

# FORMAL DIFFERENTIATED APPROACH TO MANAGING WOMEN WITH STRESS URINARY INCONTINENCE

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## ABSTRACT

**Object of research:** treatment of women with stress urinary incontinence (SUI).

**Investigated problem:** substantiation of the choice of treatment methods in the management of women of different ages with SUI depending on the urogynecological status, age, financial capabilities, risk of complications and speed of achieving the desired result.

**The main scientific results:** An approach has been developed to substantiate the most rational method of treatment of women of different ages with SUI, taking into account the provision of an adequate standard of living. It is based on the use of hierarchy analysis, which allows to determine the priorities between competing treatments – mid-urethral sling (MUS), pelvic floor muscle training (PFMT) and containment (absorbent pads). The expediency of applying a formal differentiated approach is confirmed by the results of questionnaires of representative groups of women on the technology of UDI-6 and IIQ-7 questionnaires before and after treatment. It is recommended to choose a rational method of treatment or a set of treatment methods personally depending on the urogynecological status, age, financial capabilities, risk of complications and speed of achieving the desired result. MUS has gained the highest number of points due to the short time of treatment and rehabilitation, long-term postoperative effect, accessibility, low level of complications and significant improvement of life quality in young and elderly women. The most rational method of treatment of middle-aged patients with SUI is the method of PFMT as one that has a positive impact on the life quality of women and does not require financial costs.

**The area of practical use of the research results:** medical institutions providing urogynecological care to women.

**Innovative technological product:** development of a formal differentiated approach to the management of women with SUI, which allows to choose the most rational method of treatment taking into account the life quality.

**Scope of the innovative technological product:** clinical practice of treatment of women with SUI.

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## 1. Introduction

### 1. 1. The object of research

The object of research is the treatment of women with stress urinary incontinence.

### 1. 2. Problem description

Stress urinary incontinence (SUI) negatively affects the physical, social activity and emotional health of women, worsens their life quality [1]. There is universal agreement on the importance of this problem in terms of human suffering and economic cost [2]. There are non-surgical and surgical methods of SUI management in women. Mid-urethral slings (MUS) are a recognized world standard for surgical treatment of SUI [2–4]. This is a short-term operation with a small (1–3 days) period of postoperative rehabilitation, long-term effectiveness of transobturator MUS was confirmed by ten years of observation of a large group of patients with 92 % cure rate [5]. However, MUS is not without complications.

Non-surgical methods of treatment of women with SUI include pelvic floor muscle training (PFMT), which improves the functions assigned to it by the body – stabilization of paraurethral mechanisms of urinary retention [6]. Containment (absorbent pads) is important for people with

SUI when active treatment is unavailable or impossible for some reason. Such containment requires constant daily use, and the quality of life with their use increases, but not much [7].

### 1. 3. Suggested solution to the problem

Rationalization of the choice of treatment for women with SUI, for example, through a formal analytical approach, is a task not fully solved, and therefore relevant for improving the life quality of women in accordance with international standards.

Thus, using the method of hierarchies [8] it is possible to compare treatments from different groups of methods and draw a conclusion based on a quantitative formal calculation. By correctly choosing the criteria for comparing methods, prioritizing between these criteria and comparing the method of treatment for each criterion, it is possible to determine personally or for a particular group, for example, by age, the most rational method of treatment.

**The aim** – improving the life quality of women with SUI by developing and substantiation a formal differentiated approach to their treatment. This approach will allow algorithmic diagnosis and treatment of women with SUI taking into account their social and age differentiation, which corresponds to the content of the questionnaires UDI-6 and IIQ-7.

## 2. Materials and Methods

The study was conducted from October 2017 to February 2021 on the basis of the Kyiv Maternity Hospital No. 3 (gynecological department). It included 63 patients with complaints of SUI. The main group consisted of 33 patients who underwent surgical treatment of SUI, which was represented by synthetic MUS –transobturator tension-free vaginal tape vagina-to-skin direction (TVT-O). For comparison, 30 women were treated conservatively. The women of the comparison group were in turn divided into 2 subgroups. Subgroup 1 of the comparison included 15 women who used the method of behavioral and physical therapy – PFMT. The pelvic floor exercises included squats, fitball, Kegel exercises, and therapeutic exercises. The 2 subgroups of the comparison included 15 women who used containment (absorbent pads).

