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The effect of fasudil on the uterine scar model created in rats

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The experimental procedure was approved by the Dokuz Eylül University Local Ethics Committee (Protocol No. 34/2019).
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No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Uterine healing post-obstetric surgery is crucial for maintaining fertility. This study investigates if fasudil has a therapeutic impact on scars formed by a full-thickness incision in a rat's uterus.
Methods: We divided 21 female Wistar Albino rats randomly into three groups: control, scar, and treatment. The control group underwent no surgical procedure. We created a uterine scar model in the scar and treatment groups. For 30 days, the treatment group was intraperitoneally administered a single dose of 20 mg/kg/day fasudil dissolved in saline, while the control and scar groups were given saline. After these 30 days, all rats were sacrificed. We removed the right and left uterine horns from all groups. The left side was set aside for histological analysis, while the right side was used for ELISA analysis (alpha-SMA and TGF-beta).
Results: The treatment group exhibited an increased uterine wall thickness compared to the scar group (P=0.03), although there was no discernible difference when compared with the control group. Both inflammation and fibrosis were notably higher in the scar group (P=0.01) but absent in both the treatment and control groups. The ELISA results, measuring alpha-SMA and TGF-beta, showed no statistically significant difference between the groups (P=0.321, P=0.375).
Conclusion: Fasudil effectively reduced inflammation and fibrosis in our experimental rat model, hence preventing scar formation. We believe our study adds significant value to the existing literature by potentially expediting tissue regeneration.

Keywords: uterine scar, fasudil, wound healing, alpha-SMA, TGF-beta

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Introduction

Cesarean section is the most commonly performed obstetric surgery worldwide. It involves a full-thickness incision on the uterine wall, which is sutured by a specialist physician at the end of the delivery, leaving the primary wound to heal. Scar defects can develop if the cesarean-section wound does not heal properly, leading to gynecological issues such as abnormal uterine bleeding, postmenstrual spotting, painful menstrual periods, painful sexual intercourse, chronic pelvic pain, and secondary infertility. These complications can significantly affect the patient's quality of life [1-3]. Therefore, preventing the development of uterine scars can help avoid these many complications.

Fasudil, a potent and selective ROCK inhibitor, has been shown to suppress fibrosis in various diseases [4]. An *in vitro* study evaluated its effects on human urethral scar tissues, including changes to the cytoskeleton, collagen synthesis, and apoptosis of urethral fibroblasts. It demonstrated that fasudil could inhibit actin polymerization and collagen synthesis via the RhoA/ROCK pathway and induce apoptosis in scar fibroblasts [5]. In the treatment of cardiovascular diseases like cerebral and coronary vasospasm, angina, and hypertension, fasudil usage by patients did not result in serious side effects [6,7].

The RhoA/ROCK signaling pathway is linked to the expression of α-smooth muscle actin (α-SMA), which aids in the transformation of fibroblasts into myofibroblasts, facilitating wound healing and scar formation [8]. This expression of α-SMA signifies the activation of the RhoA/ROCK signaling pathway in fibroblasts [9]. α-SMA serves as a tool to differentiate myofibroblasts from fibroblasts, marking it as the go-to indicator for recognizing myofibroblasts. Myofibroblasts, present in both the development and modification phases of tissue damage, play a crucial role in generating extracellular matrix, including collagen [10]. They exist in all fibrotic diseases, such as scleroderma, as well as in liver, kidney, and lung fibrosis [11,12]. TGF-β stimulates myofibroblasts to overproduce extracellular matrix (ECM), leading to scar formation [13,14]. A separate study highlighted the role of RhoA in hypertrophic scar and keloid formation [15]. Furthermore, the RhoA/ROCK pathway is a key regulator in the contraction of smooth muscles within the myometrial layer of the uterus. This pathway operates through a distinct intermediary step in smooth muscle cells, enhancing myosin light chain (MLC) phosphorylation, thus triggering uterine contractions [16].

Existing literature indicates that the RhoA/ROCK pathway contributes to scar formation, including in the uterus. This led us to hypothesize that the RhoA/ROCK pathway could be involved in uterine scarring. We conducted a study to examine this concept, specifically investigating the impact of the ROCK inhibitor fasudil on scars produced by full-thickness incisions in rat uteruses.

Materials and methods

The Dokuz Eylül University Local Ethics Committee approved the experimental procedure (Protocol No. 34/2019). The study was conducted in the university's Experimental Animals Laboratory in March 2020.

The study involved 21 Wistar Albino female rats weighing between 180 and 220 g. Throughout the experiment, the rats were kept under normal environmental conditions and maintained a regular diet (21±2ºC, unlimited water and food). These rats (n=21) were randomly divided into three groups: Group 1, the control group (n=7), underwent no surgical procedures; Group 2 (n=7) received a uterine scar model; and Group 3 (n=7) received both a uterine scar model and a fasudil application.

Making uterine scar model with hysterotomy in rats

After administering 10 mg/kg xylazine hydrochloride and 70 mg/kg ketamine hydrochloride intramuscularly for anesthesia, the rats were placed in a dorsal horizontal position. The area set for the operation was cleaned with povidone-iodine. A transverse laparotomy incision of 2.5–3 cm was then made. We also made, on both horns of the uterus, a 1 cm vertical incision reaching up to the endometrial cavity [17,18]. This incision area was then sutured with 4.0 rapid vickryll, and the abdominal incision was also closed with the same material.

After 1 month, the same anesthesia and laparotomy method were performed through the same incision to surgically remove both horns. After removal, the left side was submerged in a 10% neutral formalin solution for histopathological assessment. After 3–5 days of fixation, it was embedded in paraffin blocks. The right side was preserved in dry ice for ELISA analysis. Subsequently, the rats were euthanized using high-dose anesthesia [17].

Following the hysterotomy, the rats were then treated with 80000 units/100mg of penicillin, administered intramuscularly for three consecutive days post-procedure [17].

Fasudil application

Fasudil (Santa Cruz, catalog number: sc-203418D), an anti-cicatrizant/anti-fibrotic agent, was dissolved in saline and administered as a single dose of 20 mg/kg/day intraperitoneally for 30 days [4]. The control and scar groups received saline during the experiment.

Histological and biochemical examination

The histological assessment was conducted using Hematoxylin-Eosin and Masson Trichrome stains. As previously described [19], the thickness of the uterine wall, as well as any inflammation and fibrosis, were evaluated microscopically. In the biochemical evaluation, levels of TGF-beta1 and alpha-SMA were determined. Adhering to the manufacturer's instructions, the levels of TGF-beta1 and alpha-SMA (catalog numbers E1688Ra and E2330Ra by BTLAB) were analyzed by ELISA.

Statistical analysis

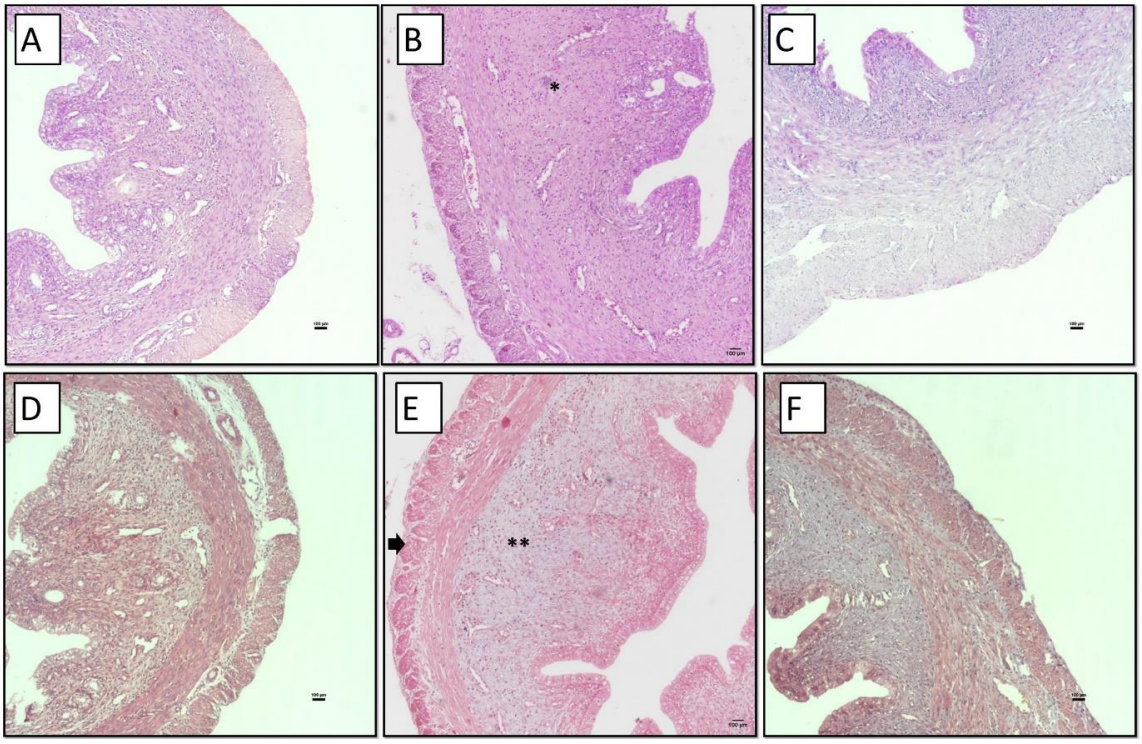
We performed a statistical analysis of the study data using the Statistical Package for Social Sciences (SPSS) 26.0 software. We calculated the mean and standard deviation of the data for the analysis. To determine the origin of the differences between the groups, we used the Kruskal Wallis and Mann-Whitney U tests.

Results

Histological Findings

We assessed whether fasudil treatment protected against scar formation by examining uterine healing post-injury. This was conducted using Hematoxylin-Eosin staining to identify general

Figure 1: Photomicrographs of the uterus tissue. Fibrosis (**), inflammation (*). Black arrows show thinning perimetrium. A, D: Control group, B, E: Scar group, C, F: Treatment group, Scale bar: 100 µm. A, B, C: Hematoxylin and Eosin Stain, D, E, F: Masson Trichrome stain.



morphological features in uterine histology. Masson Trichrome staining was used to assess the structure of the connective tissue and the degree of collagenization.

In the control group, the endometrium, myometrium, and perimetrium layers were identified as healthy. However, in the scar group, the perimetrium layer was thin, with noticeable increases in inflammation and fibrosis. Microscopic observation revealed fibrosis, augmented connective tissue, and angiogenesis. We saw inflammation characterized by PMNL cell presence, edema, and congestion.

Interestingly, the treatment group displayed histological findings similar to those of the control group (Figure 1). In the scar group, a reduction was observed in the thickness of the uterine wall. Contrastingly, a significant increase in wall thickness was noted in both the control and treatment groups (Table 1).

Biochemical Findings

Table 1 shows the levels of alpha-SMA and TGF-beta as determined by ELISA; the results are presented as mean (standard deviation). The alpha-SMA levels were 32.7 (5.6) ng/mL in the control group, 29.8 (3.8) ng/mL in the scar group, and 28.9 (4.2) ng/mL in the treatment group. There was no significant difference between the groups (P=0.375). Similarly, the levels of TGF-beta were 684.1 (180.1) ng/L in the control group, 597.4 (103.3) ng/L in the scar group, and 908.8 (222.3) ng/L in the treatment group. The difference between these groups was not statistically significant (P=0.321).

Table 1: Morphometric parameters and ELISA results (alpha-SMA and TGF-beta)

	Control group mean (SD)	Scar group mean (SD)	Treatment group mean (SD)	*P*-value
Uterine wall thickness (µm)	620.28 (45.56)	425.71 (55.76)*	596 (25.25)	0.01*
Inflammation	0.42 (0.34)	1.85 (0.69)*	0.42 (0.53)	0.03*
Fibrosis	0.14 (0.37)	2.42 (0.53)*	0.8 (0.69)	<0.001*
Alpha-SMA (ng/mL)	32.7 (5.6)	29.8 (3.8)	28.9 (4.2)	0.375
TGF-beta (ng/L)	684.1 (180.1)	597.4 (103.3)	908.8 (222.3)	0.321

Discussion

Over 50% of women with a history of cesarean section exhibit a uterine scar defect. This defect contributes to heightened maternal morbidity and longer hospital stays. The links between uterine scar defects, gynecological symptoms, obstetric complications, and possible subfertility makes it crucial to understand why scars form post-cesarean section and develop prevention strategies. Therefore, our study investigates whether fasudil has a therapeutic role in a scar model created by performing a full-thickness incision on a rat's uterus.

