions have unknown pathogenesis and cannot be cured. Each subspecialty has widely varying methods for treating the symptoms which arise from these conditions.

Yet, these same learned bodies all teach that bladder, bowel and pain symptoms co-occur. Common sense alone would suggest a common origin! The Integral Theory system offers a potential solution to the crisis. The scientific breakthrough for the bladder began in 1990: The causation of urinary incontinence was from outside the bladder,[7,8] mainly from the vagina and it supporting ligaments, because of damaged collagen at childbirth and old age. In 2008, It was discovered that anorectal function and dysfunction had similar ligament pathogenesis.[9] A second discovery in 1990, was that ligaments could be reinforced by harnessing the collagen produced by a foreign body reaction to an implanted material, for example, a polyester tape.[10] This discovery is the basis for the gold standard operation for cure of stress urinary incontinence, with 10 million operations to date world-wide.[10]

The key point of the integral theory system is the binary control system, Figure 1. Cortically-directed reflex muscles contract against suspensory ligaments, pubourethral (PUL) anteriorly and uterosacral (USL) posteriorly to close the outlet tubes (urethra and anus) for continence, open them for evacuation, and to stretch the organs in opposite directions to support their stretch receptors “N” from below, Figure 1; this mechanical support of “N”, prevents afferent impulses from prematurely activating the micturition and defecation evacuation reflexes (green arrows), Figure 1. If the ligaments are weak or loose, some or all of these functions are diminished, and the dysfunctions are

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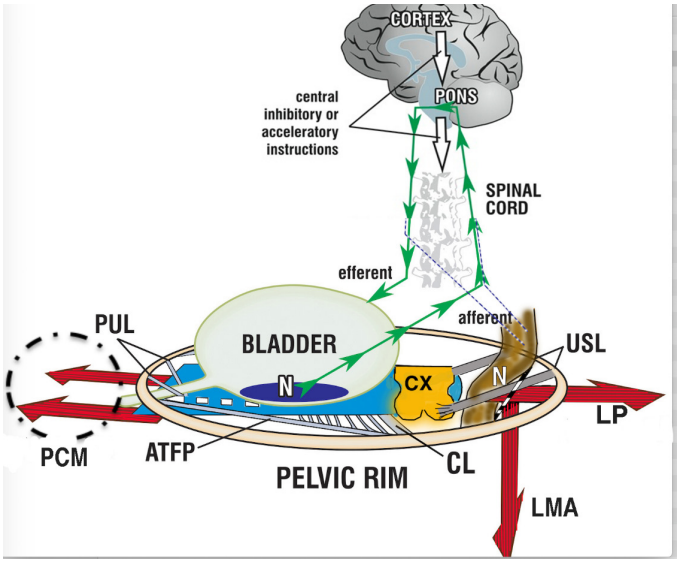

Figure 1. The binary cortico/peripheral control systems of bladder and bowel are virtually identical. Afferent impulses from stretch receptors "N" in the bladder and bowel proceed to the cortex which interprets them as "fullness". By reflexly stretching bladder and bowel bidirectionally (large arrows), the muscles tension the underlying supports of the stretch receptors "N" of each organ to prevent them from firing off emptying impulses prematurely, thereby controlling inappropriate activation of the micturition and defecation reflexes, which is sensed by the cortex as urgency. If convenient to empty, the closure reflex shuts down, and the emptying reflexes (micturition and defecation) are activated. The posterior walls of the urethra and anorectum are actively pulled open (broken lines) by LP/LMA immediately prior to evacuation. This external opening exponentially decreases resistance to flow, thereby facilitating evacuation.[4]
Dysfunction Anatomical damage to any part of the system may interfere with the binary control of all the above functions. CORTEX: facilitatory or inhibitory centres; NERVES: afferent or efferent (for example MS); PERIPHERAL: ligament or muscle damage (mainly ligaments); LOCAL: mucosal prolapse, tumours

expressed clinically as stress incontinence on effort (urinary, fecal), inability to evacuate (urinary, fecal), and inability to "hold on" due to premature activation of the evacuation reflexes, urge incontinence (urinary, fecal).

High cure rates have been recorded for all these conditions, simply by repairing damaged pelvic ligaments, mainly PUL and USL, using precisely inserted slings. Table 1 is an example of how pelvic symptoms, (bladder and bowel symptoms in particular) co-occur: 611 women were cured of prolapse, bladder and fecal incontinence with USL repair by a TFS minisling.[11]

A more recent development is the use of No2 or No3 polyester sutures to directly repair the ligaments.[12] Calculations based on an explanted failed aortic graft from the author's doctor of surgery thesis[13] indicated that the collagen created in reaction to

Table 1. Anatomical and symptom cure following TFS uterosacral minisling repair

	Number of patients with symptom or condition/total patients (%)		Significance of the x^2 values of the McNemar tests when testing: H_0 *vs.* H_1	
	pre-TFS	post-TFS	CURE	*
Pelvic pain	194/611 (31%)	42/611 (7%)	77%	*
Nocturia	254/611 (41%)	77/611 (7%)	68%	*
Urge/ Urge incontinence	317/611 (52%)	51/611 (8%)	85%	*
Frequency	310/611 (51%)	55/611 (9%)	83%	*
Fecal incontinence	93/532 (17%)	34/532 (6%)	65%	*
Apical prolapse	611/611 (100%)	63/611 (10%)	90%	*

an implanted No2 polyester suture was two orders of magnitude greater than the breaking strength of ligaments. Application of this direct ligament repair method is already being applied to all the main ligaments, PUL (for SUI), cardinal (for cystocele), USL (for uterine prolapse) and deep transversus perinei (for perineocele and descending perineal syndrome). These are minor very low cost procedures which can be performed under local anesthesia, and, if proven to have long-term effect, will likely become the gold standard surgery for pelvic symptoms and organ prolapse. The cost is a few dollars per patient, a far cry from the many hundreds (or thousands) of dollars for mesh kits.

Keywords: Pelvic organ prolapse; bladder dysfunction; rectal dysfunction; wide-bore polyester sutures; integral theory

ETHICS

Peer-review: Internally peer-reviewed.

DISCLOSURES

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Sexual functioning after total abdominal hysterectomy or total laparoscopic hysterectomy in climacteric women

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ABSTRACT

Objectives: Hysterectomy is a major surgical procedure in gynecology and the postoperative effects of hysterectomy significantly alter women's quality of life. The aim of this study is to investigate the effects of total abdominal hysterectomy (TAH) or total laparoscopic hysterectomy (TLH) for benign indications on sexual function changes in the climacteric period of women.

Materials and Methods: A prospective study of 188 women with benign uterine conditions in the climacteric period operated with hysterectomy (134 in the TAH group and 54 in the TLH group) between 2018 and 2021 were performed. After hysterectomy, the sexual function changes in women were determined between TAH and TLH groups using the female sexual function index (FSFI).

Results: The demographic characteristics of the patients were similar in both groups. In TLH group, a statistically significant increase was determined in the postoperative FSFI score of patients compared to their preoperative score ($p<0.001$). On the other hand, no significant difference was determined between postoperative and preoperative scores in the TAH group ($p>0.05$).

Conclusion: In the climacteric period, TLH procedure in benign conditions improved the sexual functions of women compared to TAH method according to the FSFI scores.

Keywords: Hysterectomy; total abdominal hysterectomy; total laparoscopic hysterectomy; FSFI; sexual function

INTRODUCTION

Hysterectomy is one of the most commonly performed surgical procedures to treat a number of conditions, particularly for benign indications.[1] Traditionally, hysterectomy has been performed via laparotomy or the vaginal approach to be mostly abdominal hysterectomy until the late 1980's when the first laparoscopic procedures were introduced.[2] Since laparoscopic hysterectomy has some superiorities to total abdominal hysterectomy (TAH), such as earlier return to work and less blood loss, it has been increasingly preferred by surgeons for hysterectomy during the last decade, particularly in developed countries.[3,4] On the other hand, total laparoscopic hysterectomy (TLH) also has some

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shortcomings, including high cost, long learning curve, and need for sophisticated technological tools such as sealing devices.[3,5] Therefore, TAH still is the most-performed type of hysterectomy in worldwide.

All hysterectomy methods have important risks of acute complications such as infection, major bleeding, and injury of adjacent organs. In the long-term, some changes in quality of life, mental health, and sexual functions in patients after hysterectomy have been reported in the literature.[6,7] Because hysterectomy may cause changes in pelvic vascularization and innervation and it is related with vaginal shortening, it has been associated with being a potential factor in female sexual dysfunction etiology. Besides, there are conflicting data in the literature about the effect of hysterectomy on female sexual function. If oophorectomy is performed with hysterectomy in a premenopausal patient, the hormonal effect is the main factor on sexual function. However, it is controversial whether the effects of hysterectomy without oophorectomy on sexual function are positive or negative. Studies are showing that post-operative sexual function changes positively, especially in patients who have undergone hysterectomy for reasons such as chronic pelvic pain and abnormal bleeding.[8-10] Unfortunately, the literature lacks sufficient evidence whether the type of hysterectomy is the reason of this inconsistent outcome.

In this study, we aimed to compare sexual function changes with a questionnaire in women who underwent TAH or TLH for benign indications in the climacteric period.

MATERIALS AND METHODS

Study Design and Study Group

We performed a single-center prospective cohort study performed at Atatürk Training and Research Hospital, İzmir Katip Çelebi University, İzmir, Türkiye. Ethical approval was obtained from Local Ethics Committee of İzmir Katip Çelebi University, İzmir, Türkiye (19.12.2018-IRB#0401). Verbal and written approval for inclusion into the study was obtained from each participant. All protocols were conducted in accordance with the principles of the Declaration of Helsinki. Informed consent was obtained from all individual participants included in the study.

The initial cohort assessed for eligibility comprised in the climacteric women who had undergone total hysterectomy for benign hysterectomy indications at our center, from July 2018 to December 2021 by high volume surgeons.[11] After the first analysis of patient data, 188 patients were finally enrolled, 134 in the TAH group and 54 in the TLH group. The exclusion criteria for TAH and TLH groups were as follows: Concomitant bilateral oophorectomy, additional gynecologic operation with/or after hysterectomy, psychiatric diseases, chronic diseases that could affect sexual function such as hypertension, diabetes, hypothyroidism, and multiple sclerosis, lack of preoperative female sexual function index (FSFI) survey data, and unable to reach the patient by phone.[12,13]

Data Collection

The following data were obtained and recorded from electronic and medical records: Demographic characteristics (height, weight, age, body mass index, and gravida-parity), the mean age of menarche, the mean age of first gestation, the type of delivery and the preoperative FSFI scores.

The patients included in the study were called and invited to our clinic for interview. In the face-to-face interview, we asked the volunteers to answer questions on the FSFI which is considered an appropriate measure of sexual function assessment.[14,15] The answers received were recorded on the case form. Scores were calculated according to the subcategories of the answers given to the FSFI questions, which consisted of six subcategories: Desire, arousal, lubrication, orgasm, satisfaction, and pain.[16] Women with total FSFI score ≤26.5 were considered to have sexual dysfunction.

Statistical Analysis

All analyses were performed using the SPSS 21 program. Pearson chi-square test was used to determine the difference between categorical variables. Conformity of continuous numerical data to normal distribution was evaluated with Shapiro-Wilk test and histogram. In cases where the normal distribution condition was met, the independent samples t-test was used in pairwise comparisons, and the Mann-Whitney U test was used in the comparison of numerical data that did not comply with the normal distribution in paired groups. Data are presented as mean ± standard deviation, and *p*-value below 0.05 was considered statistically significant.

RESULTS

From July 2018 to December 2021, 188 women in the climacteric period having TAH and TLH operation were included in this study. Patients' demographic and baseline characteristics are described in Table 1. Demographic and the baseline characteristics were similar in TAH and TLH groups except the mean gravida number which was significantly higher in TLH group (p=0.046).