As a basis for the age distribution, let's use the following conditional age groups: young from 18 to 44 years, middle age from 45 to 59 years, elderly from 60 to 74 years, senile from 75 to 89 years and long-lived >90 years.

The study was conducted in accordance with the Declaration of Helsinki according to the conclusion of the Commission on Ethics of Shupyk National Healthcare University of Ukraine (minutes No. 3 from 11.01.2018). Informed consent to participate in the study was obtained from all women.

Verification of the diagnosis, determination of the type of urinary incontinence (UI) was performed using UDI-6 and IIQ-7 questionnaires and the results of functional tests (cough test, Valsalva test). Subsequently, on the basis of statistical processing of gynecological, somatic anamnesis, assessment of life quality and urogynecological status before and after treatment, the dependences of treatment results on the selected methods and the age of women were established. The methods of treatment in a particular patient were used either separately or sequentially.

To compare the results of treatment, the following criteria were chosen – factors used in the assessment of medical technology [9, 10]: impact on life quality, duration of effect after treatment, complications of treatment (responsible for clinical efficacy, effectiveness and safety) and duration treatment and treatment costs (responsible for the costs used).

To substantiate the differential approach to choosing the most rational method of treatment for women with SUI depending on age, a mathematical model was created, taking into account the positive effect of each treatment method. The chosen mathematical model is based on the method of determining hierarchies according to Saati [8]. The criteria  $k_{pi}$  of rationality of the  $i$ -th variant (method) of treatment and weighting factors  $\beta_{ki}$  were introduced, which characterize the significance of the selected factors (criteria) that influence each of the treatment options. The criterion of rationality  $k_{pi}$  and the weighting factor  $\beta_{ki}$  for each of the options (both methods and criteria) were determined by the method of compiling matrices of compatibility and pairwise comparison (sequential prioritization of comparison criteria and hierarchies of treatment methods). The value of the criterion of rationality  $k_{pi}$  of each  $i$ -th treatment option was determined by summing the results of comparisons within each period, taking into account the weights  $\beta_{ki}$  and looks like this:

$$k_{pi} = \sum_{l=1}^L \beta_l k_{i/l}, \tag{1}$$

where  $i$  is the number of the row and column of the compatibility matrix;  $l$  is the current parameter from the region  $L, l \in (1, L)$ ;  $L$  is the total number of parameters involved for comparison.

The results of the calculations are arranged in a hierarchy – the option with the highest value of the criterion will consider the most rational, expedient.

Statistical data processing was performed using the EXCEL application package using biometric analysis methods, calculation of variation series indicators.

### 3. Results

A mathematical model was constructed for the three methods to treat women with SUI – MUS (1); PFMT (2); containment (3). Their main general parameters (criteria) were selected as follows: duration of treatment (1), treatment complications (2), treatment costs (3), quality of life (4) and duration of effect after treatment (5).

At the first stage, priorities were identified between the main general parameters (criteria) of treatment by compiling their own compatibility matrix, taking into account the age of women. The results of compiling the compatibility matrix are shown in the form of a diagram, where 1 interval between the horizontal lines is equal to 1 point (Fig. 1). The most important criterion has the highest number of points.

At the second stage, compatibility matrices were compiled between treatment options for each of the parameters (Fig. 2).

At the third stage, let's define the hierarchy of treatment options and calculated the criteria of rationality, taking into account the compatibility of treatment criteria and compatibility between treatment options for each of the parameters, taking into account the age of women (Table 1).