Previous studies on uterine scars have demonstrated the potential benefits of various antioxidants [17,20]. For example, Sayin et al. [20] developed a rat model of uterine scarring to assess the therapeutic effect of resveratrol. After 30 days of administering resveratrol, they observed a successful treatment outcome, as evidenced by increased uterine wall thickness and higher levels of VEGF, GPx, and SOD.

In a separate study, Mıcılı et al. [17] explored the effect of lipoic acid on uterine scarring, comparing results from 15 and 30-day treatments. They noted that the histological findings from the 30-day treatment group mirrored those of the control group, suggesting that lipoic acid could effectively treat uterine scars.

In our study, we similarly assessed the histological and biochemical effects of fasudil on uterine scar healing. Based on our findings, which included increased uterine wall thickness and reduced inflammation and fibrosis relative to the scar group, we propose that fasudil may be an effective treatment for uterine scars.

Previous studies have demonstrated the anti-scarring effects of fasudil on various organs [4,5]. Li et al. [5] evidenced the therapeutic impact of fasudil on human urethral scar tissue *in vitro*. Similarly, Qi et al. [4] presented findings suggesting fasudil effectively reduces inflammation and fibrosis in the treatment of hyperoxia-induced pulmonary fibrosis in neonatal rats. Histological evaluations often highlight inflammation and

increased fibrosis as indicators of scar development, which, if left unchecked, can lead to long-term complications in the uterus. Consequently, successful anti-scarring therapy is critical. In this study, we explored the influence of fasudil on the healing of uterine scar tissue and discovered that it exhibits therapeutic potential, aligning with earlier findings.

Upon reviewing the literature on studies examining the effects of fasudil, we found that it is most commonly administered intraperitoneally. Subcutaneous application was favored only in wound models created on the skin [21]. In all studies probing the therapeutic impact on internal organs like the heart, kidney, and lungs, fasudil was dispensed once daily and intraperitoneally [4,22,23]. Therefore, in our study, we opted to administer fasudil once daily and intraperitoneally.

The literature reveals that the function of the RhoA/ROCK pathway has been assessed using fasudil. This pathway's role in regulating glomerular adhesion and inflammation in diabetic nephropathy has been established through contrasting groups administered with and without fasudil [16,24]. The choice to use fasudil in our research was to investigate this pathway's effect on uterine scar tissue. Our results aligned with previous studies, suggesting the RhoA/ROCK pathway might influence uterine scar tissue. For our subsequent study, we plan to include molecular-level analysis to enhance our findings.

Limitations

We could not observe the initial effects because of the extended experimental duration. For our next study, we are planning to examine both short and long-term effects, allowing us to monitor immediate processes. Augmenting the study with groups having both short and long experimental durations, a larger sample size, and varied doses will enhance our research. Furthermore, we could measure antioxidant parameters biochemically in the tissue. Evaluations of RhoA/ROCK molecule expressions could indicate the pathway's presence.

Conclusion

Consequently, we believe that fasudil positively assists the uterine wound healing process. Further studies could potentially enable its adaptation for clinical use.

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The impact of obesity on metabolic and cardiovascular health: A morphometric retrospective cohort study

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Ethics Committee Approval
The study was approved by the Hamidiye Scientific Research Ethics Committee of the University of Health Sciences (Decision No: 2022/23-6) on October 14, 2022.
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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

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Abstract

Background/Aim: Obesity is recognized as a significant risk factor for various diseases, including cardiovascular disease. The link between obesity and adverse health outcomes, particularly cardiovascular ailments, underscores the need for a comprehensive understanding of the associated metabolic and cardiovascular markers. This study aimed to compare individuals with obesity and those without obesity in terms of markers related to metabolism and cardiovascular health.

Methods: 136 participants were enrolled in the analysis, comprising 83 individuals with obesity and 53 individuals without obesity. The participants' demographic data and biochemical test results were collected, including age, sex, fasting glucose, creatinine, cholesterol, triglyceride, and body mass index (BMI). Measurements were taken for various cardiac markers using echocardiographic images. Morphometric parameters of the heart, such as left ventricular (LV) and right ventricular (RV) end-systolic-and-diastolic diameter, ejection fraction, interventricular septum thickness, aortic ascending diameter, and epicardial fat tissue thickness were assessed. Statistical analyses were employed to identify significant differences. Independent-sample t-tests and Pearson correlation tests were used for comparisons between obese and non-obese individuals.

Results: Comparisons between obese and non-obese individuals revealed that individuals with obesity exhibited significantly higher levels of fasting glucose (P=0.021), triglycerides (P=0.014), and epicardial fat tissue thickness (P<0.001). LV ejection fraction was significantly higher in obese individuals than in non-obese participants (P<0.001) but remained within the normal range. Sex-associated differences in metabolic variables of obesity and non-obesity revealed that the obese male individuals had higher fasting glucose (P<0.001) and triglyceride levels (P<0.001) compared to obese female individuals. Moreover, BMI was positively correlated with epicardial fat tissue thickness (r^2=0.29, P<0.001), and triglyceride level was significantly correlated with fasting glucose level (r^2=0.19, P<0.001).

Conclusion: The study design allowed for a comparison between obese and non-obese individuals, providing valuable insights into the differences in these markers based on obesity status. The investigation of individuals with elevated BMI levels highlights significant deviations in crucial indicators compared to those with normal levels. These findings emphasize the urgent need to address obesity as a central contributor to the development of diverse diseases and advocate for proactive strategies aimed at mitigating associated health risks.

Keywords: obesity, metabolic profile, morphometric parameters, heart

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Introduction

Obesity, characterized by excessive accumulation of adipose tissue, has become a significant global health concern, predisposing individuals to various adverse health outcomes, particularly metabolic disturbances and cardiovascular disease [1]. Changes brought on by obesity can put the body at risk for alterations in heart shape and function, leading to cardiovascular disease [2]. While these changes may be less pronounced in overweight or moderately obese adults, they are most noticeable in highly obese individuals [3]. Experimental research suggests that metabolic anomalies may play a role in the heart structure and function changes associated with obesity [4]. Postmortem studies have provided information on the anatomy of heart chambers in highly obese individuals, showing increased epicardial fat tissue and thickened left and right ventricular walls [4]. Echocardiographic investigations can help determine how obesity impacts heart morphology [5]. However, these parameters alone do not fully explain the modifications in heart morphology related to obesity, especially those concerning left ventricle (LV) geometry. Speculation suggests that metabolic issues linked to obesity may contribute to altered heart shape in humans, based on experimental studies [6]. Previous research has highlighted the duration of obesity as a factor influencing LV morphology, demonstrating a direct correlation between LV diastolic chamber size and wall thickness with the duration of obesity [7].

One study found that only 6% of normal weight patients and 34% of obese patients had enlarged left atriums [8]. Studies have shown a significant correlation between body mass index (BMI) and left atrial dimensions measured in anteroposterior or longitudinal views [9]. LV diastolic dysfunction is thought to contribute to left atrium enlargement in obese individuals. The prevalence of left atrial enlargement in obesity may be underestimated by measuring the left atrial dimension [9].

Understanding the complex interactions between morphometric factors and metabolic profiles in obesity is crucial due to its widespread prevalence. Morphometric measures, such as BMI, provide insights into adipose tissue distribution and serve as important predictors of health concerns associated with obesity. The literature establishes a relationship between morphometric factors and metabolic health, with increased adiposity significantly increasing the risk of metabolic diseases like insulin resistance, type 2 diabetes, and dyslipidemia [1,10]. Morphometric approaches, particularly BMI, have emerged as non-invasive, affordable tools for estimating body fat [11,12].

This study aims to explore the relationship between morphometric variables and metabolic parameters in the context of obesity. By examining a comprehensive set of morphometric measurements and their associations with metabolic and cardiovascular markers, this research seeks to enhance our understanding of the mechanisms linking obesity, morphometrics, and metabolic outcomes. Investigating these relationships may offer insights for developing targeted interventions to reduce metabolic and cardiovascular disease risks associated with obesity and improve overall health.

Materials and methods

The sample population consisted of 136 participants, with 83 classified as obese (BMI ≥30) and 53 as non-obese. Echocardiographic data were obtained from the archives of Istanbul Health Sciences University Siyami Ersek Thoracic and Cardiovascular Surgery Training and Research Hospital between June 2021 and January 2023. BMI was calculated by dividing weight in kilograms by the square of height. Quality control procedures included participant re-examination and blind re-reading to assess intra- and inter-sonographer variability and intra- and inter-reader variability. Metabolic profiles were determined through biochemical analysis, including fasting blood tests for parameters such as hemoglobin, cell count, HDL, LDL, cholesterol, creatinine, and uric acid. The doctor conducting echocardiographic recordings was blinded to the patients' metabolic characteristics. Measurements of LV dimensions in diastole and systole, as well as ventricular septum and posterior wall thickness, were taken.

Statistical analysis

Descriptive statistics, including means and standard deviations, were used to summarize participant characteristics by adiposity level. Pearson correlation analysis was used to assess differences in continuous and categorical characteristics. Normal distribution of data was checked, and two independent-sample t-tests were conducted for characteristics, adjusting for sex. The alpha level for significance tests was set at 0.05, and all analyses were performed using SPSS version 21.1 software.

Results

Clinical characteristics of obese and non-obese individuals are presented in Table 1. Apart from fasting glucose (P=0.021) and triglyceride levels, which were slightly higher in obese individuals compared to non-obese individuals (P=0.014), most of the biochemical variables in obese individuals were within normal ranges.

Table 1: Comparison of obese and non-obese in metabolic variables of obesity

Variable	Obese individuals (n=83) Mean (SD)	Non-obese individuals (n=53) Mean (SD)	*P*-value
Age (years)	45.0 (17.0)	48.9 (15.9)	0.588
Gender (Male/Female)	28 / 55	17 / 36	0.688
BMI (kg/m^2)	45.4 (11.1)	25.1 (3.1)	<0.001**
Fasting glucose (mg/dL)	117.4 (39.4)	102.5 (18.8)	0.021*
Creatinine (µmol/L)	0.9 (0.3)	0.9 (0.5)	0.122
eGFR (mL/min/1.73m^2)	90.7 (20.7)	94.2 (25.6)	0.190
Urea (mmol/L)	34.4 (22.1)	37.2 (31.4)	0.241
Uric acid (mg/dL)	6.2 (4.7)	5.0 (1.8)	0.381
CRP (mg/L)	6.3 (8.1)	8.2 (21.1)	0.069
HDL cholesterol (mg/dL)	47.9 (14.0)	53.4 (13.9)	0.836
LDL cholesterol (mg/dL)	128.6 (37.0)	132.8 (5.2)	0.753
Triglyceride (mg/dL)	175.9 (110.7)	134.4 (61.1)	0.014*
HGB (g/dl)	14.5 (7.8)	12.6 (2.1)	0.259
TSH (mIU/L)	2.2 (1.9)	2.0 (1.0)	0.184
Serbest T4 (pmol/L)	16.3 (2.21)	16.5 (2.4)	0.941
AST (U/L)	20.3 (10.4)	17.6 (7.7)	0.381
ALT (U/L)	25.1 (20.9)	16.1 (7.4)	0.002‡

SD: Standard deviation, BMI: Body mass index, eGFR: Estimated Glomerular Filtration Rate, CRP: C-reactive protein, HDL: high-density lipoprotein, LDL: low-density lipoprotein, HGB: Hemoglobin, TSH: thyroid stimulating hormone, AST: aspartate aminotransferase, ALT: alanine transaminase. *P<0.05, **P<0.001, ‡within normal value.