In TLH group, the FSFI score in subcategories was improved after surgery and the total score was increased from 20.4±4.3 to 29.6±3.2 (p<0.001). Although all scores in the TAH group (FSFI

subcategories and total score) were improved, the changes were not statistically significant (p>0.05). Although the median of all FSFI scores were similar preoperatively, the median of all FSFI score were statistically higher in the TLH group compared to TAH group (Table 2).

DISCUSSION

In the literature, it is still a controversial issue whether the uterus plays a role in women's sexual activities. It is claimed that uterine contractions have a great effect on libido, which is the perception of orgasm. Some studies supporting this situation have reported sexual dysfunction after TAH. However, there is not enough study in the literature to compare the effects of other types of hysterectomy (vaginal, TLH, etc.) on sexual function in women.[17,18]

Ayoubi et al.[16] compare different hysterectomy types for women sexual dysfunctions and the obtained results indicated that vaginal hysterectomy, TAH and TLH has same effect on sexual health in regard of arousal and intercourse frequency. However, the delay in starting the postoperative sexual intercourse after TAH procedure was found to be longer in women compared to vaginal hysterectomy and TLH procedure. They concluded that these differences might be related with significant poorer self-image in TAH group women.[16] Although we searched sexual health in different methodology, we also think that poorer self-image perception may be one of the reasons of low FSFI scores in TAH group because of worse abdominal scar. Another study reported that body image dissatisfaction was associated with lower sexual function scores after TAH.[19]

Some researchers compared conventional TLH with single-port laparoscopy-assisted vaginal hysterectomy (LAVH), and they reported more patient body image dissatisfaction rates in LAVH group but both groups had similar results for sexual function after operations.[20] In our opinion the body image dissatisfaction is acceptable with TLH, supporting this result.

In another study, FSFI questionnaire was administered to a total of 4.895 pos-hysterectomized women (3.539 women in TLH group and 1.356 women in TAH group). The results demonstrated

Table 1. Demographic and baseline characteristics of participants

	TAH	TLH	p
Age (years)	43.0±3.2	43.7±3.7	0.14
BMI (kg/m²)	25.2±4.5	24.9±3.4	0.70
Gravida	2.6±1.4	3.1±1.6	0.046
Parity	2	2	0.47
Postoperative date (months)	12.7±1.2	12.3±4.0	0.32
Type of delivery			
Cesarean	36 (26.87%)	11 (20.37%)	0.37
Vaginal	85 (63.43%)	30 (55.56%)	0.44
Both vaginal and cesarean	13 (9.70%)	8 (14.81%)	0.33
Nullipara	0	5 (9.26%)	0.32
Mean age of menarche	12.6±1.1	12.4±1.0	0.45
Mean age of first gestation	21.7±5.1	21.6±3.5	0.38

BMI: body mass index; TAH: total abdominal hysterectomy; TLH: total laparoscopic hysterectomy

Table 2. The comparison of changes of preoperative and postoperative FSFI scores in TAH and TLH groups

	TAH			TLH		
	Preoperative FSFI score	**Postoperative FSFI scores**	p	**Preoperative FSFI scores**	**Postoperative FSFI sacores**	p
Desire	2.4±0.8	3.6±1.0	0.43	2.2±0.9	4.3±0.8	<0.001
Arousal	3.9±0.9	4.5±0.9	0.37	4.0±1.0	5.2±0.5	<0.001
Lubrication	3.8±0.7	4.3±1.0	0.32	3.9±0.7	5.2±0.7	<0.001
Orgasm	3.5±0.6	4.1±0.9	0.44	3.4±0.5	4.8±0.7	<0.001
Satisfaction	3.4±0.7	4.2±0.8	0.33	3.8±0.7	5.1±0.6	<0.001
Pain	3.3±0.6	4.1±0.9	0.54	3.1±0.5	5.0±0.7	<0.001
Total	20.1±4.2	24.9±4.6	0.44	20.4±4.3	29.6±3.2	<0.001

TAH: total abdominal hysterectomy; TLH: total laparoscopic hysterectomy; FSFI: female sexual function index

that all FSFI score in subcategories was found to be high and statistically significant scores were obtained in lubrication and satisfaction parameters in the 12th month postoperative follow-up.[21] Our result supported this well-attended study in long-term period.

To investigate the change of sexual function in pos-hysterectomized women, Lermann et al.[22] compared five different hysterectomy methods (TAH, TLH, LAVH, laparoscopic supracervical hysterectomy, and vaginal hysterectomy). They observed no significant differences between hysterectomy types and sexual function according to brief profile of female sexual function assessment tool. In this study we found statistically significantly high FSFI scores for TLH group.[22] The difference in results may be the different questionnaire used in Lermanns' et al.[22] study and the longer follow-up interval.

In a study on women who underwent hysterectomy in the climacteric period, FSFI scores in TLH group were significantly improved compared preoperative values at 6th month according to arizona sexual experiences scale, system checklist-90-revised and Rosenberg self-esteem scale instruments.[23] In this study we confirmed these results at about one-year follow-up.

Ercan et al. [24] compared pos-hysterectomized women (TAH, TLH and vaginal hysterectomy) with non-surgical women to determine sexual function changes after surgery. The results indicated that non-surgical women had significantly better scores than all patients who were underwent hysterectomy by any methods. They concluded that shortened vaginal length was the major determinant of altered sexual function in hysterectomized women.[24] In recent study, Kiremitli et al.[25] reported that TAH caused more vaginal length loss than TLH and post-operative FSFI score were significantly higher in TLH group than TAH group.

CONCLUSION

Sexual dysfunction is an important health problem among women, and it prevents satisfaction from sexual activity. Many physical and/or medical conditions lead to the occurrence of the sexual dysfunction. Hysterectomy is a standard surgical procedure to treat benign gynecological conditions, and its effects on the sexual dysfunction have been reported in many studies. Our results indicated that TLH procedure has provided significantly better improvement of FSFI scores than TAH operation and significantly higher FSFI scores, as well. TLH may be the most appropriate surgical method among hysterectomy procedures to prevent sexual dysfunction in women. Furthermore, this study has some important key features such as being single center study, conducting in homogenous group of patients and relatively large of study populations.

ETHICS

Ethics Committee Approval: Ethical approval was obtained from Local Ethics Committee of İzmir Katip Çelebi University, İzmir, Türkiye (19.12.2018-IRB#0401).

Informed Consent: Informed consent was obtained from all individual participants included in the study. **Peer-review:** Externally peer-reviewed.

Contributions

Surgical and Medical Practices: E.Y.T., S.A.K.; Concept: E.Y.T., S.A.K., D.U.; Design: E.Y.T., D.U.; Data Collection or Processing: C.M.G.; Analysis or Interpretation: E.Y.T., C.M.G.; Literature Search: E.Y.T., S.A.K.; Writing: C.M.G., D.U.

DISCLOSURES

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ORIGINAL ARTICLE

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Female sexual behaviour and perception during pregnancy: A questionnaire-based study

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ABSTRACT

Objectives: Several reasons including especially the pregnancy-specific physical changes affect and suspend sexual life in that special period of time. Although the latest scientific data have revealed that sexual activity is safe during pregnancy sexual life during that period is affected by several reasons such as the area where individuals live, thoughts and beliefs.

Materials and Methods: This was designed as a prospective and cross-sectional questionnaire-based study. Sexual functions were assessed with the female sexual function index. In addition to demographic characteristics, sexual behaviour and perception of individuals were questioned with an additional questionnaire form.

Results: The assessment was performed over 171 patients who gave complete answers to the questions. Out of the patients, 54 (31.6%) were in the 1st trimester, 51 (29.8%) were in the 2nd trimester and 66 (38.6%) were in the 3rd trimester. Although the frequency of intercourse was gradually decreasing there was no patient who had not engaged in sexual activity. According to results, the decrease in frequency of intercourse was because of the thoughts of harming the fetus and physical discomfort. Sexual dysfunction was lowest during 2nd trimester. The missionary position was the most commonly preferred position. None of the participants had oral or anal sex.

Conclusion: Sexual behaviour during pregnancy is specifically affected by individual changes and thoughts. Although the thought that sexual intercourse would harm the fetus does not prevent sexual activity it is still highly accepted. Further studies are needed to correct these fallacies of individuals and assess country profile.

Keywords: Pregnancy; sexuality; female sexual function index

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INTRODUCTION

Pregnancy is a miraculous period of time when several physiological in particular, psychological, anatomical, and physical changes occur together. Among specific dynamics of pregnancy, its effect on sexual life is also quite important, but can be ignored. Therefore, pregnancy brings about sexual tensions which affect marriage relationships and which even defy these.[1] Sexual behaviours during pregnancy are affected by several factors such as decrease in sexual desire, changes in body image, fear of harming the fetus, dyspareunia, and medical contradictions.[1-3] These behaviours may also change in accordance with geographical, familial, religious, social, cultural, and individual beliefs. Studies performed in early 2000s in our country reveal that sexuality is repressed and sexual desire decreases during pregnancy.[4,5] However, there is not sufficient number of studies revealing this change and its course within time.

This study aimed to question sexuality during pregnancy specific to our country within the changing world and time. This really hard-to-speak issue in a Middle Anatolian city has been discussed in various perspectives and presented to literature to contribute to our country profile.

MATERIALS AND METHODS

This cross-sectionally and prospectively designed study was performed as a face-to-face questionnaire with 275 pregnant women between the ages of 18 and 44 who were admitted to Yozgat Bozok University Outpatient Clinic of Obstetrics and Gynecology and who admitted to participate in the study. Women whose pregnancy was at risk, those who did not admit to participate in the study, those who gave inadequate answers to the questions, and those who did not want to answer were excluded.

The questionnaire form consisted of three sections. The first section involved socio-demographic characteristics including independent variables; second section involved attitudes and behaviours related to sexual life during pregnancy and third section involved questions of the female sexual function index (FSFI).

The FSFI was developed by Rosen et al.[6] as a 19-item multidimensional scale in order to assess female sexual function in the USA in 2000. This scale assesses sexual problems or function in the past 4 weeks. Seven basic parameters including desire, arousal, lubrication, pain, orgasm, satisfaction, and total score are assessed in the structure of scale. Each item is scored between 0 and 5. The highest raw score to get in the scale is 95.0 and the lowest raw score is 4.0.[6] Turkish adaptation of FSFI was performed by Aygin and Aslan.[7]

Statistical Analysis

Statistical package program SPSS 20 (IBM Corp. released 2011. IBM SPSS Statistics for Windows, version 20.0, Armonk, NY: IBM Corp.) was used to evaluate the data. Data was expressed as mean ± standard deviation and in percentages. Continuous variables were investigated using analytical methods (Kolmgrov-Simirnov/Shapiro-Wilk's test) to determine whether or not they are normally distributed. If the numerical data was non-parametric, the Kruskal-Wallis test was conducted, if it was parametric, a One-Way ANOVA test was carried out and Bonferroni correction was used for the post-hoc assessment. Relationships between categorical variables were analyzed by chi-square test. Bivariate correlations were investigated by Spearman's correlation analysis and $p<0.05$ was accepted as statistically significant.

RESULTS

A total of 252 patients were included in the study. Patients who gave incomplete answers to the questions were excluded and the assessment was performed over a total of 171 patients. The patients were divided into 3 groups by their pregnancy trimesters. Out of the patients, 54 (31.6%) were in the 1st trimester, 51 (29.8%) were in the 2nd trimester and 66 (38.6%) were in the 3rd trimester.

There was no significant difference among the groups in terms of patient ages ($p=0.899$). Mean body mass index (BMI) values were significantly higher among patients in the 3rd trimester compared to those in the 1st and 2nd trimesters ($p<0.001$). There was no significant difference among the groups in terms of duration of marriage. Mean gestational week was 8.4±1.8 in the 1st trimester, 17.8±2.6 in the 2nd trimester and 31.6±2 in the 3rd trimester ($p<0.001$). There was no significant difference among the groups in terms of educational levels of participants ($p>0.05$). The 1st and 2nd trimester groups had higher income level compared to 3rd trimester group ($p<0.001$). Demographic characteristics of the participants were reported in Table 1.