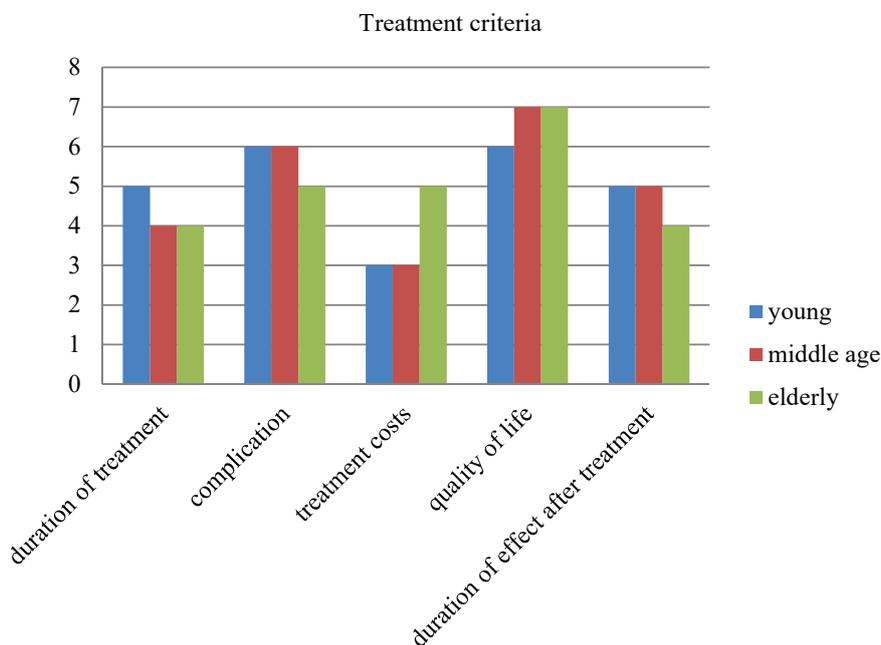


Fig. 1. Distribution of priorities of treatment criteria for women of different age groups, points

Table 1

Hierarchy of SUI treatment methods in women of different ages, points

Age periods	Research groups		
	Main group (MUS)	1 subgroup of comparison (PFMT)	2 subgroup of comparison (containment)
Young	97	78	50
Middle age	81.5	87.5	56
Elderly	86.5	83.5	55