The echocardiographic features of the study population are outlined in Table 2. The thickness of epicardial fat tissue was greater in obese individuals than in non-obese participants (P<0.001). Obese individuals also had a higher LV ejection fraction than non-obese individuals (P<0.001), but it remained

within normal limits. Obese individuals exhibited a higher atrial diastolic filling wave velocity in terms of functional parameters (P=0.025). Triglyceride levels in obese individuals were positively correlated with fasting blood sugar levels (r2=0.19, P<0.001), and epicardial fat tissue thickness was strongly correlated with BMI (r2=0.29, P<0.001) (Table 3) (Figure 1).

Table 2: Comparison of obese and non-obese in cardiac variables of obesity

Variable	Obese individuals (n=83) Mean (SD)	Non-obese individuals (n=53) Mean (SD)	*P*-value
Left ventricular-end-systolic diameter (mm)	28.1 (8.7)	30.9 (14.5)	0.019‡
Left ventricular-end-diastolic diameter (mm)	48.1 (6.2)	49.7 (10.3)	0.026‡
Left ventricular posterior wall thickness (mm)	10.4 (2.1)	10.1 (1.3)	0.285
Interventricular septum thickness (mm)	10.3 (2.2)	10.1 (1.6)	0.845
Left atrium diameter (mm)	34.8 (7.1)	37.3 (7.9)	0.514
Right atrium-end-diastolic diameter (mm)	31.4 (4.8)	32.7 (4.9)	0.961
Right ventricular-end-diastolic diameter (mm)	29.8 (4.6)	29.3 (5.0)	0.678
Aortic ascending diameter (mm)	33.1 (3.9)	32.5 (4.8)	0.167
Aortic root diameter (mm)	20.3 (2.1)	20.4 (2.6)	0.079
ECG heart rate	77.8 (14.3)	72.9 (10.5)	0.094
Systolic blood pressure (mm Hg)	133.3 (20.6)	122.9 (19.7)	0.785
Diastolic blood pressure (mm Hg)	79.7 (12.2)	76.6 (9.4)	0.207
Ejection fraction (%)	60.0 (8.5)	56.5 (15.0)	<0.001**
Aortic valve flow rate	1.4 (0.2)	1.3 (0.2)	0.997
Pulmonary valve flow rate	1.0 (0.2)	0.9 (0.2)	0.986
Pulmonary arterial pressure (mm Hg)	18.4 (7.1)	22.0 (9.3)	0.091
Epicardial fat tissue thickness (mm)	6.8 (2.2)	3.6 (1.1)	<0.001**
Mitral A-wave (m/s)	0.7 (0.2)	0.7 (0.2)	0.025*
Mitral E-wave (m/s)	0.8 (0.2)	0.8 (0.2)	0.838
Mitral E/A-wave ratio	1.3 (0.5)	1.2 (0.4)	0.681

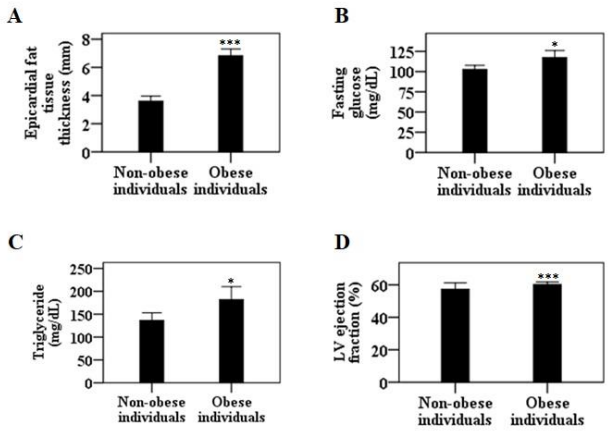
SD: Standard deviation, ECG: Electrocardiogram. *P<0.05, **P<0.001, ‡within normal value.

Table 3: Correlation (r^2-value) of BMI with cardiovascular indicators, and fasting glucose level with triglyceride in obesity.

Variable		r^2	*P*-value
Epicardial fat tissue thickness	BMI	0.29	<0.001**
Fasting glucose level	triglyceride	0.19	<0.001**

BMI: Body mass index. **P<0.001.

Figure 1: Metabolic and cardiac parameters of obese and non-obese individuals were compared. Significant findings were observed in epicardial fat tissue thickness (A), fasting glucose level (B), triglyceride level (C), and LV ejection fraction (D) in obese individuals compared to non-obese individuals.



The data are presented as the mean (SD). **P<0.01, ***P<0.001.

Sex-related differences in metabolic factors between obese and non-obese individuals are displayed in Table 4. Fasting glucose (P<0.001) and triglyceride (P<0.001) levels were higher in obese males compared to obese females.

Sex-related differences in cardiac variables of obese individuals are depicted in Table 5. The interventricular septum thickness (P=0.004), left ventricular end-diastolic diameter (P=0.002), left ventricular end-systolic diameter (P=0.002), left atrial diameter (P=0.022), and aortic root diameter (P=0.030) were all higher in obese men but still within normal ranges. Conversely, obese women had greater left ventricular posterior wall thickness (P<0.001), left ventricle ejection fraction (P=0.013), and mitral E/A-wave ratio values than obese males, but within normal limits (Figure 2, 3).

Table 4: Sex-associated differences in metabolic variables of obesity

Variable	Obese group		
	Male (n=28) Mean (SD)	Female (n=55) Mean (SD)	*P*-value
Fasting glucose (mg/dL)	130.4 (54.6)	110.8 (27.1)	<0.001**
Creatinine (µmol/L)	0.9 (0.2)	0.8 (0.3)	0.213
eGFR (mL/min/1.73m2)	90.1 (17.4)	91.0 (22.4)	0.371
Urea (mmol/L)	38.5 (33.7)	32.3 (12.7)	0.068
Uric acid (mg/dL)	6.5 (1.9)	6.0 (5.6)	0.370
CRP (mg/L)	5.0 (6.0)	6.9 (8.9)	0.039*
HDL cholesterol (mg/dL)	45.4 (16.0)	51.6 (15.0)	0.837
LDL cholesterol (mg/dL)	125.3 (36.1)	135.8 (39.8)	0.488
Triglyceride (mg/dL)	234.6 (155.2)	148.6 (69.0)	<0.001**
HGB (g/dl)	13.8 (3.5)	14.9 (8.4)	0.561
TSH (mIU/L)	1.9 (1.7)	2.3 (2.0)	0.448
Free T4 (pmol/L)	16.3 (2.8)	16.3 (1.9)	0.128
AST (U/L)	24.7 (14.4)	18.0 (6.7)	0.001‡
ALT (U/L)	35.5 (29.6)	19.8 (11.9)	0.003‡

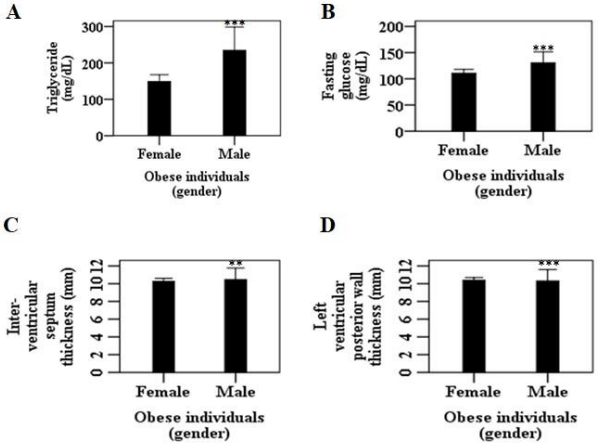
SD: Standard deviation, eGFR: Estimated Glomerular Filtration Rate, CRP: C-reactive protein, HDL: high-density lipoprotein, LDL: low-density lipoprotein, HGB: Hemoglobin, TSH: thyroid stimulating hormone, AST: aspartate aminotransferase, ALT: alanine transaminase. *P<0.05, ***P <0.001, ‡within normal value.

Table 5: Sex-associated differences in cardiac variables of obesity

Variable	Obese group		
	Male (n=28) Mean (SD)	Female (n=55) Mean (SD)	*P*-value
Left ventricular-end-systolic diameter (mm)	32.3 (12.1)	25.9 (5.3)	0.002‡
Left ventricular-end-diastolic diameter (mm)	51.7 (7.6)	46.2 (4.3)	0.004‡
Left ventricular posterior wall thickness (mm)	10.3 (3.3)	10.4 (1.1)	0.000‡
Interventricular septum thickness (mm)	10.5 (3.4)	10.3 (1.3)	0.004‡
Left atrium diameter (mm)	35.0 (10.3)	34.6 (4.9)	0.022‡
Right atrium-end-diastolic diameter (mm)	30.7 (5.3)	31.7 (4.6)	0.258
Right ventricular-end-diastolic diameter (mm)	29.4 (5.1)	30.0 (4.5)	0.686
Aortic ascending diameter (mm)	33.8 (3.4)	32.8 (4.1)	0.431
Aortic root diameter (mm)	20.4 (4.5)	19.9 (1.9)	0.030‡
ECG heart rate	77.1 (14.4)	78.2 (14.4)	0.478
Systolic blood pressure (mm Hg)	136.4 (21.3)	131.8 (20.2)	0.683
Diastolic blood pressure (mm Hg)	83.0 (12.5)	78.0 (11.9)	0.800
Ejection fraction (%)	58.0 (11.1)	61.4 (2.9)	0.013‡
Aortic valve flow rate	1.4 (0.2)	1.4 (0.2)	0.236
Pulmonary valve flow rate	1.0 (0.2)	1.0 (0.2)	0.393
Pulmonary arterial pressure (mm Hg)	17.6 (5.0)	19.3 (8.0)	0.123
Epicardial fat tissue thickness	8.0 (1.9)	6.3 (2.1)	0.590
Mitral A-wave (m/s)	0.7 (0.2)	0.7 (0.3)	0.023‡
Mitral E-wave (m/s)	0.8 (0.2)	0.8 (0.2)	0.022‡
Mitral E/A-wave ratio	1.3 (0.3)	1.4 (0.6)	0.025‡

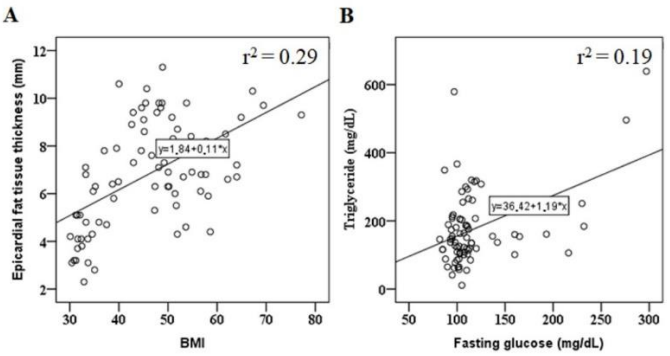
SD: Standard deviation, ECG: Electrocardiogram, ‡within normal value

Figure 2. Metabolic and cardiac parameters of obese men and obese women individuals were compared. Significant findings were observed in triglyceride level (A), fasting glucose level (B), and interventricular septum thickness (C) in obese men compared to obese women individuals. However, a significant difference was observed in obese women compared to obese men in terms of left ventricular posterior wall thickness (D).



The data are presented as the mean (SD). **P<0.01, ***P<0.001.

Figure 3: Correlation analysis on metabolic and cardiac parameters of obese individuals is shown. Significant correlations were observed between BMI and epicardial fat tissue thickness (r^2=0.29, P<0.001) (A), and between fasting glucose and triglyceride (r^2=0.19, P<0.001) (B).



Discussion

Our study found strong evidence emphasizing the importance of addressing obesity as a serious health issue. Obese subjects had higher epicardial fat tissue, consistent with previous studies [2,13]. Increased epicardial fat tissue is linked to serious consequences like coronary inflammation, accelerated atherosclerosis, and fibrosis, as noted by Packer et al. [14]. These findings highlight the significance of elevated epicardial fat tissue as a potential indicator of cardiovascular disease. Additionally, our study showed that obese participants had elevated fasting glucose levels, signaling increased intracellular calcium concentrations and a higher risk of cardiovascular disease [15]. Impaired fasting glucose levels also raise concerns about a higher risk of type 2 diabetes, as the spectrum of obesity-related diseases expands. Furthermore, our results indicated significantly higher levels of triglycerides in the peripheral blood of obese individuals, which are independently associated with increased cardiovascular risk [16].