Of the patients, 22.2% in the 1st trimester, 35.3% in the 2nd trimester and 31.8% in the 3rd trimester stated that they were afraid of harming the fetus if they had sexual intercourse during pregnancy. According to the answers of patients about sex position changes, 11.1% of patients in the 1st trimester, 29.4% in the 2nd trimester and no patient in the 3rd trimester stated that they did not change their positions during sexual intercourse and the difference among the groups was significant ($p<0.001$). Regarding that change, especially patients in the 2nd trimester preferred having sex in side-lying and doggy positions in addition to missionary. None of the patients preferred oral and anal sex or partnerbation instead of sexual intercourse. Of the pregnant women, 63% stated that their frequency of sexual intercourse

decreased during pregnancy. According to the statistical analysis, there was no change in pregnant women's frequency of sexual intercourse by trimesters (p>0.05) and sexual activity continued even in the 3rd trimester. The prevalence of foreplay during pregnancy was significantly higher in the 3rd trimester (p<0.01) (Table 2). Of the participants, 75% stated that sexual intercourse during pregnancy caused them to feel physical discomfort and 63% stated that they thought the fetus would get hurt during sexual activity. This rate was higher in the 3rd trimester, but not statistically significant.

According to the intergroup assessment of FSFI results, total FSFI and sub-domain scores were statistically significantly higher in the 2nd trimester (p<0.001). Only the lubrication score was higher and satisfaction score was statistically significantly lower in the 3rd trimester compared to the other groups (Table 3) (p<0.01). No statistically significant relationship was found among total FSFI scores and age, BMI and duration of marriage in all patients (p>0.05). In subgroups, as age (r=-0.291, p=0.033) and duration of marriage (r=-0.445, p=0.001) increased total FSFI score decreased. As duration of marriage (r=0.333, p=0.017; r=0.320, p=0.009) increased in the 2nd and 3rd trimesters total FSFI score statistically significantly increased. In addition, as BMI increased in the 3rd trimester (r=0.505, p<0.001) total FSFI score statistically significantly increased (Table 4). Total FSFI scores were statistically significantly higher in all patients in the groups with

Table 1. Demographic characteristics

		1st trimester	2nd trimester	3rd trimester	*p*
Age (years)		29.9±7,9	29±7	28.4±4.5	0.899
BMI (kg/m²)		27.1±5.1[a]	26.4±4.9[a]	29.1±3.9[b]	<0.001
Pregnancy week		8.4±1.8[a]	17.8±2.6[b]	31.6±2.0[c]	<0.001
Period of marriage		5.7±5.9	5.3±5.7	5.9±5.0	0.473
Education level	**Primary school**	21 (38.9%)	12 (23.5%)	24 (36.4%)	0.121
	High school	12 (22.2%)	15 (29.4%)	24 (36.4%)	
	University	21 (38.9%)	24 (47.1%)	18 (27.3%)	
Income	**Low**	12 (22.2%)	21 (41.2%)	15 (22.7%)	<0.001
	Middle	12 (22.2%)	6 (11.8%)	33 (50.0%)	
	High	30 (55.6%)	24 (47.1%)	18 (27.3%)	

BMI: body mass index; weight (kg)/height (m)², [abc]There is no significant difference between groups containing the same letter

Table 2. Attitudes and behaviors of participants regarding sexual relations during pregnancy

		1st trimester		2nd trimester		3rd trimester		
		n	%	n	%	n	%	
Foreplay	**Yes**	27	50.00	30	58.80	57	86.40	<0.001
	No	27	50.00	21	41.20	9	13.60	
Sex position	**Changed**	6	11.10	15	29.40	0	0.00	<0.001
	Has not changed	48	88.90	36	70.60	66	100.00	
Position preference	**Missionary**	51	94.40	33	64.70	57	86.40	<0.001
	Woman on top	3	5.60	0	0.00	9	13.60	
	Side lying	0	0.00	12	23.50	0	0.00	
	Dogi	0	0.00	6	11.80	0	0.00	
I'm fearing that sex will damage my baby	**Yes**	12	22.20	18	35.30	21	31.80	0.31
	No	42	77.80	33	64.70	45	68.20	
We prefer only oral sex	**Yes**	0	0.00	0	0.00	0	0.00	
	No	54	100.00	51	100.00	66	100.00	
	No	54	100.00	51	100.00	66	100.00	
We prefer anal sex	**Yes**	0	0.00	0	0.00	0	0.00	
	No	54	100.00	51	100.00	66	100.00	

low education and income level (p<0.01) (Table 5). According to total FSFI score, general prevalence of sexual dysfunction was 52.6% (90/171) in all pregnant women.

DISCUSSION

This study primarily reveals that sexual life during pregnancy is still a hard-to-speak issue at least in some regions of our country. A total of 252 pregnant women participated in the study; however, 171 (67.8%) of them gave complete answers to the questions. As pregnancy proceeds the frequency of sexual intercourse decreases. Main reason of this was found as the fear of harming the fetus during sexual activity. Throughout pregnancy, the most commonly preferred position was missionary position followed by doggy and side-lying positions. According to FSFI scores, the lowest prevalence of sexual dysfunction was observed in the 2nd trimester. The general prevalence of sexual dysfunction was 52.6% among all pregnant women.

Pregnancy is the most special period of a woman in her life. Especially the first pregnancy is a crucial crisis period. Several physiological changes occur in that special period. These changes occur in order to provide healthy growth of fetus in particular and facilitate adaptation of mother to pregnancy. Although changing

Table 3. FSFI parameters according to trimesters

	1st trimester	2nd trimester	3rd trimester	*p*
Desire	2.8±0.8[a]	3.7±1.1[b]	3.2±0.6[a]	<0.001
Arousal	3±0.8[a]	3.6±0.8[b]	3.1±0.7[a]	0.001
Lubrication	3.6±0.9[a]	4±0.8[a]	4.3±0.6[b]	<0.001
Orgasm	2.8±0.7[a]	3.8±1[b]	3.3±0.7[a]	<0.001
Satisfaction	3.9±0.2[a]	4.7±0.4[b]	2.5±0.8[c]	<0.001
Pain	3.1±1.4[a]	3.4±1[a]	4.1±0.9[b]	<0.001
Total score	19.3±3.1[a]	23.2±2.7[b]	20.6±2.3[a]	<0.001

[abc]There is no significant difference between groups containing the same letter, FSFI: female sexual function index

Table 4. The relationship of total FSFI scores with age, BMI and duration of marriage

FSFI total	Age		BMI		Period of marriage	
	r	*p*	r	*p*	r	*p*
1st trimester	-0.291	0.033	-0.152	0.273	-0.445	0.001
2nd trimester	0.169	0.236	-0.202	0.155	0.333	0.017
3rd trimester	-0.142	0.256	0.505	<0.001	0.320	0.009
All groups	-0.094	0.222	0.007	0.924	0.052	0.500

BMI: body mass index; weight (kg)/height (cm)^2, FSFI: female sexual function index

Table 5. The relationship between FSFI total score and education level and income level

	Education level						
	Primary school		High school		University		*p*
	Mean	SD	Mean	SD	Mean	SD	
FSFI total all groups	21.89	3.05	21.45	1.80	19.78	3.62	<0.001
FSFI total 1st trimester	19.61	2.33	20.88	2.90	18.09	3.55	0.437
FSFI total 2nd trimester	25.63	2.05	22.32	1.59	22.56	2.94	<0.001
FSFI total 3rd trimester	22.03	1.98	21.20	0.87	18.03	1.87	<0.001
	Income						
	Low		**Middle**		**High**		
FSFI total all groups	22.71	3.58	20.79	2.64	19.97	2.58	<0.001
FSFI total 1st trimester	18.43	2.46	21.65	2.68	18.71	3.13	0.003
FSFI total 2nd trimester	25.09	2.99	22.70	2.08	21.70	1.36	<0.001
FSFI total 3rd trimester	22.82	1.17	20.13	2.52	19.75	1.24	<0.001

FSFI: female sexual function index; SD: standard deviation

physiology during pregnancy seems to make some functions including sexual intercourse difficult the present scientific data reveal no harmful effect of sexual activity during pregnancy, on the contrary, parents' getting used to that period and facilitation of their adaptation to physical and emotional changes are closely associated with continuity of sexual activity.[8-10] However, sexual intercourse cannot be provided as desired due to some reasons. Especially pregnancy-specific physiological and psychological changes are on the top of these reasons. First reflections of this situation have almost never changed in literature. Sexual desire and frequency of sexual intercourse decrease as the gestational week proceeds and the most comfortable sexual activity happens during the second trimester. While orgasm reveals individual changes a general decrease in sexual satisfaction is reported.[11-13] Our study results are similar to these data. Frequency of sexual activity was the highest in second trimester. Kerdarunsuksri and Manusirivithaya[14] reported that one out of five pregnant women had no sexual relationship within the past four weeks. Bartellas et al.[15] found that sexual activity increased only in 6% of pregnant women. Our data reveal that sexual activity did not end even during the 3rd trimester but decreased.

In a study performed in Aydın, Türkiye in 2012, the rate of pregnant women who had the thought that sexual intercourse during pregnancy would harm the fetus was 59% and the rate of those who changed their sexual position due to that thought was 45.5% and the rate of those who answered the question what position change was 27% (8%: Missionary, 7%: Side-lying position, 7%: Knee chest position, 5%: Sitting position). A significant relationship was found between the thought that the fetus would get hurt during sexual activity and position change in statistical analysis. According to our results, missionary position was most commonly used and no positional change was needed throughout pregnancy and the participants defined their sexual activity as "as before". Although positional change in sexual intercourse is associated with physical changes caused by pregnancy, missionary position is the most commonly preferred sex position during pregnancy as well as during non-pregnancy period in Europe.[16,17] Considering the other studies performed in our country and our practice, we think that women do not want to answer such questions and that they hesitate and often dismiss them as "as before". On the other hand, the most commonly preferred position in Iran where there is a conservative structure like in our country is doggy position.[18]

FSFI was used in this study for specific and multidimensional assessment of sexual dysfunction. General assessment score of this questionnaire is accepted as 26 in general population. Scores of 26 and below are included in sexual dysfunction category. However, as all scores decrease during pregnancy several researchers accept 21 as the cut-off value.[19] According to the assessment in which we accepted 21, the prevalence of sexual dysfunction was 66.7% in the 1st trimester, 29.4% in the 2nd trimester and 45.5% in the 3rd trimester. In general assessment according to total FSFI score, the prevalence of sexual dysfunction was 93.4% in a study in Thailand and 61% in Brazil (cut-off value was accepted as 26.5 in both studies). It was observed in studies conducted in our country that there were differences in scale usages or that total score assessment was not performed even if FSFI was used, which makes data comparison difficult in terms of our country. In a study in which FSFI was used, when the cut-off value was accepted as 26 after the assessment of total scores, prevalence of sexual dysfunction became over 80%. In our study, the prevalence was 96.5% when cut-off value was accepted as 26. In another study in which a different index (index of female sexual function) was used, mean scores were 23.2±9.8 and 67% of pregnant women experienced sexual dysfunction.[20-22] When the trimesters were assessed we found a common finding in which all scores decreased and sexual dysfunction became evident in the 1st and 3rd trimesters. For subscores in our study, all scores in the 2nd trimester were statistically significantly high ($p<0.001$). Only the lubrication score was higher and satisfaction score was statistically significantly lower in the 3rd trimester group compared to the other groups. Two studies performed in our country reveal that the prevalence of sexual dysfunction is higher in individuals with low educational level and without social insurance and in those who do not want to be pregnant.[23,24]

In our study, we found no statistically significant relationship between total FSFI scores and age, BMI and duration of marriage in all patients. In subgroups, total FSFI score in the 1st trimester decreased as age and duration of marriage increased. It statistically significantly increased during the 2nd and 3rd trimesters as the duration of marriage increased. This may suggest that younger and recently married couples are more willing to have sexual intercourse. Another finding in our study was that the decision of sexual intercourse was more affected by physical discomfort or fear of harming the fetus rather than religious opinions, which is faced as an independent thinking. In a study performed by Yangin and Eroğlu[25], the responses of 24 couples who ended sexual activity during pregnancy for the question why they ended were assessed and according to the results, 63% felt physical discomfort during sex, 58% believed that they would physically harm the fetus, 33% believed that having sex during pregnancy was sinful for Islam, 25% believed that their baby would "get stained", and 21% ended sexual activity upon the advice of a healthcare personnel.