In our study, significant differences in left ventricular ejection fraction were observed between obese and non-obese individuals, aligning with recent research comparing various measures of LV in these groups [17]. Though our findings revealed differences between obese and non-obese individuals, they were within the normal range.

Gender-related differences play a crucial role in metabolic dynamics and health outcomes. Obese men in our study had higher triglyceride and fasting glucose levels than women, indicating a higher susceptibility to metabolic and cardiovascular diseases. These findings, inconsistent with current research, underscore the importance and reliability of our study [18]. These unique findings emphasize the originality of our study, as these patterns have not been previously documented. The complexity of these gender-based variations in BMI could stem from genetic diversity, dietary habits, physical activity levels, and environmental factors [19,20]. These distinctions also vary based on women's pre-menopausal, pregnant, and post-menopausal statuses. While well-documented, these gender-related differences contribute to the intricate web of metabolic dynamics and health outcomes across diverse populations. Our study highlights BMI as a crucial indicator of metabolic and cardiovascular disease risk due to its role in determining adiposity levels and its strong correlation with fasting glucose and triglyceride levels in obese patients [21].

Our findings emphasize the link between increased BMI and cardiovascular shifts among obese individuals, stressing the importance of weight management in reducing cardiovascular risk [22]. We observed a positive correlation between elevated BMI and epicardial fat tissue thickness, suggesting morphological heart alterations as weight increases in obese individuals. Surprisingly, non-obese individuals had higher LV-end-systolic and end-diastolic diameters than obese individuals, likely due to half of the non-obese group being overweight individuals with slightly higher ages than obese individuals.

Central adiposity assessment in human populations often relies on BMI estimation [23]. Among obese participants, metabolic assessments revealed significant correlations between fasting glucose and triglyceride levels [21], indicating BMI's importance as a metabolic disease risk indicator.

Limitations

The study's limitations include potential influences of various variables on observed differences between obese and non-obese individuals. Factors like age, gender, lifestyle habits, and underlying medical conditions may introduce bias and impact metabolic and cardiovascular markers. Without proper control for these factors, attributing differences solely to obesity status becomes challenging. Additionally, the study's cross-sectional nature limits establishing causality or understanding the temporal relationship between obesity and outcomes. Longitudinal studies or randomized controlled trials would offer more robust evidence on obesity's impact on metabolic and cardiovascular health over time. Future prospective clinical studies with larger patient populations are essential.

Conclusions

Our study underscores the urgency of addressing obesity as a serious health concern, with compelling evidence linking increased BMI to adverse cardiovascular outcomes. Higher epicardial fat tissue in obese individuals, known precursor to coronary inflammation and atherosclerosis, was observed. Obese participants also displayed elevated fasting glucose and triglyceride levels, indicating heightened cardiovascular and metabolic risks. Gender-related differences highlight the complexity of these associations, with obese men showing greater susceptibility to metabolic and cardiovascular diseases compared to women. Our study emphasizes BMI's significance as a key indicator of metabolic disease risk, particularly among obese individuals, as evidenced by its correlations with epicardial fat thickness and metabolic parameters. By elucidating these intricate relationships, our research stresses the importance of effective weight management strategies in reducing cardiovascular risk and improving overall health outcomes in obese populations.

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Current dietary approaches in ulcerative colitis: Exploring implications for women's health

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Abstract

Ulcerative colitis (UC) affects many individuals, significantly impacting their quality of life (QoL) and leading to severe medical complications. Unfortunately, the adverse health outcomes of UC are often overlooked, particularly in relation to women's health, including pregnancy, lactation, sexuality, and menopause. The main objective of this review is to provide guidance for women with UC, helping them navigate their disease and gain knowledge about the effects of nutrition on their overall well-being. A literature search was conducted between October 1, 2022, and July 14, 2023, using books, documents, and journal articles. Internet-based sites such as PubMed, ScienceDirect, EBSCO, and Google Scholar were also utilized. It became evident that women with UC are greatly affected during active periods of the disease, which can significantly reduce their QoL. Pregnancy, sexuality, menstruation, and puberty were among the factors most negatively impacted by the disease. A diet rich in anti-inflammatory foods, probiotics, berberine, turmeric, and vitamin D was found to have a positive association with UC. However, the consumption of a Western dietary pattern or a meat-based diet increases the risk of the disease. In conclusion, maintaining remission and following dietary patterns that suppress inflammation may help reduce complications and improve QoL in women. Our data suggest that all women diagnosed with UC should be well-informed and educated about the disease and its consequences. Further studies are needed to investigate the relationship between ongoing dietary habits and the treatment of UC in women.

Keywords: ulcerative colitis, dietary modifications, women's health, disease management

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Introduction

Ulcerative colitis (UC) is a chronic inflammatory bowel disease (IBD) that can affect many young individuals and is classified as an uncontrollable disease by the Japanese Ministry of Health, Labor, and Welfare [1,2]. It is the most widespread type of IBD and is relatively common among chronic intestinal diseases [3]. Over time, the incidence and prevalence rates of UC have been increasing. Canada, Northern Europe, and Australia have the highest reports of new cases, specifically 0-19.2 per 100,000 in North America. Similarly, the reported prevalence rates are highest in Canada and Europe [4]. Increased urbanization rates expose individuals to environmental pollutants and lifestyle changes. Another factor may be the increasing rate of Westernization in many cultures, which mainly includes changes in eating patterns that can alter the host's microbiome and adaptive immunity [5]. The colon is the most affected area in UC, and there is often a strong family history of IBD in patients with at least one affected first-degree relative [4]. The majority of genetic information related to UC comes from genome-wide association studies (GWAS) in IBD, which have identified multiple genetic polymorphisms that contribute to the disease. Out of the 200 loci correlated with IBD, 15% are specific to UC [5]. The first peak incidence of UC occurs among those aged 20-29, while a second smaller peak occurs in individuals aged 60-89, known as the seventh to ninth decades of life [4].

Factors associated with developing UC include a fatty diet, stress, medication use, quitting tobacco use, high socioeconomic status, and a Westernized lifestyle [6]. Although the exact cause of UC is unclear, it is known that the intestinal bacterial population can trigger an inappropriate and exaggerated immune response in individuals who are genetically susceptible, leading to damage in the intestinal tissue. In addition to the genetic factors in UC patients, it is important to note that UC involves dysregulation of the body's natural defense system against antigens, most commonly free-living bacteria [7]. The pathology of UC involves inflammation of the mucosa, starting in the rectum and extending to all or part of the large intestine [4]. UC is primarily characterized by bloody stool and diarrhea, but can also cause symptoms such as fatigue, incontinence, increased bowel movements, mucus release, nocturnal defecation, abdominal cramps, fever, weight loss, loss of appetite, and tenesmus [4]. Diagnosis of UC is confirmed based on clinical symptoms, findings on colonoscopy or sigmoidoscopy showing continuous colonic inflammation starting in the rectum. Therefore, the diagnosis is made through the pathological discovery of chronic colitis [6]. Approximately half of patients with severe UC require surgery within the first few years of their disease. The primary risks of surgery include hemorrhage, infection, sepsis, and neurological complications, and the preferred surgical option is ileal-pouch anal anastomosis [4].

Women's health is significantly affected during their reproductive years, with issues related to sexuality, fertility, pregnancy, delivery mode, lactation, menopause, menstruation, and puberty being of particular importance [8]. Although the general clinical course of UC in pregnant women is not significantly different from the general population, if the disease is active during pregnancy, there is a 60% chance that it will worsen [1]. A 2014 study of 121 women with IBD found that 25% experienced changes in their menstrual cycle intervals and 21% experienced changes in the duration of flow in the year before their diagnosis [9]. Poorly controlled IBD has also been associated with a delay in the onset of puberty [10]. Some women with UC choose not to have children due to concerns about the adverse effects of medications on the unborn child, complications during delivery and lactation, fertility issues, and pregnancy complications such as congenital abnormalities, preterm birth, small for gestational age (SGA) babies, and spontaneous abortion [1]. The rate of voluntary childlessness is estimated to be up to 17% in women with UC compared to 6% in the general population [8]. While most mothers are encouraged to breastfeed their babies for at least six months, women with IBD often discontinue breastfeeding due to concerns about medication [11].

Since patients with IBD have reduced absorption of nutrients in their intestines, they are more likely to have deficiencies in specific nutrients, especially during active stages of the disease. This can lead to severe malnutrition and negative outcomes in pregnancy, such as premature birth or babies with a small size for gestational age. In addition to the disease itself, the mother's nutritional status is also important because nutrients are mainly transferred to the fetus through the placenta [12]. The exact cause of increased disease activity during pregnancy in women with IBD is not fully understood, but a study has shown that markers of inflammation, particularly tumor necrosis factor-alpha (TNF-a) and interleukin-6 (IL-6), are elevated in intestinal tissues [13]. The diet plays a significant role in modifying the microbiome and the immune response in the intestines, making nutrition a crucial factor in the development of IBD. Adequate intake of dietary fibers, primarily from fruits and vegetables, omega-3 fatty acids, iron, and vitamin D, may help improve disease activity by preventing inflammation. Therefore, the focus should be on inducing and maintaining remission in the clinical management of UC and ensuring sufficient nutrient intake through diet [14].

This study aims to provide guidance for women with UC on managing their disease activity without compromising their quality of life. It also aims to educate these patients about current dietary approaches for UC, including which food groups to consume and which dietary patterns to follow in order to manage their disease. The ultimate goal is to empower women with UC to prevent disease activity and maintain remission, as this is the most important factor to consider. Another objective of this study is to encourage women to seek medical help and consult healthcare professionals before complications arise. Therefore, clinicians and health systems should provide specialized care and support for these patients.

Women's Health and UC

Women with UC are at a higher risk of adverse pregnancy outcomes, as shown by a nationwide study. The study found increased inflammation in endoscopic procedures and a higher risk of surgery related to IBD in women with histological inflammation. Nearly half of the patients in this group experienced an increased risk of premature birth and having babies with a small size for gestational age due to active disease. It is recommended that pregnant patients with IBD consult with a Maternal-fetal medicine specialist, especially if they have undergone surgery for IBD. The gastroenterologist should coordinate the care of women

with UC throughout their pregnancy, taking into account the severity of the disease and the pregnancy status. A clear and understandable treatment plan should be provided to manage the disease from conception to postpartum.

During the active period of the disease, when patients may struggle to gain weight, the involvement of a nutritionist may be necessary. A psychiatrist can provide support for anxiety and depression, which often increase during pregnancy and IBD. Additionally, a lactation specialist can assist these patients with their IBD medications [15].

There is no evidence that vaginal delivery influences the risk of IBD development in offspring. Women with IBD who have good control of inflammation during pregnancy are more likely to have a healthy pregnancy [15]. A meta-analysis showed no significant differences in the incidence of Caesarean section, therapeutic abortions, or ectopic pregnancies between women with active and inactive IBD. However, overall, women with IBD are more likely to deliver by Caesarean section than those without IBD [1].

Breastfeeding is the recommended primary source of nutrients for infants, and it is advised that almost all mothers breastfeed for at least six months. However, many women with IBD discontinue breastfeeding due to concerns about medication [11]. These mothers should be encouraged to continue breastfeeding, as disease flares may occur postpartum. A multidimensional approach, involving specialized physicians and dietitians, should be provided for high-risk pregnancies.

Puberty onset can be affected in girls with IBD, leading to delayed puberty and anovulatory fertility, primarily due to inadequate or excessive nutrition. Symptoms of IBD can also worsen during menstruation, including increased intestinal motility [16]. A study found that healthy controls experienced more frequent bowel movements during menstruation compared to IBD patients [17]. Late puberty onset has also been associated with other risk factors, including failure to grow, malnutrition, poor nutritional status, corticosteroid use, and persistent flares [10].

A cohort study showed that women with IBD experience early onset of menopause compared to non-affected women. Early and premature menopause is associated with numerous long-term negative health effects, including a higher risk of osteoporosis and heart disease. Therefore, early menopause can further increase the risks associated with IBD in women [18].

Sexual dysfunction can occur in patients with IBD, leading to emotional and behavioral issues. Problems with sexual activity not only affect social relationships but also reduce personal abilities and productivity. A study found that a higher number of patients with UC were in an active disease period, resulting in higher levels of anxiety and depression compared to those in remission [19]. A meta-analysis suggested that the use of oral contraceptives substantially increases the risk of developing UC and discontinuing their use reduces the risk. Therefore, women with IBD should be advised to discontinue oral contraceptives [20].

Role of Diet in UC Women's Health

Western dietary pattern

As mentioned, IBD has increased in most countries due to the adoption of a Western dietary pattern. This pattern includes high intakes of refined grains, unhealthy fats such as saturated fatty acids and trans-fat, and low intakes of dietary fiber and whole grains. A systematic review found that North and South America had a high intake of ultra-processed foods, which increased the risk of disease development. Additionally, these countries had the highest consumption of processed meat, soft beverages, refined sugars, and salty snacks. The association with increased disease risk can be explained by the substantial number of additives, preservatives, and sodium in this dietary pattern [21]. This dietary pattern triggers an inflammatory environment that can affect intestinal permeability and change the content of the gut microbiota [22].

The outcomes of a case-control study revealed that a Western dietary pattern was positively associated with the risk of breast cancer in both pre- and post-menopausal women. This may be due to the consumption of exogenous hormones through the ingestion of red/processed meat and poultry, which can activate the hormones in breast tissue and stimulate the proliferation and growth of tumors. Ingesting high glycemic index foods, such as cereals high in sugar, dairy high in fat and sugar, and sugary beverages, may also increase estrogen levels and promote the proliferation and growth of tumor cells [23].

Meat-based diet

A different study illustrated that a meat-based diet, including poultry, red meat, and processed meat, also known as a carnivorous diet, correlated with a higher risk of UC [24]. Proteins with high sulfur and cysteine content, which sulfate-reducing bacteria utilize to generate hydrogen sulfide (H2S), can exacerbate IBD flares since they have detrimental inflammatory effects [25]. In line with this study, a protein-rich diet, including beef, burger, canned tuna, chicken, chicken liver, and eggs, is associated with an increased risk of IBD [22].

Iron-rich diet

Iron absorption can be adversely impacted by inflammation in the gastrointestinal system, especially in conditions such as UC, which reduces iron absorption and causes iron deficiency in many women. As a result, the quality of life decreases, and hospitalization rates increase due to anemia in these patients. Therefore, UC patients are recommended to consume the required amount of iron from either iron-rich foods or supplements. Guidelines for patients at risk for iron deficiency include eating meat and fish, green vegetables (although compounds that inhibit iron absorption may be present), legumes (if tolerated by patients), reducing the consumption of caffeine as it inhibits the absorption of iron, and most importantly, eating foods that are rich in non-heme iron with vitamin C to enhance absorption. For example, spinach and lemon juice. Women with an iron deficiency should be aware of iron inhibitors such as phytates, phosphates, and calcium [26]. Processes like implantation, placenta growth, angiogenesis, and nutrient transfer to the fetus from the mother require essential amino acids. However, supplements containing them are costly and only profitable for some patients. A low-cost alternative is bone broth, which provides substantial amounts of minerals, vitamins, collagen, and essential amino acids of more than 50%. It has been reported that bone broth helped diminish the expression of inflammatory cytokines such as interleukin-1 beta (IL-1B), IL-6, and TNF-a [27,28].

Anti-inflammatory diet

A randomized, placebo-controlled trial found that an anti-inflammatory diet, including increased consumption of dietary fiber, probiotics, n-3 fatty acids, fruits, and vegetables (antioxidants), and decreased intake of red and processed meat and refined sugar, positively correlated with reduced disease risk. Not only did the composition of the gut microbiome change, but the fecal calprotectin level, which is a marker of inflammation in the colon and relapse of disease, was also lower. A substantial increase in seafood intake was also seen in participants following this anti-inflammatory dietary pattern, a source of n-3 fatty acids [29]. In line with these results, findings of another study that aimed to summarize the association between fish consumption and dietary n-3 polyunsaturated fatty acids (PUFAs) with IBD risk illustrated a robust positive correlation between n-3 PUFAs intake and decreased UC risk. However, no significant association was found between diet fish consumption [30]. n-3 PUFAs, which are anti-inflammatory, can be considered a prebiotic as they produce short-chain fatty acids (SCFA), mainly butyrate, and prevent gut dysbiosis while restoring eubiosis. The ratio of Firmicutes/Bacteroidetes resembles dysbiosis, in which Bacteroides are proinflammatory. It has been shown that administration of either a low dose (0.4 g/kg/day) or high dose (1 g/kg/day) eicosapentaenoic acid/docosahexaenoic acid leads to restoring the ratio of these species in the long term [31]. Another study revealed that n-3 supplementation was protective against the risk of preterm birth in women with a low n-3 status at baseline. However, if n-3 supplementation was given to women with a normal baseline status, the risk of preterm birth increased. Pregnant women should be carefully monitored to reduce the likelihood of preterm birth since prenatal supplementation has become more widespread nowadays [32].

Flavonoids

Flavonoids, specifically Quercetin and Rutin, which are found in many fruits like apples, grapes, citrus fruits, and berries, and vegetables like onions, broccoli, and tea, have been studied in UC patients. They have antioxidant, anti-inflammatory, immune modulating, mast-cell stabilizing, and free-radical scavenging properties, as shown in animal studies. They have also been shown to have minimal adverse health effects and can even be used with other drugs [33]. Quercetin has also been proven to show positive results in managing hypertension (pre-eclampsia) during pregnancy and spontaneous abortion by having anti-inflammatory, antioxidant, and cell-signaling modulation properties [34,35].

Berberine and Turmeric

Berberine, an isoquinoline alkaloid derived from Captis Chinesis, is widely used in traditional Chinese medicine. It has been found to have therapeutic effects on UC, including excellent anti-inflammatory and anti-bacterial effects. A journal article has shown that berberine protects the epithelial barrier of the intestine in UC. It achieves this by selectively enriching bacterial flora, producing SCFA, stimulating fermentation, increasing the amount of bifidobacteria that protect the intestinal mucosa, and improving intestinal porosity [36]. Furthermore, berberine has been used to restore reproductive health in women with polycystic ovary syndrome (PCOS) by regulating insulin resistance, unstable glucose levels, and lipid metabolism. Although human studies have not yet been conducted, in vitro and animal studies have shown promising effects of berberine in reducing inflammation [37].

Similarly, turmeric, with its bioactive component curcumin, also exhibits therapeutic properties. Curcumin has antioxidant, anticoagulant, and anti-carcinogenic properties that prevent inflammation [31]. When the effects of Bromelain and Turmeric were analyzed in an animal-based study, it was found that the combination of both substances had a synergistic mechanism that decreased inflammation in UC. In line with these results, curcumin capsules were also found to be a beneficial herbal treatment for reducing the duration and severity of dysmenorrhea, a severe condition that causes pain before or during a period [38].

Pregnant women are at a higher risk for many diseases, including COVID-19. Studies have investigated the relationship between safe, low-dose curcumin supplementation in pregnant women and the prevention of COVID-19. Pregnant women are chosen as candidates for developing COVID-19 because their bodies experience increased inflammation in the first and third trimesters, and the secretion of proinflammatory cytokines such as IL-1B, IL-6, and TNF-a is significantly increased in COVID-19 patients. Findings reveal that curcumin suppresses the release of proinflammatory cytokines, acts as an antioxidant by scavenging oxidative molecules, and helps maintain anticoagulant levels when given at doses of 0-3 mg/kg/day recommended by the World Health Organization to prevent liver or kidney issues. Other advantages of curcumin are its effectiveness in herbal treatment, affordability, and easy availability over the counter. Therefore, it is necessary for governments, healthcare workers, and the community to spread this information and promote agribusiness [39].

Probiotics

Probiotics have numerous beneficial health effects, such as normalizing gut flora, reducing bloating, balancing immune responses, and strengthening gut barriers. They are widely used in managing UC. Among the most studied probiotic strains are Bifidobacterium longum, Lactobacillus plantarum, Lactobacillus acidophilus, and Bifidobacterium lactis. These strains have shown various positive health effects in UC patients, including decreased plasma C-reactive protein (CRP) levels, reduced drug use and hospitalization, and most importantly, maintaining remission and improving the gut microbiome [40]. Probiotics have also been used as an alternative therapy for preserving fertility, pregnancy, and menopause. It has been confirmed that the primary probiotic strain that can restore the microbiome of the vagina is Lactobacillus, as it inhibits the growth of harmful bacterial strains and maintains homeostasis in the vagina. Fertility has been improved in PCOS women after supplementing with Lactobacillus, as reductions in inflammatory cytokines such as IL-6 and CRP have been observed [41].

Dietary Fiber

Although epidemiological studies have associated a fiber-rich diet, including whole grains, fruits, and vegetables, with a reduced risk of unpleasant pregnancy and birth effects, many Australian women consume insufficient dietary fiber during pregnancy [42]. Based on a cohort study (n=208), only 29.5% of women met the recommended intake for dietary fiber of 29 grams

daily. The Australian Dietary Guidelines recommend consuming two fruit portions and five servings of greens every day during pregnancy, but it has been demonstrated that only approximately 4% of pregnant patients meet these recommendations each day [43]. Another study has revealed that a high-vegetable diet, including various colored peppers and vegetables such as tomato, onion, and olive pickles, protects IBD patients [22]. Fruits, cereals, and vegetables contain phytochemicals (lignans, flavonoids, and antioxidants) that exert antioxidant effects, maintain intestinal integrity, and have anti-inflammatory effects through growth factors [44].

Vitamin D

Since the majority of UC patients have malnutrition, the absorption of certain nutrients and vitamins, especially iron and vitamin D, can be affected. A study has shown that supplementing with a dose of 40,000 IU of vitamin D for eight weeks decreases the expression of inflammatory markers in both the circulation and intestine of patients with active UC [45]. In terms of female reproductive health, serum levels of 25 (OH)D greater than 50 nmol/L have been significantly correlated with a higher likelihood of successful pregnancy following in vitro fertilization treatment, as it stimulates the production of estrogen and progesterone. Supplementation of 400 IU of vitamin D daily is recommended for all pregnant women, even before conception, but higher amounts are required for women deficient in vitamin D, primarily 800 IU [46].

Another aspect of the benefits of vitamin D on women's health is menopause. Low levels of vitamin D are correlated with increased secretion of parathyroid hormone (PTH) in postmenopausal women. Therefore, supplementing with vitamin D reduces PTH levels and increases levels of 25(OH)D, which helps prevent osteoporosis. Elevated PTH levels can lead to high calcium levels in the blood, resulting in bone thinning and increased bone porosity. However, women who are not deficient in vitamin D will not experience additional benefits from supplementation. Therefore, the decision to supplement should be based on individual needs. Body Mass Index (BMI) is a crucial indicator of vitamin D deficiency, and studies have shown that supplementing can reduce levels of triglycerides and insulin in postmenopausal women [47]. Previous studies have also found a positive association between vitamin D deficiency and an increased risk of pregnancy, childbirth, and postpartum-related complications such as low birth weight, premature birth, and repeated pregnancy loss. Therefore, vitamin D deficiency is an independent factor that increases the risk of IBD disease activity [48].

Conclusion

In conclusion, this review provides substantial evidence of the multifaceted impact of UC on women throughout various stages of life, including puberty, sexuality, fertility, pregnancy, lactation, and menopause. It also highlights the relationship between diet and susceptibility to UC symptoms. The active phase of the disease significantly exacerbates UC symptoms, particularly during pregnancy. Concerns about adverse outcomes during pregnancy and for the baby have led women to delay conception or discontinue treatment, demonstrating the significant influence of disease activity.