Study Limitations

Although the internet use has increased and access to information has become easier the information that sexual intercourse during pregnancy does not harm the fetus still remains uncovered. This may be associated with the geographical region in which our study was conducted. Talking about sex was characterized as a shame or a sin in studies performed in previous years as well and the data are similar in some countries such as Iran where sexuality cannot be freely spoken.[19] The most important limitation of this study is that its sample size is not large enough to represent general country profile; however, it can represent the Middle Anatolian profile. Sexual dysfunction complaints of partners were orally questioned and were not objectively assessed with a scale, which can be another limitation of our study because female sexual dysfunctions may result from their partners. On the other hand, participants who answered all the questions were having their first pregnancy and had nuclear family profile, which homogenized our data and made a healthier assessment possible.

CONCLUSION

Sexual dysfunction increases in the 1st and 3rd trimesters during pregnancy. Sexuality during pregnancy or maybe salt sexuality is still faced as a hard-to-speak issue. The thought that sexual intercourse during pregnancy may harm the fetus is a common idea in our country. It is necessary to popularize consultancy services and education to correct this fallacy and for healthy sexuality.

ETHICS

Ethics Committee Approval: Ethics committee approval was obtained from the Clinical Research Ethics Committee of Yozgat Bozok University (2017-KAEK-189_2022.12.29_09).

Informed Consent: Informed consents were obtained from each patient.

Peer-review: Externally peer-reviewed.

Contributions

Concept: D.A.K., A.C.K.; Design: E.B., A.A.S.; Data Collection or Processing: E.B., F.C., D.A.K.; Analysis or Interpretation: E.B.; Writing: D.A.K., E.B.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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Configuration, geometry, and presence of defect in the pelvic floor muscles of women with apical pelvic organ prolapse

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ABSTRACT

Objectives: This study aimed to assess the presence of defects in the pelvic muscles, muscle configuration, and the relationship of pelvic organs using magnetic resonance imaging (MRI) in women with apical pelvic organ prolapse (POP), and compare these findings with measurements from women without POP.

Materials and Methods: The study analyzed computer-based medical records of patients diagnosed with POP prolapse at İzmir Bakırçay University Çiğli Training and Research Hospital between March 2022 and May 2023. Forty-five patients diagnosed with apical POP were matched with 45 patients of the same age group without prolapse. Pelvic MRI images of all patients were examined, and the pubococcygeal line, H line, and M line were marked. Additionally, measurements of the uterocervical angle, genital hiatus width, obturator internus muscle area, and levator ani defect were assessed.

Results: The demographic characteristics of patients with POP were similar to those in the control group. There were no statistical differences in the POP group regarding pubococcygeal distance, genital hiatus length, vaginal length, uterocervical length, and puborectal distance (H). The presence of unilateral and bilateral levator ani muscle defects was more common in the POP group (p=0.02 and p=0.03). The obturator internus muscle area was lower in the POP group compared to the control group (1770±293.4 mm^2 vs. 2104±303.5 mm^2, p=0.02). M length was higher in women with POP (27.3±5.8 mm vs. 15±4.2 mm, p=0.02).

Conclusion: MR images revealed defects in pelvic floor muscles and descent of pelvic organs in patients with POP. MRI has the potential to become a standard preoperative examination for pelvic floor abnormalities, assisting in surgical planning.

Keywords: Cystocele; levator ani defects; magnetic resonance imaging; pelvic floor; rectocele

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INTRODUCTION

Pelvic organ prolapse (POP) encompasses a range of clinical conditions leading to genitourinary, gastrointestinal, and sexual dysfunctions. These conditions arise due to insufficiency in the pelvic floor.[1] The support of pelvic organs in females relies on the interplay between pelvic floor muscles and the connective tissue that anchors to the bony pelvis.[2]

The levator ani muscle complex, comprised of the pubococcygeus, puborectalis, and iliococcygeus muscles, furnishes primary support to the pelvic organs by providing a stable and flexible foundation upon which these organs repose.[3] Fibrous thickening of the endopelvic fascia, referred to as uterosacral and cardinal ligaments, play a role in stabilizing the pelvic organs in their optimal positions. Another muscle implicated in pelvic floor insufficiency is the obturator internus.[4] Diagnosis and classification of pelvic floor dysfunction hinge on physical assessment, encompassing a multifaceted array of measurements. Given that one-third of individuals undergoing prolapse surgery necessitate subsequent procedures, a thorough preoperative evaluation becomes indispensable for accurately identifying structural weaknesses leading to the descent of supportive structures.[5] Recently, magnetic resonance (MR) imaging has emerged as a valuable tool in the preoperative assessment of POP, aiding in the identification of various anatomical anomalies in patients. This proactive approach holds the potential to enhance postoperative outcomes and consequently lower the risk of recurrence.[6] MR imaging (MRI) facilitates an in-depth morphological assessment of the pelvic floor structure.Through high-resolution static MRI, it becomes possible to offer unbiased and quantitative evaluations of deficiencies in pivotal pelvic floor support muscles, like the levator ani, as well as alterations in the positioning and orientation of the uterus and vagina.[7,8] The utilization of MR imaging is projected to experience growth, particularly in scenarios involving pelvic floor disorders where surgical intervention is anticipated.

This study was planned to examine the presence of pelvic muscle defects, muscle configuration, relationships of pelvic organs with MRI in women with apical POP and compare them with measurements of women without POP.

MATERIALS AND METHODS

This study was carried out by examining the computer-based medical records of patients diagnosed with POP at İzmir Bakırçay University Çiğli Training and Research Hospital between March 2022 and May 2023. Utilizing pelvic MRI scans acquired from all participants using the Siemens Avanto T1.5 system, a comprehensive analysis was conducted. Key parameters studied included the pubococcygeal line (PCL), denoting the line extending from the base of the pubic bone to the sacrococcygeal joint; the H line, drawn from the lower end of the pubic bone to the posterior rectal wall at the point of the anorectal junction where the puborectalis muscle becomes visible; and the M line, which runs perpendicular from the posterior extremity of the H line to the PCL (Figure 1). Furthermore, assessments encompassed the angle formed by the uterus and cervix, the width of the genital hiatus, the area of the obturator internus muscle, and the identification of any levator ani defects (Figure 2). The G Power software aided in determining the appropriate number of participants for the study. With the line length M as the primary determinant, a sample size of 45 patients was established, aiming for 80% statistical power and a significance level (α) of 0.05. The study encompassed 45 patients diagnosed with apical POP and a matched group of 45 individuals without prolapse, all within the same age range (control). Exclusion criteria encompassed patients with pelvic masses in the uterine

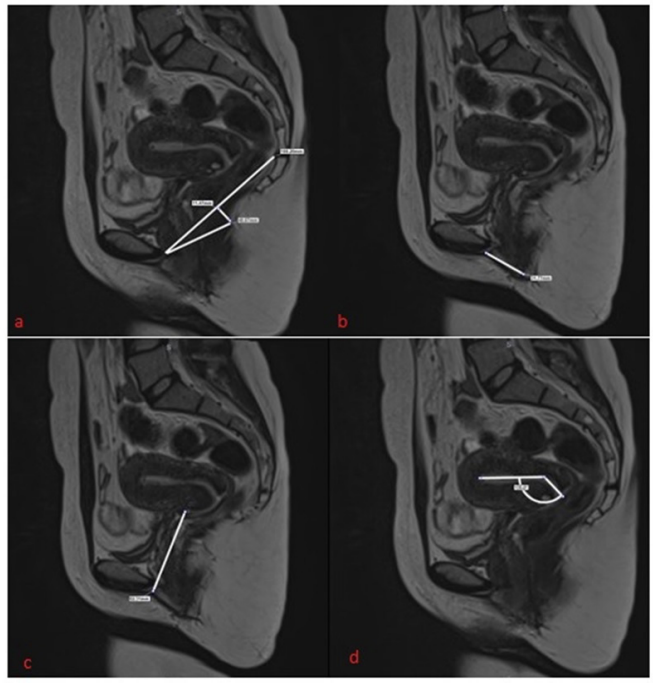

Figure 1. a) Pubococcygeal line, H line, M line, H line; **b**) Genital hiatus distance; **c**) Vaginal length; **d**) Uterocervical angle

Figure 2. MR images of levator ani muscle, thin arrow shows damaged muscle and thick arrow shows intact muscle
MR: magnetic resonance

and adnexal regions, a history of pelvic surgery, and those who had undergone radiotherapy.

The study was performed in accordance with the principles of the Declaration of Helsinki and was approved by the İzmir Bakırçay Ethical Committee (approval number: 1074/1054-23).

MRI Measurements

The PCL is defined as the measurement from the lower extremity of the pubic bone to the sacrococcygeal joint. Referred to as Line H, this measurement represents the distance between the lower edge of the pubic bone and the posterior wall of the rectum at the point of the anorectal junction where the puborectalis muscle becomes visible. Line M is determined by the length drawn perpendicular to the PCL from the posterior terminus of Line H (Figure 1). Alterations in the structure of the levator ani muscle were assessed utilizing the grading system introduced by DeLancey.[9] Axial planes were used to evaluate both the bilateral levator ani and obturator internus muscles. Muscle defects were categorized as either unilateral or bilateral. The area of the obturator internus muscle was quantified, encompassing the area between the anterior pubic bone, the posterior sacrum, and the sacrospinous ligament. Measurements in the sagittal plane included the urogenital hiatus, defined as the distance from the urethra to the perineal body, and vaginal length, which was determined as the distance from the urethral meatus to the anterior fornix along the midsagittal line. To gauge the uterocervical angle (Figure 1), the clockwise angle between the axis connecting the internal and external openings of the cervix and the axis traversing the uterine cavity was measured.

Statistical Analysis

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS), version 23.0 (SPSS Inc., Chicago, IL), as well as R statistical calculation software (version 3.6.1, https://www.r-project.org/). A significance level of $p<0.05$ was adopted to determine statistical significance. For continuous variables, mean and standard deviation values were computed. Parametric tests were employed when both compared groups demonstrated normal distribution; conversely, non-parametric tests were utilized for groups with non-normally distributed data. In cases of independent group comparisons, an independent sample t-test was employed as the parametric test, while the Mann-Whitney U test served as the non-parametric alternative

RESULTS

During the study period, MR images of 45 women diagnosed with POP and MR images of 45 patients without POP were compared. Both groups had similar demographic characteristics (Table 1). There was no statistical difference between the two groups in terms of the pubococcygeal distance (PC), genital hiatus length, vaginal length, uterocervical angle, and puborectal distance (H). However, both unilateral (58% vs. 26%) and bilateral (38% vs. 18%) levator ani muscle defects were more common in the POP group than in the control group ($p=0.02$ and $p=0.03$, respectively). The obturator internus muscle area was found to be smaller in the POP group compared to the control group (1770±293.4 mm^2 vs. 2104±303.5 mm^2, $p=0.02$). The M length, which is the distance between the PC and H line, was greater in POP patients (27.3±5.8 mm vs. 15±4.2 mm, $p=0.04$) (Table 2).