The positive association between UC and inflammation is evident through elevated levels of proinflammatory markers such as CRP, TNF-a, and IL-6. Therefore, an anti-inflammatory diet that emphasizes a high intake of dietary fiber from fruits, vegetables, and whole grains is an optimal strategy for maintaining disease remission and preventing adverse health outcomes in women with UC.

Early diagnosis of UC should prompt regular checkups, at least every six months, to monitor for deficiencies and maintain consistent levels of inflammatory cytokines. Preventing malnutrition and nutritional deficiencies is crucial as they can worsen disease symptoms. Therefore, it is imperative to implement nutritional education programs for women with UC, regardless of symptom severity, to prevent future complications.

To strengthen the foundation for future research, it is recommended to include a more diverse and representative sample of the general population. This should include women of all ages diagnosed with UC, both outpatients and inpatients, and individuals from different income levels in both urban and rural settings. Additionally, increasing sample sizes and the number of studies in specific investigations is necessary to ensure the validity and reliability of results. It is also important to mitigate biases, such as recall, selection, and publication biases. Prospective research methods should be prioritized over retrospective approaches to enhance the robustness of data collection.

Future investigations should explore the nuanced relationship between different dietary patterns and their impact on UC symptoms in women. Furthermore, the association between assisted reproductive techniques, conception methods, and disease course should be further examined. Shedding light on contemporary dietary trends and approaches for treating UC in women should be a focal point for future research endeavors.

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Case report
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Recurrent malignant fibrous histiocytoma of the forearm: A rare soft tissue sarcoma

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Abstract

Malignant fibrous histiocytoma (MFH), while rare, is the most prevalent soft tissue sarcoma (STS) found in extremities. Its prognosis hinges on factors such as tumor size, invasion depth, and differentiation degree. For MFH and all STSs, wide surgical resection is the gold standard treatment method. In this study, a 48-year-old woman, initially diagnosed with lipoma and with a mass excised from her right forearm, later exhibited recurring MFH masses in the same location. Superficial tissue ultrasonography identified malignant soft tissue tumors in the lesion area. Positron emission tomography was used to stage the tumor preoperatively, revealing fluorodeoxyglucose uptake in the repeating lesions. Right forearm magnetic resonance imaging confirmed the malignant lesions. Post imaging, the patient underwent wide surgical excision, eliminating the fascia. Regular follow-up revealed no recurrence or metastasis at 6 months and 1 year. Excisions frequently occur without radiological imaging, based only on a preliminary lipoma or sebaceous cyst diagnosis. However, excisions should follow radiological imaging, particularly when soft tissue tumors beneath the skin appear benign.

Keywords: malignant fibrous histiocytoma, soft tissue sarcoma, magnetic resonance

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Introduction

Soft tissue carcinomas are significantly diverse and comprise various subtypes [1]. One rare subtype within this group is malignant fibrous histiocytoma (MFH). Although the specific cellular origin of MFH remains unclear, it shows a strong correlation with tumor cells, particularly fibroblasts or myofibroblasts. While most common in middle-aged and elderly adults, MFH can present at any age. It tends to grow in subcutaneous tissues, bones, muscles, and tendons. Though rare, MFH can also develop in internal organs [2]. Geographically, it predominantly occurs in the limbs (mainly the lower ones), trunk, or the head and neck region [3]. The cause of MFH remains unknown, but potential risk factors could include age, radiation exposure, genetic preconditions, and exposure to chemicals like arsenic and vinyl chloride [4]. MFH is identified by irregularly shaped spindle cells that deeply penetrate the dermis, often accompanied by hemorrhage, necrosis, and infiltration of lymphoid tissue cells. These tumor cells – usually large and atypical – exhibit irregular mitotic images [5].

At the onset of the disease, symptoms are generally mild or non-existent. However, MFH often manifests as a swiftly expanding mass or lump, potentially leading to distressing symptoms like pain, swelling, or tenderness. Growth of the tumor can result in the creation of a soft tissue mass, along with deteriorating strength or function, particularly if it impacts muscles and bones. It could also result in pathological fractures [6]. The definitive diagnosis of MFH is made via a pathological examination of a biopsy from the tumor. Such an examination not only confirms the diagnosis but also ascertains the level of malignancy.

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Treatment selection for MFH is influenced by factors such as the size of the tumor, its extent of spread, and the patient's overall health condition. The therapeutic options for MFH include surgery, radiation therapy, chemotherapy, and targeted therapies. Similar to other soft tissue carcinoma treatments, a wide surgical resection is the gold standard approach for MFH [3,7]. Complementary radiotherapy is particularly crucial for cases involving larger lesions, highly aggressive tumors, and positive or narrow surgical margins. Soft tissue sarcomas (STSs) like MFH may be responsive to radiotherapy either in combination with surgery or to target remaining tumors post-surgery [8]. The effectiveness of chemotherapy in MFH remains uncertain, but it can be used as an adjuvant therapy [7]. Conventional chemotherapy is usually reserved for cases with widespread disease, as substantial trials have not shown much benefit [3]. A significant meta-analysis concluded that additional use of doxorubicin did not enhance overall survival rates. Nonetheless, many experts suggest that pre-operative and/or supplementary chemotherapy can lower the risk of unseen local or metastatic disease [9].

The prognosis of MFH hinges on factors like tumor size, degree of spread, condition of regional lymph nodes, and the patient's overall health. Early diagnosis and suitable treatment can lead to successful outcomes in some instances. However, due to the disease's aggressive nature and potential to spread, the prognosis is frequently unfavorable [10].

Case presentation

A 48-year-old woman came to the clinic with three lesions on her right forearm that she noticed by touch. She had no other medical conditions. Her medical history showed a previous surgery for a lipoma in the same area where the lump was found. A physical examination showed a surgical scar on the extensor area of her right forearm, beneath which three separated lesions could be felt (Figure 1).

The patient, previously diagnosed with lipoma, had undergone surgery. However, despite a pathology report confirming MFH, a second operation was not performed. A superficial tissue ultrasound of the lesion area unveiled soft tissue tumors with potential malignant features. These included mildly lobulated contours, a solid appearance, and minimal blood flow, as seen through Doppler ultrasound (Figure 2). Prior to surgery, a positron emission tomography/computed tomography (PET/CT) scan was performed for staging. The scan revealed increased fluorodeoxyglucose (FDG) uptake in the recurring lesions (Figure 3).

Figure 1: Right forearm extensor area with pre-operative recurrence.

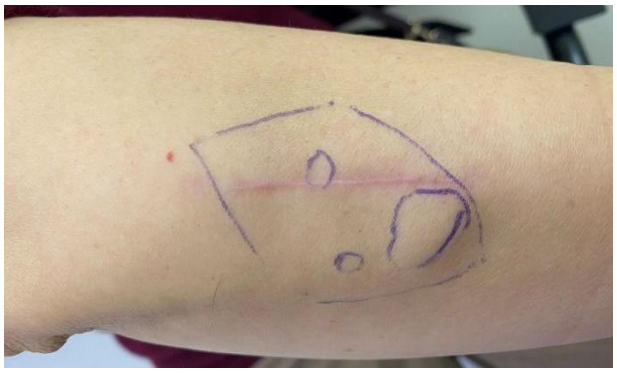


Figure 2: On US examination, a hypoechoic solid appeared as a lesion with smooth oval contours.

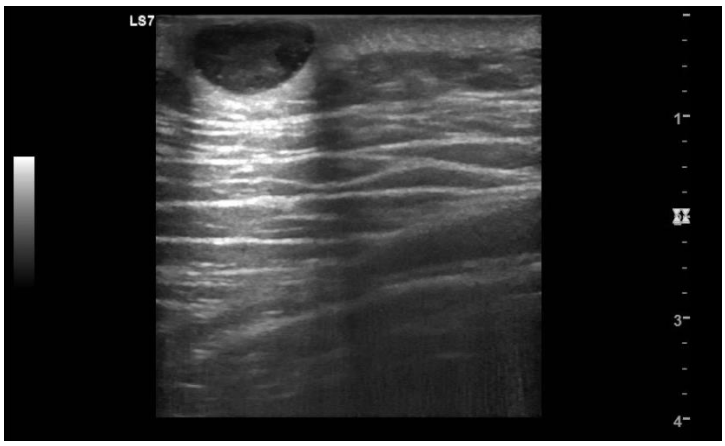
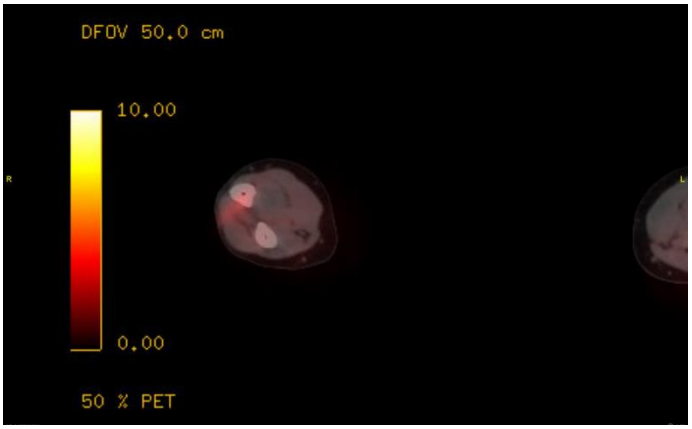
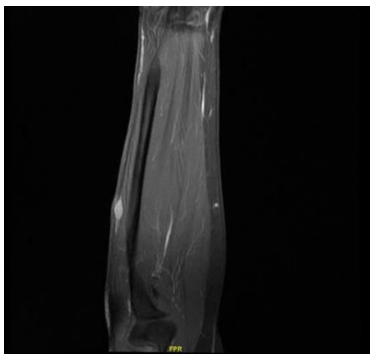


Figure 3: FDG uptake is compatible with malignancy in the axial section in PET-CT examination.



No metastasis was found in any areas beyond the identified lesion. Magnetic resonance imaging (MRI) of the right forearm showed muscle tissue invasion by the lesions (Figure 4).

Figure 4: In contrast-enhanced fat-suppressed coronal section T1-Weighted MR examination, the lesion showed contrast enhancement.



The patient underwent a wide resection surgery where a 2-cm margin of the extensor muscle group's fascia was removed (Figure 5). The resected area was then repaired using radiotherapy mapping and a fasciocutaneous flap. The excised tissue was preserved in a 10% formaldehyde solution and forwarded to the pathology lab.

Upon examination, the tissue specimen presented as a yellow-beige, homogeneous tumor without a capsule, measuring 15×10×8 mm with uneven yet distinct borders. Tumor samples were placed in cassettes for tracking and further embedded in paraffin blocks after routine procedures. These blocks were then sliced into 2-µm-thick sections for microscopic analysis. The stained samples displayed a tumor with misshapen, hyperchromatic nuclei, noticeable nucleoli, and sporadically forming a storiform pattern. There was a noticeable presence of giant tumor cells and mitotic cells (Figures 6, 7, and 8).

Figure 5: Pre-operative image.

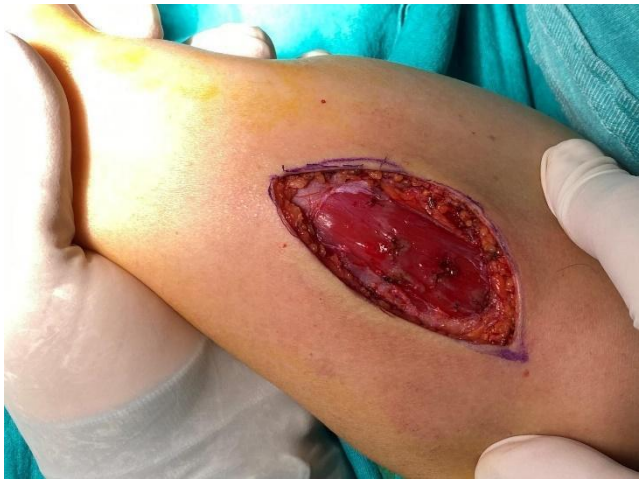


Figure 6: Tumor with distinct borders in subcutaneous tissue. Hematoxylin and eosin ×40.

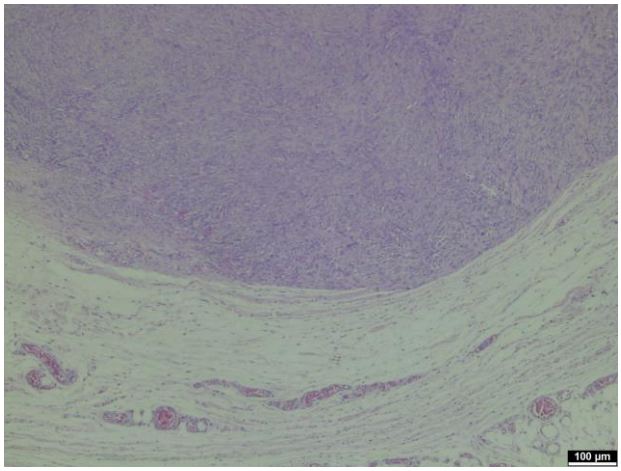


Figure 7: Pleomorphic tumor spindle and mitotic cells. Hematoxylin and eosin ×400.

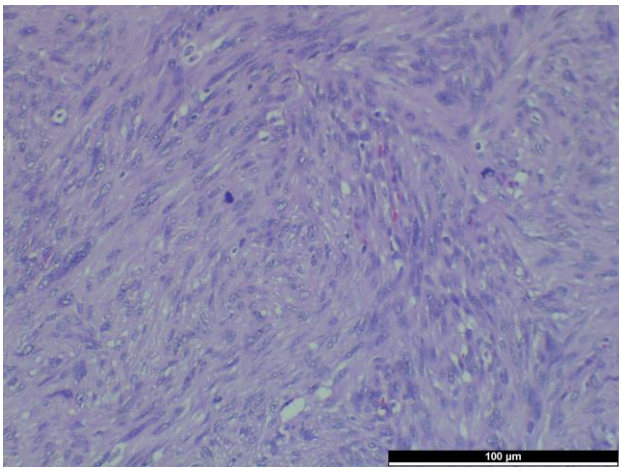
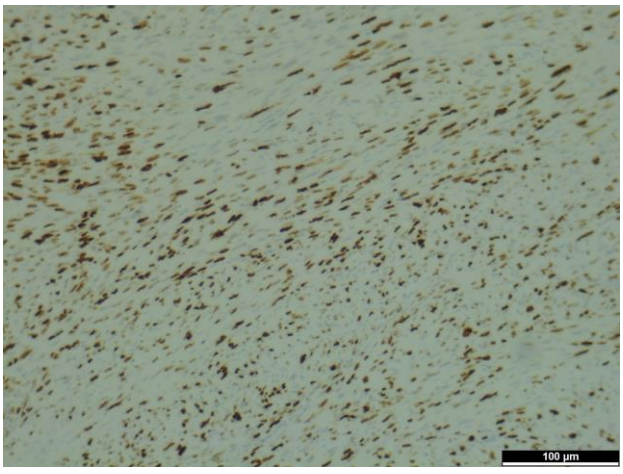


Figure 8: Positive nuclear staining in 35% of tumor cells with Ki-67 immunohistochemical staining.



The patient was diagnosed with MFH based on the findings. A pathological report showed a surgical margin of 5 mm to the deep fascia. Post-surgery, the patient received radiotherapy. After 6 months, a thorax CT scan took place. Ultrasonography (USG) was employed to check the surgical area, and the results showed no recurring lesions. A year later, a thorax CT scan and superficial tissue USG were performed with no signs of metastasis or recurring lesions. Currently, the patient is under regular observation.

Discussion

Soft tissue sarcomas (STS) are a heterogeneous category of malignant tumors encompassing various subgroups [1]. Gustafson's study featuring 508 patients in 1994 showed that the most prevalent subgroup was MFH [11]. However, a larger study indicated leiomyosarcoma as the most common STS, comprising 23.9% of cases, followed by MFH at 17.1%. In an epidemiological investigation focusing specifically on extremity-located soft tissue carcinomas, MFH proved to be the most dominant [1].

MFH symptoms can differ based on the tumor's size and location. Usually, a visible mass or lump appears in the tumor's area. There might be pain, tenderness, or discomfort in the affected zone. Some instances might show skin discoloration, ulcers, or surface bumps.

USG is pivotal in identifying soft tissue abnormalities and distinguishing between solid and fluid-filled masses. Doppler USG is valuable for evaluating the vascular nature of a lesion, differentiating potential vascular abnormalities. MFH often manifests as non-specific radiological features, forming masses of varied sizes. Although MRI also displays non-specific findings for MFH, MRI is favored for its high-definition resolution in diagnosing and conducting differential diagnosis. MRIs typically indicate low to medium intensity on T1-weighted images and high intensity on T2-weighted images. Enhanced imaging generally presents contrast enhancements. In terms of differential diagnosis, liposarcoma, rhabdomyosarcoma, and synovial sarcoma should be taken into account.

The prognosis in STS depends on factors such as tumor size, degree of invasion, and the level of differentiation. In this specific case, the tumor appeared solid and displayed minimal vascularization, noted through Doppler ultrasound.

MRI was instrumental in offering insights into the characteristics of the soft tissue lesion. Additionally, it enabled the differentiation of tumor-like processes, including benign lipomatous lesions, intramuscular hemangiomas, and hematomas. However, for evaluating calcifications, MRI is not sufficient.

In MRI , MFH generally appears as a hypointense lesion on T1-weighted images becomes hyperintense on T2-weighted images, and displays as a contrast-enhancing lesion in post-contrast images. Unfortunately, MRI lacks specific characteristic features that could suggest MFH.

MRI aids in understanding the spread of the tumor, both internally and externally, from the bone, and it also shows any involvement of nearby soft tissue, blood vessels, and nerves. Consistent with existing literature, the MRI findings in this case revealed no invasion into neighboring soft tissue, blood vessels or nerves.

MFH frequently manifests with vague radiological findings and can lead to variously sized masses. Adjacent bone often shows cortical erosion, a significant feature in radiography. Additionally, it can trigger periosteal responses and pathological fractures. Peripheral calcifications and ossifications are rarely detected in radiography. In our situation, the patient, who had previously had a lipoma removed from the forearm, presented with a reoccurrence of swelling. Consequently, direct radiography was not deemed necessary, and a preliminary superficial ultrasound was carried out instead.

The diagnosis and monitoring of patients often utilize fluor-18-labeled FDG PET/CT imaging. It is instrumental in staging, assessing treatment responses and prognosis, spotting relapse, and differentiating possible relapse from post-treatment alterations [13]. In our case, the PET/CT revealed FDG uptake in the recurrent malignant soft tissue mass, pointing to its malignant nature.

The primary treatment for MFH is surgery, particularly wide excision with a 1–2 cm margin of normal tissue [8]. It has been shown that wide surgical resection, including regional nodal dissection if needed, is the preferred method of treating MFH [14]. Optimal treatment involves surgical resection with negative margins, yet the median survival without distant metastasis is 8.5 months [2]. Recurrence can occur even with treatment [15]. In the case presented, the patient underwent wide surgical resection after recurrence, and no further occurrences were reported in the 12-month follow-up period after the surgery.

Neoadjuvant or adjuvant radiotherapy might be useful, as suggested by one study [16]. Another study indicates that radiation can be used for tumors that cannot be operated on, are larger than 5 cm in the extremities, or are surgically removed but with positive histological margins [14]. Due to recurrence in our patient, postoperative radiotherapy was administered.

Approximately 10% of cases may show metastases from the extremity, typically to the lung, or from the retroperitoneal region to the liver, at diagnosis time. Diagnostic methods such as CT, MR, PET-CT, and USG are necessary. While MRI adequately stages regional soft tissue tumors, PET-CT, bone scintigraphy, and a high-resolution CT scan of the lungs offer the best detection of metastatic spread [13]. There was no evidence of distant metastasis in our case study.

A precise diagnosis of MFH typically requires a blend of clinical, radiological, and pathological assessments. Biopsies and histopathological examinations of the tumor tissue, supplemented with immunohistochemistry, can distinguish between various sarcomas and other similar conditions. Consultation with an expert oncologist or pathologist is vital for determining the right diagnosis and suggesting suitable management. MFH was confirmed in our case based on the former diagnosis and histomorphological attributes. Within the surgical practice, it is known that many clinics still perform excisions based on initial diagnoses like lipoma or sebaceous cyst without employing radiological imaging. Conducting an excision after radiological imaging is advisable, particularly due to the potential presence of STS in seemingly harmless soft tissue tumors found beneath the skin.

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A rare entity: Giant pelvic dedifferentiated solitary fibrous tumor

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Abstract

Solitary fibrous tumors are a rare soft tissue tumor of mesenchymal origin with variable behavior. The clinical presentation of solitary fibrous tumors is related to the local mass effect, i.e., the size and localization of the lesion. Although they can occur anywhere in the body, they often originate on lined surfaces within a cavity [pleura, peritoneum, dura]. Such tumors occur in only four to six people out of ten million people annually. Since it is such a rare entity, solitary fibrous tumors may not be considered in the differential diagnosis list when it occurs in uncommon localizations. Solitary fibrous tumors are the "great simulator" of soft tissue tumors. The diagnosis is difficult to make and often requires a multidisciplinary approach integrating clinical, radiological, immunohistochemical and genetic factors. Radiological imaging is usually the first step in the detection of these lesions. Computed tomography and magnetic resonance imaging methods allow us to determine the localization of lesions, assess their size and internal structure, as well as their relationship with adjacent anatomical structures and detect distant metastases. The most important treatment method is excisional surgery. Although radiotherapy and chemotherapy are thought to be effective in reducing recurrence, the global efficacy of these treatment methods has not been clearly demonstrated. In addition, randomized prospective studies with large patient populations evaluating the efficacy of other treatment modalities, such as immunotherapy and targeted therapy, are needed. We reported the CT and MRI findings of a 63-year-old patient who presented with complaints of abdominal distension and was diagnosed with pelvic dedifferentiated solitary fibrous tumor.

Keywords: solitary, fibrous, tumor, giant, pelvic

Introduction

Solitary fibrous tumors [SFTs] are a mesenchymal tumor occurring mainly in the pleura [1]. SFTs occur equally in men and women between the ages of 40 and 70 [2]. The rare tumor accounts for less than 2% of all soft tissue tumors [3]. Up to 6% of SFTs are localized in the pelvic region [4].

The symptoms of SFTs show variability according to the localization of origin [5]. Most SFTs can be asymptomatic at presentation, but large sizes can cause abdominal pain, bowel obstruction, and urinary symptoms [6].

In this article, we aimed to present CT and MRI findings of a rare case of giant pelvic located dedifferentiated SFT.

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Case presentation

A 63-year-old male patient was admitted to the emergency department with abdominal pain. There was nothing noteworthy in the patient's background. Abdominal examination revealed tenderness in the pelvic region and a contrast-enhanced abdominal CT scan was performed. A heterogeneous dense mass filling the pelvis and extending to the midline of the abdomen was observed (Figure 1). Hydroureteronephrosis secondary to obstructive retention in the right renal collecting system was detected (Figure 2). Contrast-enhanced MRI was performed to elucidate the origin of the mass lesion. A retroperitoneal mass was seen, with an intermediate signal on T1-weighted sequence, a hyperintense signal on T2-weighted sequence, lobulated contour, including cystic-necrotic areas, and well contrasted (Figure 3-6). Diffusion-weighted images [DWI] showed diffusion restriction (Figure 7). No pathological lymphadenopathy was detected. With these findings, a retroperitoneal mesenchymal tumor with malignant features was considered. A diagnostic laparotomy was performed. Histopathology was reported as dedifferentiated SFT (Figure 8). The patient was followed up with neoadjuvant chemo-radiotherapy before surgery.

Figure 1: Sagittal section contrast-enhanced abdominal CT image: There is a heterogeneous and densely contrasted mass lesion, approximately 19x17x10 cm in size [within the stars], filling the retrovesical space and extending cranially up to the supraumbilical level. The bladder is displaced anteriorly [blue arrow]. Fat planes cannot be seen between the prostate gland [red arrow].