DISCUSSION

The consequences of pelvic floor insufficiency can extend beyond a single organ or specific region. Failure to comprehensively identify all sites of prolapse may result in incomplete surgical correction and subsequent recurrences.[10] Earlier investigations have indicated that around one-third of individuals undergoing surgical intervention for pelvic prolapse require subsequent reoperations.[11] Clinical assessment often underestimates the degree of descent or might even overlook it altogether.[12] MRI can serve as a valuable tool for preoperative planning, particularly in intricate cases involving multiple compartments. Our study identified both unilateral and bilateral levator ani defects in the

Table 1. Demographic characteristics of the patients

	POP with patients n=45	Control patients n=45	*p*-value
Age, years	55.6±6	54.6±5.8	0.75
BMI, kg/m^2	29.1±5.1	28.8±5	0.65
Gravity	3 [2; 5]	3 [2; 5]	0.66
Parity	2 [1; 3]	2 [1; 3]	0.71
Smoking	8 (18%)	9 (20%)	0.61
Maximum birth weight, g	3340±450	3410±514	0.62

BMI: body mass index; POP: pelvic organ prolapse

Table 2. Comparison of MRI measurements of patients with pelvic organ prolapse with patients without genital prolapse

	POP with patients n=45	Control patients n=45	*p*-value
Pubococcygeal distance (PC), mm	121.1±17.3	119.3±16.2	0.33
Genital hiatus length, mm	47.5±6.7	46.8±6.6	0.37
Vaginal length, mm	65.2±9.4	68.5±10	0.46
Uterocervical angle	167.2±32.2	172±35.3	0.55
Presence of bilateral levator ani muscle defect, n (%)	17 (38)	8 (18)	**0.03**
Presence of unilateral levator ani muscle defect, n (%)	26 (58)	12 (26)	**0.02**
Obturator internus muscle area (mm^2)	1770±293.4	2104±303.5	**0.02**
M line distance, mm	27.3±5.8	15±4.2	**0.02**
Puborectal distance (H), mm	53.3±6.7	52.5±6.1	0.38

POP: pelvic organ prolapse; MRI: magnetic resonance imaging

MR images of patients diagnosed with apical prolapse. However, the area measurement of the obturator internus muscle was smaller in prolapse patients.

Even among women without pelvic issues, a slight shift in pelvic organ position can manifest due to heightened intra-abdominal pressure.[13] In cases of patients with symptoms, an organ descent of 1 cm above the PCL signifies pelvic floor laxity, while an organ descent exceeding 2 cm frequently necessitates surgical treatment.[14] Our findings showed that the distance between the PCL and the puborectal line was an average of 27 mm for POP patients. However, this descent distance was on average 15 mm in patients in the control group without clinical prolapse. Although we demonstrated partial pelvic floor insufficiency in these patients based on MR images, these patients had no signs of prolapse in their gynecological examination and did not experience POP-related symptoms. We believe that the possible cause of pelvic organ failure in patients in the control group, even if they were asymptomatic, was due to levator ani muscle damage. This is because unilateral levator ani muscle damage was observed in 26% of these patients.

Another risk factor associated with POP and detectable by MRI is injury to the levator ani muscle.[15] The term "levator avulsion" denotes the detachment of the puborectalis muscle from the pelvic sidewall.[16] This injury often arises as a consequence of vaginal childbirth and can manifest as either a unilateral or bilateral condition.[16] Nevertheless, evidence suggests that levator ani avulsion constitutes a risk factor for post-prolapse surgery recurrence.[17] The count of births and the maximum infant birth weights for the patients within both study groups were comparable. Although both groups were similar in terms of demographic characteristics, levator muscle damage was more common in POP patients, both unilaterally and bilaterally.

Another important muscle that causes pelvic floor disorders is the obturator internus.[18] The arcus tendineus is formed by the connection of the levator ani muscle to the obturator fascia along the pelvis' lateral wall. Consequently, elongation of the obturator internus muscle amplifies tension in the fascial attachments, thereby bolstering the mechanical support provided by the levator ani. Research focusing on the rehabilitation of the obturator internus has demonstrated its potential to shield patients against pelvic floor dysfunction, alleviate symptomatic urinary incontinence, and enhance pelvic floor strength among young women. These benefits are attributed to the same underlying mechanism.[19] Our study showed that the obturator internus muscle area was lower in POP patients. Exercises for the obturator internus muscle, which have been reported to increase levator ani muscle function by 40%, can be offered to patients to reduce recurrences after surgery.

Study Limitations

The sample size utilized in the study was relatively small .Studies with a larger sample could have offered a more robust representation, allowing for a broader generalization of the results. The study employed a retrospective design. A prospective design would have enabled better data control and more precise outcomes. The study did not assess patients' clinical outcomes or include factors such as postoperative recovery or symptomatic relief. Given these limitations, it is essential to interpret the results and findings of the study with caution.

CONCLUSION

Our study underscores the profound impact of pelvic floor insufficiency on various dimensions of pelvic organ health. The ramifications of not identifying all prolapse sites extend

to incomplete surgical repair and the potential for recurring issues, underscoring the critical necessity of precise preoperative planning. In this context, MRI emerges as an invaluable asset, particularly in intricate cases encompassing multiple compartments. It effectively revealed levator ani defects and diminished obturator internus muscle areas among patients with apical prolapse. Additionally, our findings underscore the significance of even minor shifts in pelvic organ positioning, signaling pelvic floor laxity and the potential requirement for surgical intervention. The measurement between the PCL and puborectal line demonstrated its relevance in assessing pelvic organ descent, thereby indicating its potential importance in gauging prolapse risk. Notwithstanding certain limitations -such as our study's modest sample size and retrospective design- it furnishes meaningful insights into the roles of levator ani muscle impairment and levator avulsion as risk factors in POP. Furthermore, the notable influence of the obturator internus muscle in pelvic floor disorders suggests the potential efficacy of targeted exercises in diminishing recurrences post-surgery.

In clinical practice, a comprehensive evaluation of pelvic floor function, incorporating MRI assessments and clinical examination, is crucial for accurate diagnosis and treatment planning for POP patients. Future research with larger prospective cohorts will further elucidate the relationships between pelvic floor muscle function, surgical outcomes, and patient satisfaction, contributing to improved management strategies for this challenging condition.

ETHICS

Ethics Committee Approval: The study was performed in accordance with the principles of the Declaration of Helsinki and was approved by the İzmir Bakırçay Ethical Committee (approval number: 1074/1054-23).

Informed Consent: Retrospective study.

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Contributions

Medical Practises: İ.K.; Concept: İ.K.; Design: İ.K., M.B.; Data Collection or Processing: M.B.; Analysis or Interpretation: M.B.; Literature Search: İ.K., M.B.; Writing: İ.K., M.B.

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ORIGINAL ARTICLE

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The relationship of abnormal anorectal angle with urinary incontinence in women asymptomatic for fecal incontinence

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ABSTRACT

Objectives: The objective of this study was to explore whether alterations in the anorectal angle (ARA) manifest in women without defecation problems but encompassing different types of urinary incontinence.

Materials and Methods: Data from prospectively collected database of women with pelvic floor complaints who underwent complete urogynecological and anal examination in a tertiary reference hospital were retrospectively reviewed. Women with anal incontinence and other defecation problems were excluded from analysis. Women with a clinical diagnosis of incontinence were grouped into 3 as: Stress incontinence group, urge incontinence group, and mixed incontinence group.

Results: Pairwise comparison yielded that there was no difference in ARA between control, urge urinary incontinence, and stress urinary incontinence group (106.78±14.50, 112.08±11.56, and 113.10±6.80, respectively). However, Bonferroni comparison revealed that ARA in the mixed incontinence group (118.05±11.49) was significantly greater than ARA in the control group.

Conclusion: Women with mixed incontinence exhibits markedly elevated ARA values when compared to the continent women. These findings suggest that the co-occurrence of stress and urge incontinence is associated with deviations in anorectal anatomy, even among women who do not display symptoms of defecation problems or fecal incontinence.

Keywords: Anorectal angle; fecal incontinence; perineal ultrasonography; urinary incontinence

INTRODUCTION

All components of the pelvic floor work in a harmonious manner, with each component contributing its unique influence to pelvic symptoms, as pointed out by the integral theory (IT) of the pelvic floor.[1] In 1990, this theory revolutionized our understanding of urinary incontinence by proposing that stress incontinence and urgency stem from vaginal laxity and the weakening of supportive ligaments-specifically, the pubourethral and uterosacral ligaments. This explanation marked a pivotal milestone, particularly in the context of midurethral sling

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procedures. Over time, the IT's scope has extended, recognizing that while these two ligaments are integral, they are not the exclusive contributors to idiopathic fecal incontinence.[2]

The mechanism of anal continence is intricate and relies on the harmonious functioning of various components, including innervation, sphincter function (both internal and external anal sphincters), rectal distensibility, the anorectal angle (ARA), intestinal motility, and fecal consistency.[3] However, amidst this intricate web of influences, an active muscular mechanism for anorectal opening and closure emerges as a central protagonist.[3,4]

During straining, the puborectalis muscle, which a part of a triple loop system contracts, effectively occluding the anal canal. In contrast, during defecation, relaxation of the puborectalis coincides with the contraction of the levator plate. This action lifts the "suspensory sling" opening of the anorectal canal and facilitating evacuation simultaneously with "rectal detrusor contraction".[5]

The anorectal angle (ARA) defines the angle demarcating the connection between the rectum and the anal canal. The puborectalis muscle, a vital component of the levator ani, fashions the ARA into a supportive structure, creating a soft posterior impression that outlines the anorectal junction.[6,7] During defecation, the ARA widens, promoting efficient feces evacuation while maintaining pelvic floor integrity. Once defecation concludes, the puborectalis resumes its contracted state, restoring the acute ARA angle. This prompts the anal canal to close, returning the ARA to its original configuration and the pelvic floor to a state of equilibrium. Consequently, the ARA and sphincter relaxation are intimately connected, with the ARA's expansion facilitating voluntary defecation.[7]

Due to the close connection among pelvic floor muscles and the connective tissue, an ongoing debate has emerged concerning the potential link between anorectal and urinary dysfunction. Earlier research primarily focused on individuals with anal incontinence. Therefore, an imperative research objective has arised to examine women without anal incontinence, with a focus on the comprehensive integrity of the pelvic floor compartments. Thus, our aim was to explore whether alterations in the ARA manifest in women without defecation problems but encompassing different types of urinary incontinence.

MATERIALS AND METHODS

Data from prospectively collected database of women with pelvic floor complaints who underwent complete urogynecological and anal examination in a tertiary reference university hospital were retrospectively reviewed. Women with anal incontinence and other defecation problems were excluded from analysis. Women with a clinical diagnosis of incontinence were grouped into 3 as: Stress incontinence group, urge incontinence group, and mixed incontinence group. Control group was composed of healthy women who underwent a similar examination.

All patients underwent a pelvic floor sonography as defined by Santoro et al.[8] To evaluate the ARA, the convex probe was positioned transperineally, allowing visualization of the anorectal canal, anorectal junction, and rectal ampulla. The ARA was quantified along the midsagittal plane, defined as the angle between the rear edge of the distal rectum and the central axis of the anal canal.

Statistical Analysis

Mean and standard deviation values are used to present quantitative variables. The normal distribution of quantitative data was assessed using the Shapiro-Wilk test, and for independent samples, Student's t-test was employed. Multivariate regression analysis was used to control for possible confounding effect of age and therefor age-adjusted means for ARA measurements were calculated. $P<0.05$ was considered statistically significant.

RESULTS

One hundred and ninety-nine women underwent transperineal ultrasonography and detailed pelvic examination. According to their incontinence status patients were classified in to 4 mutually exclusive groups as: No incontinence (Control group), pure stress urinary incontinence (SUI), pure urge urinary incontinence (UUI) and mixed UI. Baseline characteristics of the patients according to incontinence status are depicted in Table 1. All four groups were similar with respect to age, body mass index, gravida and number of vaginal delivery.

Anorectal angle at rest was compared among 4 types of incontinence groups with ANOVA. Bonferroni method for pairwise comparison showed no difference in ARA between control, UUI, and SUI group (106.78±14.50, 112.08±11.56, and 113.10±6.80, respectively). However, ARA in the mixed incontinence group (118.05±11.49) was significantly greater than ARA in the control group (Figure 1).