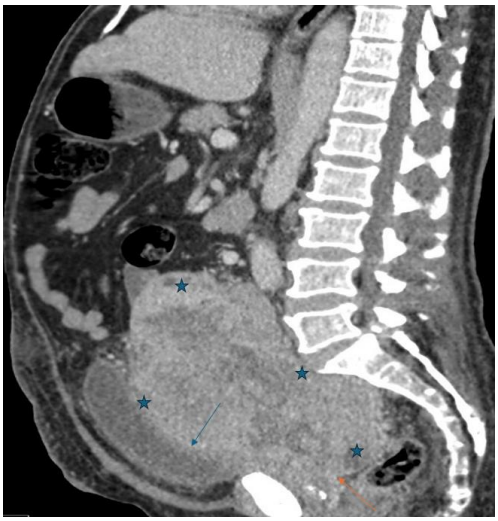


Figure 2: Coronal section contrast-enhanced abdominal CT image: There is grade 1-2 dilatation of the intrarenal collecting system on the right [blue arrow] due to compression of the heterogeneous mass lesion [stars] filling the pelvis.

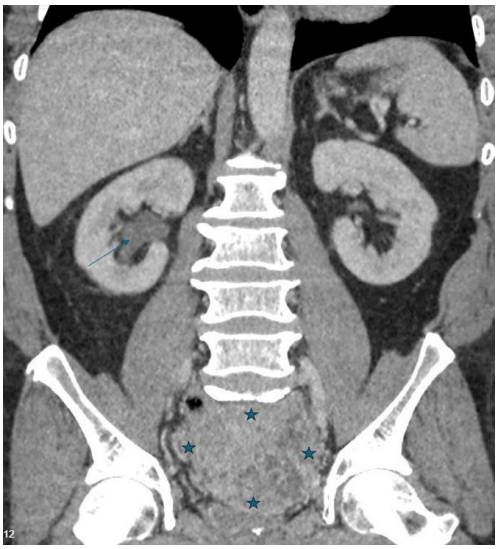


Figure 3: Sagittal section pelvic MRI T2A image: There is a large mass lesion [in stars] filling the pelvis in the retrovesical area with cystic/necrotic [blue arrows] hyperintense foci, solid components are hypointense, and the bladder is displaced anteriorly [red arrow].

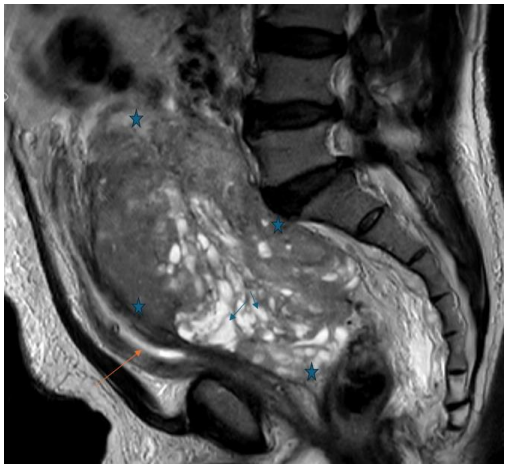


Figure 4: Axial section pelvic MRI T1A image: Mildly heterogeneous mass lesion with solid components with intermediate signal in the pelvis [within the stars].

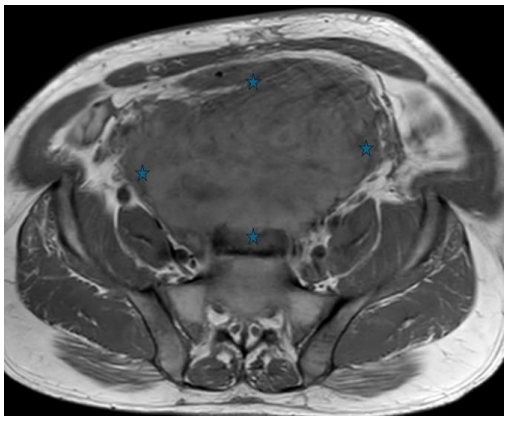


Figure 5: Coronal section pelvic MRI fat-suppressed T2A image: Hypointense thin fibrous capsule is observed at the margins of the lesion [blue arrows].

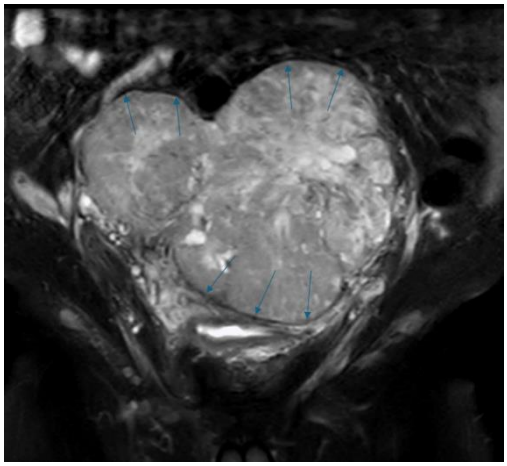


Figure 6: Sagittal section pelvic MRI postcontrast fat-suppressed T1A sagittal image: The mass lesion is well circumscribed and lobulated contoured with intense contrast enhancement in the solid components.

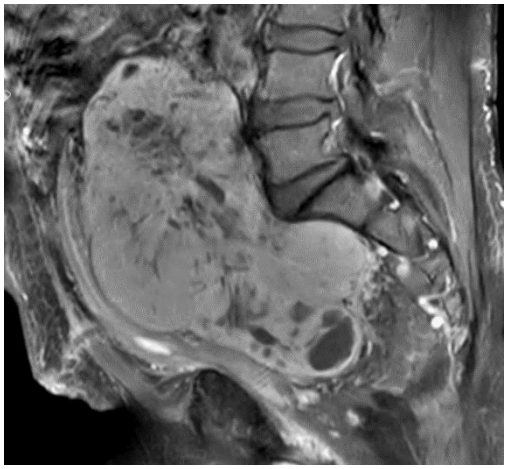


Figure 7: On diffusion weighted images, the mass is hyperintense on 1.b:1000 image, 2. ADC map as hypointense [ADC value average 0.90 0.95x0.001xmm²/sec] and diffusion restriction was observed, more prominent in some regions.

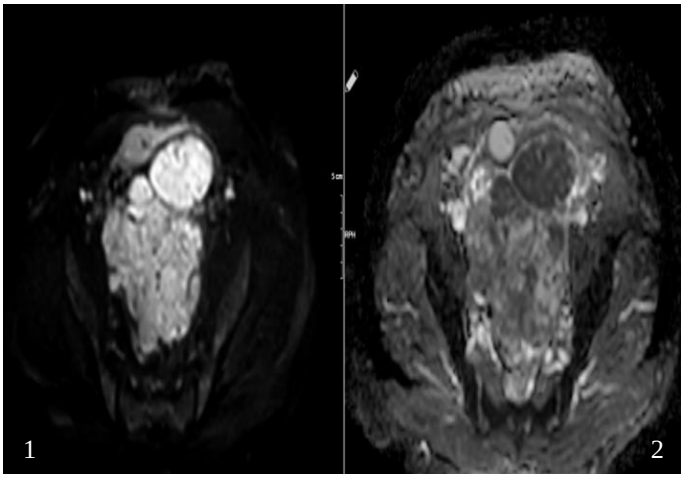
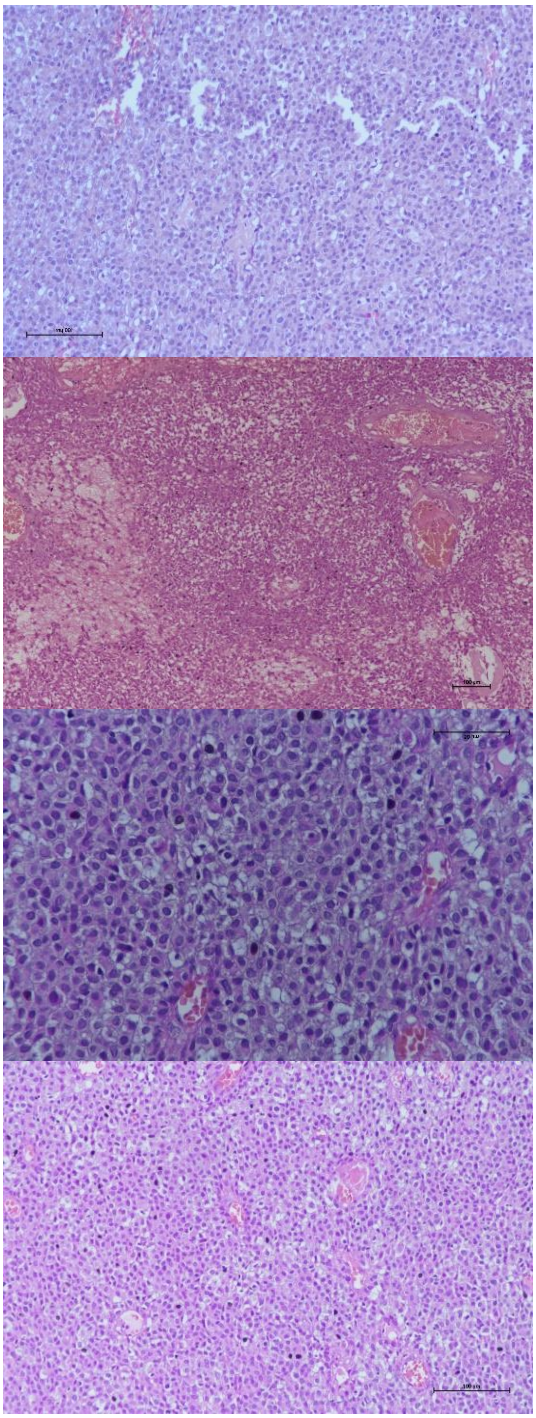


Figure 8: The histopathologic specimen images of the lesion is presented.



Discussion

SFT consists of spindle cells of fibroblastic origin [6]. Although most of them are benign, 12-22% may be malignant [7]. Histopathologically, malignant SFTs have hypercellularity, atypia, ≥4/10 mitosis rate, necrosis and infiltrative borders [8,9]. The definitive diagnosis of SFTs is currently supported by immunohistochemical staining and genetic studies [8,9]. In this case, BCL2, CD34, CD99, STAT6, ki67 positivity was detected.

The radiological appearance of SFTs is variable and nonspecific [9]. On CT scans, the majority of SFTs show marked contrast enhancement in the arterial and portal venous phase [9,10]. If the fibrous component is predominant, contrast enhancement becomes more prominent in the delayed phase [10]. Large collateral feeding vessels may be seen in one-third of all cases [10]. Heterogeneous contrast enhancement and cystic, necrotic, and hemorrhagic components are more common in aggressive SFTs [5,10]. These findings may help predict tumor behavior and guide treatment management.

MRI is a complementary examination in terms of characterizing the lesion and revealing its extension and relationship with surrounding structures [11]. SFTs show variable signal characteristics on MRIs according to the different amounts of solid and cystic components within them [10,12]. Fibrous components show hypointense signals in T1AG and T2AG series, while myxoid and cystic components show hyperintense signals in T2AG. Hemorrhagic areas may also show hyperintense signals on T1AG [11]. Radiological differentiation is difficult due to overlapping appearances in benign or malignant lesions [13]. In recent years, studies have reported that a low apparent diffusion coefficient (ADC) value in DWI may be beneficial in terms of malignant transformation, but the threshold value has not yet been established [13,14]. In addition, the differential diagnosis of SFTs with malignant features is broad [such as angiosarcoma, leiomyosarcoma, desmoid tumor, mesothelioma and uterine neoplasms] [15]. In our case, the definitive diagnosis could be made histopathologically.

Conclusion

In conclusion, CT and MRI help differentiate SFT from gynecological and rectal masses, which are more common in the pelvic region, and allow for preoperative evaluation of the relationship and invasion of surrounding organs. Histopathological evaluation is required for definitive diagnosis.

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This addition is only reflected in the printed version of the article.

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