We further analyzed age-adjusted difference in the measurement of the ARA at rest between 4 groups. This analyzed showed that the ARA difference between mixed incontinence and control group was independent of age and age adjusted difference between these groups were 11.3 (Table 2).

DISCUSSION

The relationship between anorectal dysfunction and other urinary symptoms has been a subject of debate for a long

time.[9] Most of the studies focused on patients with anal incontinence and ignored the majority of the population who are asymptomatic for anal dysfunction. In order to explore the possible anatomical abnormalities in women without defecation problems we evaluated ARA among 4 groups according to their urinary incontinence status: Control group, women with UUI, women with SUI, and women with UUI. We documented that although women with SUI or UUI tend to have an abnormally obtuse ARA, the mixed incontinence group had significantly higher ARA compared to the control group. These results indicate that combination of stress and urge incontinence associate with abnormalities in anorectal angle even in women asymptomatic for defecation problems.

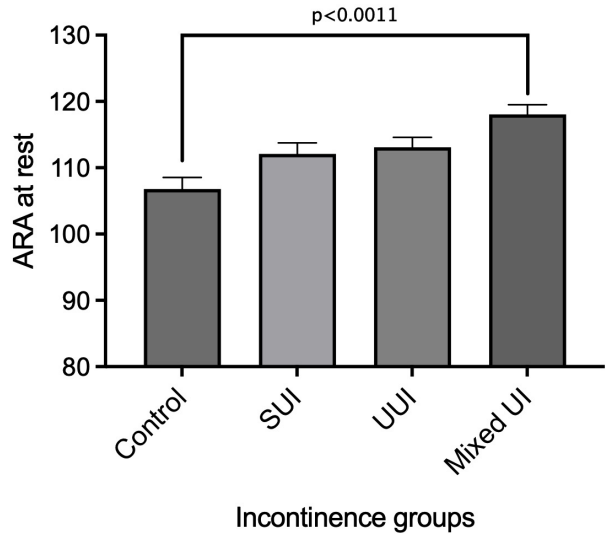

Figure 1. Anorectal angles among 4 groups of incontinence
ARA: anorectal angle; SUI: stress urinary incontinence; UUI: urge urinary incontinence

Our understanding of the mechanisms behind fecal continence and defecation is limited. The former valvular theories claimed that anterior anorectal wall of the rectum is forced by increased intra-abdominal pressure, thereby sealing the anorectal junction.[10] These theories are not currently valid because clinical studies and radiological findings suggested pelvic floor muscles take active role during continence and defecation.[5] Current explanations for normal anorectal function suggest active muscular mechanisms for anorectal opening and closure.[11] Petros[2] documented that miduretral sling procedure for stress incontinence simultaneously cure idiopathic fecal incontinence. This result intrudingly suggested that only connective tissue repair could cure fecal incontinence indicating that connective tissues should also play a role in anorectal physiology. This finding paved the way for the development of an even more comprehensive theory - "The Musculo-Elastic Theory". According to this theory, Petros and Swash[12] suggested that co-ordinated muscle forces act against durable suspensory ligaments in order to open or close the anorectal canal.

The anal continence mechanisms depend on the integral harmony of different components including neuronal innervation, muscles and ligaments. As a result of this coordination the ARA changes in defecation. The normal ARA values were defined to range from 94 to 114 degrees while at rest. This angle can vary between 15 and 20 degrees during relaxation, squeezing, or defecation.[13] Although the normal values for ARA are still debatable, abnormal ARA is related with development of fecal incontinence and other defecation problems.[14] ARA is also associated with obstetric trauma. García-Mejido et al.[15] documented that levator ani avulsion resulted in increase in the ARA during rest, contraction, and valsalva, which was more pronounced in bilateral avulsion. Another study investigating the clinical importance of ARA before sacral

Table 1. Baseline characteristics of the study population

	Control	UUI	SUI	Mixed UI	*p*-value
Age	48.97±12.07	48.24±15.84	49.15±10.19	49.92±10.69	0.940
BMI	27.30±4.16	29.23±4.51	29.19±3.90	28.40±5.05	0.142
Gravida	2.84±1.29	2.62±1.96	3.04±1.35	3.00±1.75	0.693
Vaginal delivery	2.17±1.24	1.76±1.51	2.19±1.45	2.18±1.09	0.573

BMI: body mass index; SUI: stress urinary incontinence; UUI: urge urinary incontinence

Table 2. The ARA in 4 different groups after adjustment for age

	Control group	UUI group		SUI group		Mixed incontinence group	
	Age-adjusted mean	Mean difference from control	Adjusted *p*-value	Mean difference from control	Adjusted *p*-value	Mean difference from control	Adjusted *p*-value
ARA at rest	106.78	6.29	0.250	5.31	0.138	11.29	<0.001

SUI: stress urinary incontinence; UUI: urge urinary incontinence; ARA: anorectal angle

nerve stimulation for idiopathic fecal incontinence showed that the sole independent predictor of a favorable outcome was the presence of a wide anorectal angle at rest in the preoperative defecography.[16]

According to IT, not only urinary incontinence but also other problems such as fecal incontinence and abnormal defecation are mainly caused by connective tissue laxity in the pelvic floor.[17] Our findings are consistent with the predictions of the IT. We documented in this study that mixed incontinence that is related to lax connective tissue of the uretral and vaginal surrounding is related with increase in ARA when compared to control group. To our knowledge, this is the first study in the literature comparing ARA in incontinence subgroups.

The pictorial diagnostic algorithm that is extrapolated from IT, points out the location of defects in the connective tissue. According to this algorithm faecal incontinence is estimated to be more frequent with stress incontinence in anterior zone defects and with urgency in middle zone defects.[12] The basis of this algorithm stands similar with our findings in a way that asymptomatic defects can also be observed together. Another interesting finding in our study is that the impairment in ARA becomes more pronounced when stress and urge incontinence coexist. One limitation of this study is its cross-sectional nature. Prospective follow-up of the patients is needed to define exact clinical value of asymptomatic impairment of ARA in women with mixed incontinence. Another future research goal would be to assess the changes in ARA after surgical treatment for mixed incontinence.

CONCLUSION

Women with mixed incontinence exhibits markedly elevated ARA values when compared to the continent women. This finding suggests that the co-occurrence of stress and urge incontinence is associated with deviations in anorectal anatomy, even among women who do not display symptoms of defecation problems or fecal incontinence. Prospective studies are needed to define the clinical fate of this situation in women with and without surgical management.

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ETHICS

Ethics Committee Approval: The study was approved by the Ethics Committee of Pamukkale University- 15.08.2023/13.

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Contributions

Surgical and Medical Practices: U.Ö., D.K.; Concept: U.Ö., D.K.; Design: U.Ö., D.K.; Data Collection or Processing: U.Ö., D.K.; Analysis or Interpretation: U.Ö., D.K.; Literature Search: U.Ö.; Writing: U.Ö., D.K.

DISCLOSURES

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Pathological physiology of the anorectal malformations without visible fistula. A short review

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ABSTRACT

Until 1982, pediatric surgeons came to a consensus that in patients with anorectal malformations (ARM), the intestine that is located caudal to the pubococcygeal line is the anal canal and, to achieve the best functional result, it must be preserved during surgery. Simultaneously with the publication of posterior sagittal anorectoplasty, it was stated that except for patients with rectal atresia and anal stenosis, patients with ARM are born without an anal canal. It is believed that the rectal pouch or fistula should be removed. We analyzed 41 articles, including 2 of our own studies, which reflect the entire palette of ideas about the pathological anatomy and physiology of ARM without a visible fistula (females and males without fistula and males with urethral fistula). On histological, manometric and radiological examinations, in most patients, the intestine located caudal to the PRM has the characteristics of a functioning anal canal. This literature review proves that most ARM patients without a visible fistula have a functioning anal canal, the preservation of which can ensure normal anorectal function.

Keywords: Anorectal malformations; imperforate anus; ARM without fistula; ARM with urethral fistula; physiology, anorectal malformations; pathophysiology; rectourethral fistula; without fistula; imperforate anus; anal ectopy, pelvic floor

INTRODUCTION

In 1953, Stephens[1] proposed the concept of a pubococcygeal (P-C) line, which runs from the lower limit of the pubic bone to the distal coccygeal vertebra. He showed that this line corresponds to the location of the puborectalis muscle (PRM), which plays a large role in stool retention. If the blind end of the intestine is located above this line, these cases are considered a high type of anorectal malformations (ARM), and if more caudally of this line it is a low type.[1] This understanding of the pathological physiology of ARM was reflected in the Wingspread classification (1984). Since then, it was believed that if the gut is located below the P-C line, it means the patient has an anal canal that needs to be preserved during surgery.[2]

For many years, for diagnosis of the level of ARM used an invertogram. Recently, this method has not been used since the overall sensitivity of invertograms in detecting low anomalies was 33.3%, whereas specificity was 66.7%.[3-5] The low reliability of this method is due to erroneous ideas about the physiology of the anorectal zone. It was assumed that gas in the rectum rises and is retained in the blindly ending gut. However, firstly,

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the contents of the intestine move only by a peristaltic wave. Secondly, the gas cannot pass into the closed anal canal if the rectal pressure is less than the threshold level. On radiographs in newborns, it is often difficult to determine bone landmarks for drawing the P-C line. Cremin et al.[6] showed that this line runs between the caudal and middle third of the pear-shaped ischium.

In 2005, the Krickenbeck classification was adopted, which is a listing of the main types of ARM without a division into high and low types.[2] The main idea, proposed by Peña and accepted by the community of pediatric surgeons, is that in ARMs the anal canal is absent, and the rectal pouch or fistula is so different from the rectum that it cannot be used for defect correction.[5] Neither Peña's articles nor other scientific sources provide conclusive evidence for this claim. Moreover, it contradicts all research from previous generations. Since it had been considered that all patients without a visible fistula a priori do not have an anal canal, the studies to determine the level of anomaly have lost all meaning.

The purpose of this review is to study materials on the pathological anatomy and physiology of ARM without visible fistula.

MATERIALS AND METHODS

We analyzed 41 articles, including 2 of our own studies, which reflect the entire palette of ideas about the pathological anatomy and physiology of ARM without a visible fistula (females and males without fistula and males with urethral fistula).

Histological Studies in ARM

In a study by Holschneider et al.[7] it was shown that in patients with ARM "Classical aganglionosis was found in 31% of the rectal pouch specimens, hypoganglionosis in 38%, neuronal intestinal dysplasia (NID) type B in 14%, and dysganglionosis in 10%". In the authors' opinion, "... the recommendation to use the distal rectal pouch and parts of the fistula in the reconstruction of ARMs malformations should be reconsidered".[7] These histological results were confirmed by other researchers, who believed that the histological structure of the anal canal should be consistent with the structure of the rectum.[8,9]

Alamovich et al. (citation from Duhamel[10]) investigated the innervation of the normal IAS. This study shows that the IAS itself has no autonomous innervation unlike the rest of the digestive tube. Lambrecht and Lierse[11] in neonatal pigs with ARM found that the proximal region of the fistulae in ARM has most features of a normal anal opening. They consider that the fistula should be designated as an ectopic anal canal. The most important result was the demonstration of a normal internal sphincter even in high and intermediate types of ARM.[11] A study by Uemura et al.[12] showed that "Epithelial and ganglionic distribution was similar in the distal rectal end of ARMs and in a normal anal canal". The mistake of pediatric surgeons is that when describing the normal innervation of the anal canal, they compared it with the innervation of the rectum and concluded that this is not a normal rectum. They did not know that the anal canal had a different histological structure from the rectum. Histological studies show that in most patients with ARM, the distal intestine, which is still called a fistula or rectal sac, has the histological structure of a normal anal canal.

Manometric Study

In 5 infants with ARMs (high type 2, intermediate type 3), a preoperative manometric study at the rectal end was performed with a probe introduced from the distal colostomy. This study showed the presence of rhythmic activity in all, and positive reflexive pressure fall by rectal distension in 4.[13] The presence of a rectoanal inhibitory reflex is a characteristic of the anal canal. Preoperative rectal manometry of rectoperineal or rectovestibular fistula showed the presence of functional anal structures within the fistula in all patients.[14]

X-ray Examinations

In a newborn's first hours of life, the rectal pressure is below a threshold level. Therefore, the anal canal is in a closed state, and meconium with gas is in the rectum. Only after 30 hours of birth does the rectum collect enough gas and meconium to create pressure that opens the anal canal. An article by Levitt and Peña[5] suggests doing a crosstable lateral radiograph after 16-24 hours after birth. However, they claim that this study can help show the air column in the distal rectum in the small percentage of patients.[5] Hosokawa et al.[15] on the sonograms found, that the pouch-perineum distance on the next day was significantly shorter than on the birthday (p=0.001). Such a significant shortening can only be explained by the fact that in some newborns, additional content entered the rectum that led to an increase in rectal pressure and the opening of the anal canal. This is the reason of increase in the average the pouch-perineum distance. In Figure 1 can be seen the importance of research time.

The reflex opening of the anal canal takes several seconds. Then, the rectum, adapting to the increased volume of contents, relaxes, which leads to a drop in rectal pressure. This causes a reflex contraction of the anal canal and the displacement of gas from the anal canal into the rectum. In the process of increasing the volume of rectal contents, this situation is repeated several times.[14]

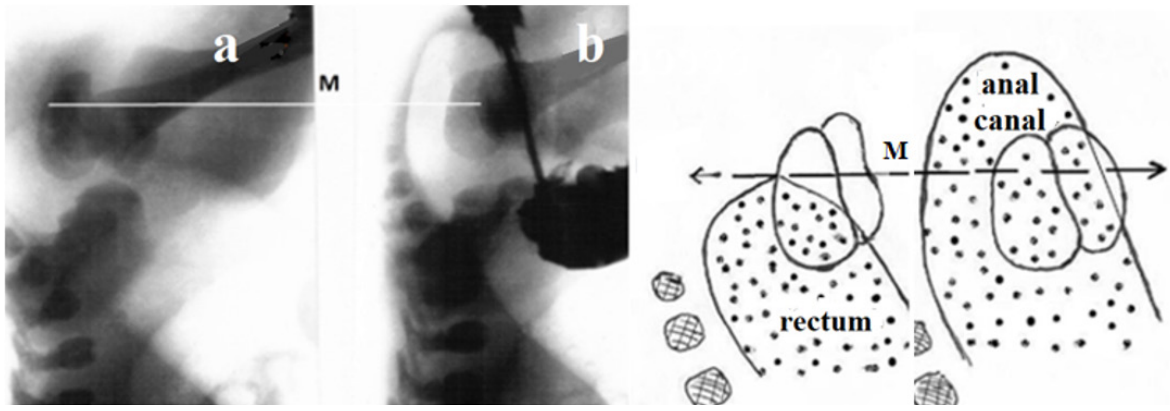

Figure 1. Radiographs of a newborn with ARM without a visible fistula. (a) Invertogram took 12 hours after birth. The distal contour of the rectum is located on a horizontal line (M) between the middle and distal third ischium, which has a typical pear shape. According to Cremin et al.[6] data, this line corresponds to the pubococcygeal line (see scheme). (b) Thirty hours after birth the erroneous introduction of contrast medium into the perineal tissue (instead of to the rectum) was produced. The anal canal opened, and gas is visible close to the perineal skin. The rectal width is noticeably larger than in Figure 1a. Line "M" was inscribed because there are no other bony landmarks on radiographs. Thus, 12 hours after birth, the X-ray picture corresponded to the intermediate type of ARM (this is the normal position of the rectum over the contracted anal canal), and after 30 hours during the tension of the abdomen, as a reaction to pain, the anal canal opened, which indicates a low type

Therefore, X-ray even 30 hours after birth does not guarantee that at the time of the radiograph the opening of the anal canal will be recorded. The threshold pressure at which the anal canal opens depends on the volume of meconium and gas, as well as on intra-abdominal pressure.[16] After 30 hours there is a theoretical risk of intestinal perforation and/or vomiting with aspiration hazard. Limiting the time of the study, limits the increase in rectal volume. The abdominal compression increases rectal pressure and causes the anal canal to open at the time of fluoroscopy (Figure 2).[17]

The approach of gas to the perineum in the restless newborn is a known phenomenon. In the literature, it is mistakenly explained with the descending perineum during an increase in intra-abdominal pressure. It is considered a mistake to assess the level of ARM by the descending perineum since in a calm state the perineum returns to its place.[5,18] As is known from physiology, during an increase in intra-abdominal pressure, the muscles of the pelvic floor do not descend but rise.[19] Some authors call this phenomenon a "well-descended rectum",[18] ignoring the fact that the rectum is fixed in the tissues of the pelvis and cannot move. In the article by Nagdeve et al.[18], of 12 male neonates with high ARM who on invertogram showed well descended rectum, with lower limit of rectal gas bubble at or below the ossified fifth sacral vertebra the fistula with urinary tract was found in 11 patients (seven had fistula to bulbar urethra and four to prostatic urethra). It is believed that the exact level of ARM is determined at the time of surgery. However, during surgery, the rectal pressure decreases, so the anal canal closes. A closed IAS both in norm and low ARM is a canal that looks like a fistula. Koga

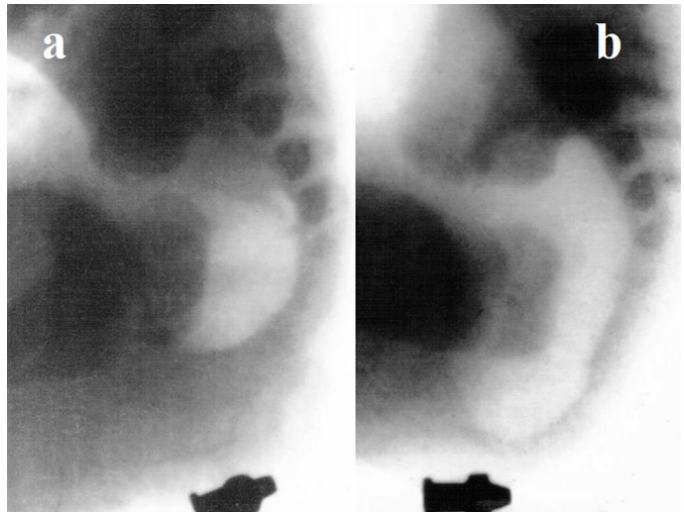

Figure 2. Radiographs of a newborn with ARM without fistula were performed horizontally. A radiopaque marker was glued to the anal dimple. (a) At rest, (b) During abdominal compression, the gas approached the marker. The distance between the marker and the intestine is the thickness of the skin and subcutaneous tissue

et al.[20] proposed a method for measuring the urethral fistula during surgery to remove it without residue. In fact, under the guise of a fistula, they removed IAS. However, "the internal anal sphincter is currently regarded as a significant contributor to continence function".[21] Thus, what is commonly called the well-descended rectum in the literature is the anal canal. This picture is no different from an open anal canal in healthy infants.[16] It follows that patient with bulbar and prostatic urethral fistulas, as well as in patients without fistula have an anal canal.

Hence these cases are the low type of ARM. The presence of the anal canal is especially evident in visible fistulas, which differ from the invisible by less displacement of the anus (Figure 3).

The inability to open the anal canal 30 hours after birth during abdominal compression indicates the presence of a high type of ARM.

Augmented-pressure Distal Colostogram

Kraus et al.[22] in the article, on augmented-pressure distal colostogram in boys, state: "… it is extremely important in this regard to understand that the lowest part of the rectum (ARM without visible fistulas) is usually collapsed from the muscle tone of the funnel-like striated muscle mechanism that surrounds the rectum in 90% of cases …". Meanwhile, it is known from anatomy that there are no muscles around the rectum. Muscles surround the anal canal, participating in fecal retention and defecation. The authors, describing the normal function of the anal canal, call it the rectum. In fact, this statement suggests that at least 90%

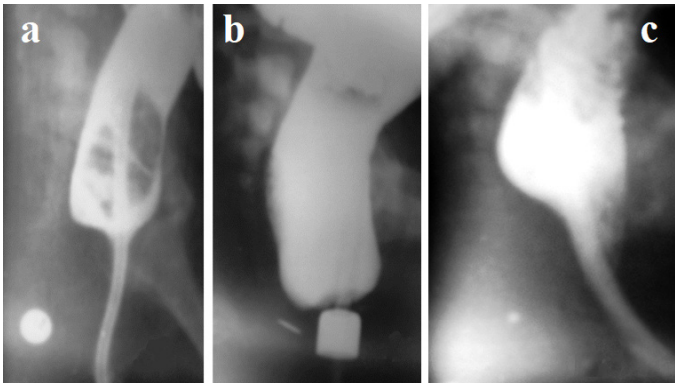

Figure 3. The radiographs of the same girl with vestibular fistula performed at different ages. (a) At the age of 3 months, the rectum was filled with barium through the catheter, conducted through the fistula. A pushpin is located near the anal dimple. The distal intestine, with a length equal to the length of the normal anal canal, constantly contracted around the catheter, preventing leakage of barium. (b) At the age of 9 months, during a barium enema, the wide opening of the anal canal occurred. The distance from the pushpin to the distal wall of the open anal canal equals 4 mm. Barium does not penetrate outward, since the tip of the enema occluded the narrow and rigid ectopic anus. The true diameter of the marker on the enema tip is 1.6 cm. The width of the rectum is 4.3 cm (the maximum rate for children 1-3 years is 3.7 cm). Conclusion: Ano-vestibular ectopy, megarectum. The diastasis between the anal canal and anal dimple is (4 mm), which corresponds to the thickness of the skin and subcutaneous tissue. (c) Barium was injected into the rectum through an intubation tube (no: 8), passed through the vestibular fistula. The penetration of barium into the upper part of the anal canal in front of the intubation tube is determined. The posterior wall of the anal canal is pressed against the tube of the contracted PRM. The contraction of the PRM and EAS provide normal liquid barium retention. This is a typical X-ray picture of a rectoanal inhibitory reflex

of boys without a visible fistula have a functioning anal canal. The augmented-pressure distal colostogram is characterized by high uncontrolled hydrodynamic pressure, which significantly exceeds the threshold pressure of the anal canal opening during defecation. Unlike reflex opening, which typically lasts less than a minute, this pressure results in the mechanical, permanent opening of the anal canal. A serious disadvantage of this method is the danger of perforation of the sigmoid colon. Therefore, most authors use a distal colostogram without high pressure.[23-26] However, only the augmented-pressure distal colostogram, with X-ray examination or with the use of CT or MRI, shows the presence of an anal canal (Figure 4).

Comparison of Treatment Outcomes for Low-type ARM

Preserving the anal canal for "ectopic anus by the simple cut-back is all that is needed to make the imperfect anus large enough to work where it lies".[27-33] For example, "All males treated for low ARMs outcomes by bowel function scores were good at 85% and satisfactory in 15%".[27] After PSARP, during which the IAS is excised, a large proportion of the patients have persistent fecal incontinence, constipation, and sexual problem.[34-41]

DISCUSSION

Following a study by Stephens[1], who proved that if in newborns with ARM gas penetrates below the P-C line, this indicates the presence of the anal canal, which must be preserved to obtain good functional results, it was recorded in the Wingspread classification (1984).[2] After 1982, Peña's articles claimed the absence of the anal canal in patients with ARM, but this statement

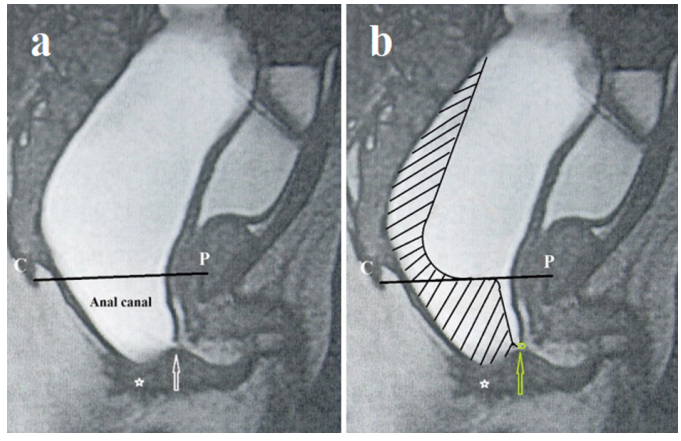

Figure 4. (a) MRI imaging during augmented-pressure distal colostogram in a male with recto-bulbar fistula (arrow). Distal to the pubococcygeal line, a wide-open anal canal is visible. Its blind end is located ≈2-4 mm from the proposed site of the anal fossa (asterisk). (b) MRI reconstruction scheme with low rectal pressure. The anal canal is closed. Conclusion: Ectopia of the anal canal into the bulbar part of the urethra

was unfounded, since it was not the result of any research. Since then, the intestine located caudal to the P-C line has been called a fistula or rectal pouch. During pull-through operations (posterior sagittal approach, anterior sagittal approach or by laparoscopy) this "fistula" is removed, as it is believed that its function is impaired. However, the authors compared histological studies indicating the presence of a normal anal canal with the innervation of the rectum. The conclusions of these authors were erroneous, since the innervation of the rectum and anal canal is different. Histological studies of the so-called fistula completely coincide with the structure of the normal anal canal.[10-12]

The idea of a functional inferiority of the "rectal pouch" was based solely on the erroneous conclusions of histological studies. Meanwhile, manometric studies indicate the presence of a normally functioning anal canal with normal basal anal pressure and a positive rectoanal inhibitory reflex.[13,14,17]

X-ray studies confirm that the so-called fistula functions like a normal anal canal. At a rectal pressure below the threshold, it is in a closed state, i.e., it performs the function of the fecal retention. With an increase in rectal pressure above the threshold level, it opens, i.e., an attempt to defecate. The presence of the anal canal is especially evident in visible fistulas, which differ from the invisible by less the anus displacement. Levitt and Peña[5] refer to the anal canal as a fistula, which is in a contracted state of the surrounding muscles. This is a description of a normal anal canal. The point of this unreasonable name change is to justify the removal of the "fistula" in posterior sagittal anorectoplasty (PSARP). Second, to justify poor long-term results. They are supposedly the maximum possible since children with ARM do not have an anal canal from birth.

However, comparing the results of a PSARP treatment in which an anal canal is destroyed, with a cutback operation in which the anal canal is completely preserved, one can see the enormous advantage of cutback operation.

CONCLUSION

Histological, manometric, and radiological studies show that most patients with ARM without visible fistulas have an anal canal. This means they have an IAS, sensitive to rectal pressure and which is located caudally to a PRM. In response to pressure in the rectum, there is a temporary relaxation of the IAS (rectoanal inhibitory reflex) and contraction of the PRM, as well as the deep and superficial parts of the external anal sphincter. Higher rectal pressure, caused by abdominal compression, stimulates the defecation reflex with a wide opening of the anal canal, which makes it possible to diagnose a low type of ARM.

ETHICS

Peer-review: Internally and externally peer-reviewed.

DISCLOSURES

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Uterine prolapse management in two primigravid women after vaginal delivery: Case report

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ABSTRACT

Pelvic organ prolapse during pregnancy is a rare condition. There are several case report studies in the literature on this, especially in patients with nulliparity. We presented the management and post-surgical follow-up of a case of pelvic organ prolapse that developed during pregnancy and immediately after delivery in two patients. Both of our patients with descensus uteri were young (26 and 27 years old) and had normal body mass index values, with no family history, no risk factors, and no history of trauma. Conservative treatment was preferred for our patient who was diagnosed with descensus in the third trimester of pregnancy. Pelvic organ prolapse did not regress after childbirth, as was expected. Although descensus occurred at the end of the third trimester of pregnancy in the first case, it developed during and immediately after delivery in the second case, and there was no regression there after in either case. The cervix protruded from the hymenal os in both patients' postpartum 4th-month controls, this had a significant impact on the patients' sexual, social, and psychological lives. Both patients had a desire to have children. Suspension surgeries using Mesh and Tape were not preferred because of the negative effects of synthetic suspension materials on the next pregnancy. Both patients underwent laparoscopic round ligament shortening and Sacrouterin ligament plication surgery. The patients were told that these operations were not permanent and that there was a possibility of sagging again afterwards. After the operation, the patients were followed up for about 2 years. In one of the patients, recurrence developed in the 19th month, 1 cm above the hymenal os. Although descensus uteri are rarely observed in young patients, the knowledge of the literature is quite limited. Unfortunately, there is no literature available to guide clinicians in the management and treatment of such health problems in young patients who want to have children. Therefore, multicenter studies including more patients are needed.

Keywords: Case report; pregnancy; primigravid women; uterine prolapse

INTRODUCTION

Uterine prolapse that develops during the first pregnancy is a very rare condition. Its incidence varies between 1/10,000-15,000.[1] Pelvic organ prolapse (POP) during pregnancy brings both maternal and fetal health problems.[2] The most important etiological cause of POP is vaginal delivery. However, this health problem leads to psychosocial, economic and sexual disorders.[3] In young patients (especially those under 30 years of age), uterine prolapse, especially matrix metalloproteinase-1 (MMP-1) expression disorder[4] or collagen metabolism abnormality[5] comes

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to mind. There are different approaches to the management and treatment of POP: Conservative (pessary treatment), and surgical treatment.[6] In the cases we have presented, both patients are under the age of 30. In the first patient, uterine descensus occurred in the third trimester of pregnancy and was successfully managed. In the second patient, it occurred during and immediately after the delivery.

CASE REPORTS

Case 1

A 26-year-old patient with gravide 1 parite 0 applied to us at the 35th week of pregnancy due to vaginal spotting. The patient has no previous history of abdominal or vaginal surgery. No health problems were detected during the gestational period controls and there were no accompanying diseases. When the patient was admitted to us with vaginal spotting, she was at 35 weeks +6 days of gestation and on ultrasound, a live fetus with fetal biometry of 35+2 days, fetal heartbeats, normal amniotic fluid, and localized in placenta fundus was observed. The applied non-stress test was reactive and no contraction was observed in the toco. Collum close effacement was not observed in the vaginal examination, however, it was observed that the collum was hymen level and was eroded and bleeding due to irritation. Antibiotic treatment and pessary treatment were recommended to the patient with uterine prolapse. The patient did not accept pessary treatment. The pregnant patient applied with groin and lower back pain to the clinic when she was 38 weeks and 4 days pregnant. The examination revealed that the patient had 5-6 cm cervical dilation and 70-80% cervical effacement. It was observed that the cervix was protruding from the hymen. The patient gave birth to a 3260 gr baby girl with APGAR 8 in the 2nd minute without intervention. The placenta and its appendages were separated spontaneously. The patient was called for control 1 week, 40 days and 4 months after delivery. During the controls, the cervix was found to protrude 2 cm more than the hymen (Figure 1), and medical (pessary) or surgical treatment was recommended. The patient did not accept pessary treatment. Considering that the patient was 26 years old, sexually active and wanted a second child, laparoscopic shortening of the ligamentum rotundum + ligamentum sacrouter plication was recommended as surgical treatment. Ligament rotundum shortening + ligament sacrouterin plication was applied to the patient. No recurrence was observed in the patient who was followed up for 2 years postoperatively Figure 2.

Case 2

A 28-year-old patient with gravide 1 parite 1 applied to our clinic with a palpable mass in the genital area. It was reported that 4 days before her anamnesis, she had a spontaneous vaginal delivery at 39 weeks + 4 days. It was learned that she did not experience any health problems during her pregnancy controls, did not undergo pelvic or abdominal surgery, and gave birth comfortably, in a short time, and without intervention. The

Figure 1. Examination 4 months after delivery

Figure 2. Control two years after operation (shortening of the ligamentum rotundum + ligamentum sacrouter plication)

patient's body mass index (BMI), who had no history of pelvic and abdominal surgery and trauma, was calculated as 22.8. The patient said that her complaint had been present for 2 days, and that she had felt something light immediately after giving birth, but that these complaints had increased. In her vaginal examination, it was observed that the cervix had protruded 2 cm from the hymen line. Uterus suitable for puerperium was observed on ultrasound and bilateral ovaries were normal. A pessary was recommended to the patient and patient acseptted. On the 40th day and 4th month, despite the use of pesser and uterine involution, it was observed that the cervix protruced 1 cm from the hymenal line. Considering the patient's age, sexual activity, and the desire for a second child, continued use of the pessary or laparoscopic ligament Rotundum shortening + plication of the ligament sacrouter was recommended. Since the use of pessary affected her psychologically and negatively affected her sexual life, the patient preferred the surgical procedure and the procedure was performed. The patient who had a recurrence in the 19th postoperative month (1 cm above the cervix hymen line) was recommended to use a pesser until she considers a new pregnancy (Figure 3).

DISCUSSION

POP is a common condition in postmenopausal and multiparous patients. The most important causes may be pelvic trauma, family history, advanced age, high BMI, interventional birth, collagen metabolism disorders, MMP-1 expression disorders, Marfan syndrome, Ehlers-Danlos syndrome and other causes.[7] However, in this article that we have presented, both patients are young and do not have the aforementioned predisposing risk factors and histories. The main structure of the uterine ligaments consists of collagen. Mutation in collagen genes can cause the ligaments of the uterus to become very weak.[8] We think that both of our patients have a gene mutation of collagen or matrix tissue. Pelvic organ (POP) treatment is examined in two groups medical (pessary treatment) and surgical.[6] Complications of uterine prolapse include the threat of fetal miscarriage, preterm labor, maternal urinary infections, maternal and fetal death[9], infection due to cervical erosion resulting in cervical dystocia, and cervical tears that may extend to the uterus during delivery.[10] For this reason, some authors argue that it would be more appropriate to recommend cesarean delivery to patients with uterine prolapse during pregnancy. Regarding the management of uterine prolapse during pregnancy, most authors recommend conservative monitoring until the end of delivery and, if necessary, antibiotic treatment for cervical erosions.[11] Because the descensus uteri usually regresses spontaneously at the end of the postpartum puerperium period.[10] There are data in the literature on performing laparoscopic hysteropexy for the descensus uteri that occurs during pregnancy,[12] however, this issue is highly controversial. Both patients we presented had apical prolapse and there was no regression in their 4th-month postpartum controls. The patients stated that their disease affected their social and sexual life negatively, and both of our patients wanted a second pregnancy. For this reason, sling surgery treatment applied to patients using tape or polypropylene Mesh was not preferred. Round ligament shortening and sacrouter ligament plication are still controversial issues in the literature because these procedures provide short-term benefits and the recurrence rate is high.[13] If longer-acting surgical methods would be preferred, it was not preferred to use Tape or polypropylene Mesh to avoid negative effects for the next pregnancy and detailed information was given to the patients about the situation. Unfortunately, there is still not enough information in the literature about sling operations performed using Mesh or Tape.

Figure 3. Recurrence in the 19th month after operation. Cervix 1 cm above the hymenal line

CONCLUSION

Although there are short case reports in the literature, there is not enough information about the management and treatment of uterine descensus during pregnancy. In addition, when we searched the literature, we could not find sufficient information about the treatment modalities of patients under the age of

30 with descensus uteri who want to have a child. Multicentric studies with a large number of patients are needed in this regard.

ETHICS

Informed Consent: Permission was obtained from the Ethics Committee of Koru Ankara Hospital.

Peer-review: Internally and externally peer-reviewed.

DISCLOSURES

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