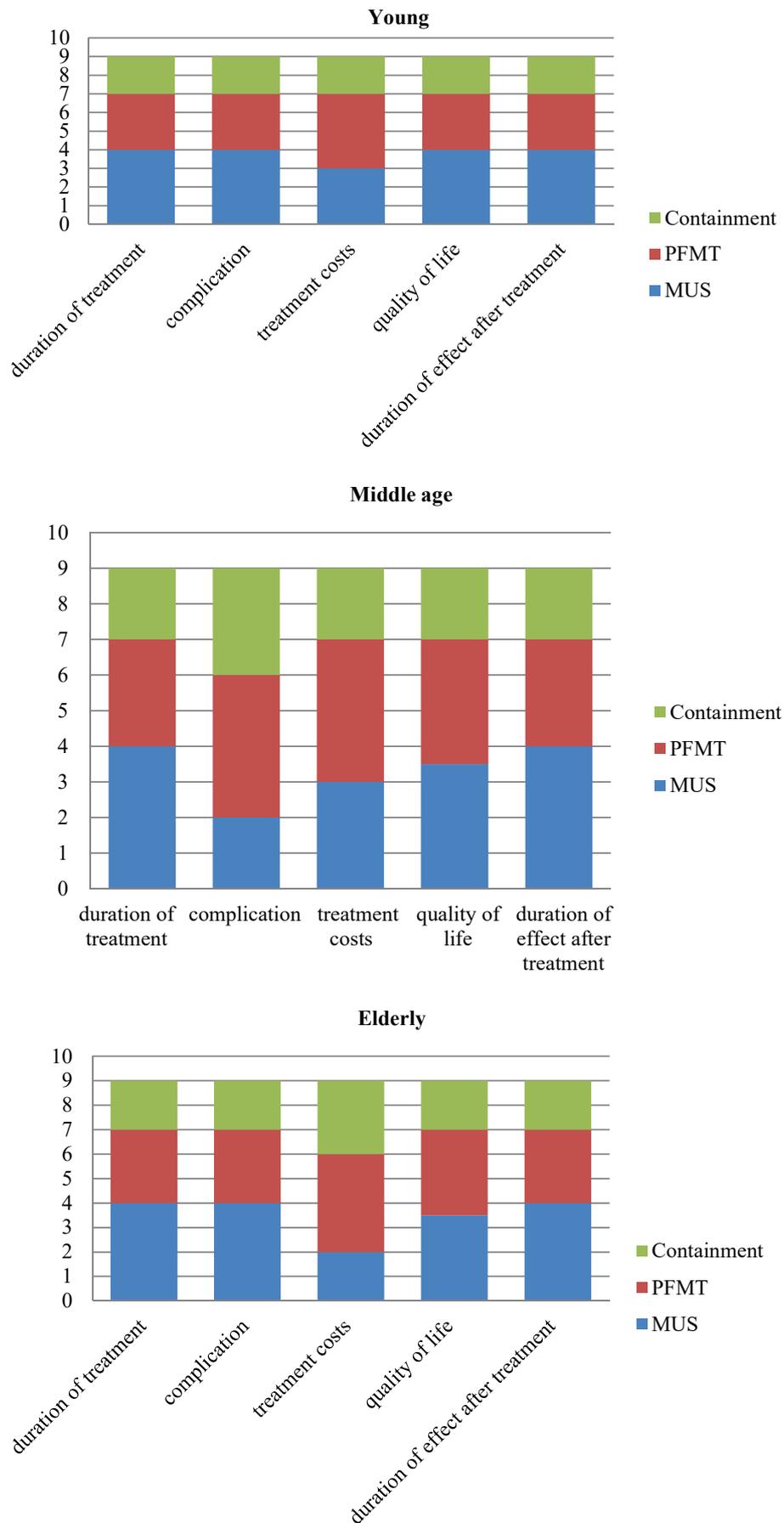


Fig. 2. Distribution of priorities between treatment options according to each of the criteria, points

The most rational method was considered to be the method that scored the highest number of points (Fig. 3).

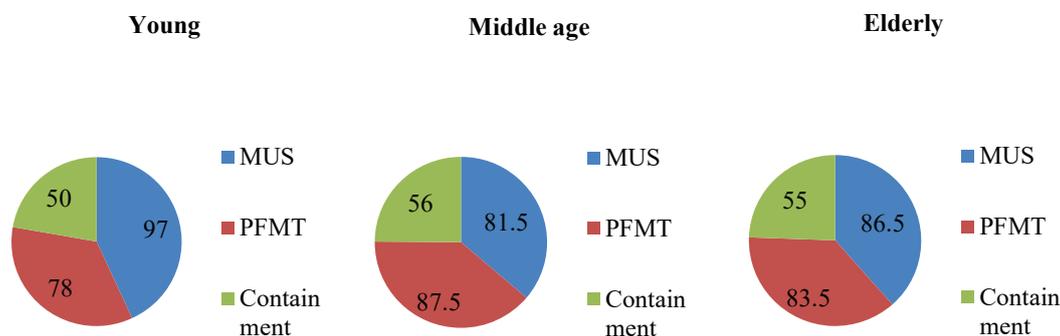


Fig. 3. Distribution of hierarchies between treatment options for women of different ages, points

4. Discussion

When compiling the matrix of compatibility of parameters (treatment criteria) revealed a certain age difference. It is estimated that the most important criterion was the quality of life (6.0–7.0), for which the treatment takes place. Complications of treatment were quite a significant criterion. Treatment costs for young and middle-aged women were the least influential (3.0), but the weight of this criterion increased with age. With age, the temporal criteria of duration change and are regarded as a decrease in their weight when comparing methods.

The most rational method of treatment of young women with SUI, MUS is identified as a method that does not require much time for the procedure and rehabilitation, has a long-lasting effect, available in terms of payment and has a positive effect on quality of life; there were no complications in women. At this stage, it is considered that the previous operation of the MUS does not increase the frequency of complications involved with the MUS during pregnancy, childbirth or the postpartum period and planning a future pregnancy should not be considered as an absolute contraindication for such an operation [11]. PFMT is inferior to 19 % of the MUS as one that requires long-term involvement and improvement of life quality is insignificant for women of this age, although the proposed methods of PFMT did not require financial costs. The least rational method of treatment is the containment, which is 47 % less points for MUS in the hierarchy of treatment methods.

The most rational method of treatment of middle-aged women with SUI was the PFMT as one that had a positive effect on the life quality of women, even disproportionately to the reduction of urogynecological complaints and did not require financial costs. With a small difference (7 %) MUS was at the second point. However, it should be noted that the severity of SUI symptoms in middle-aged women of the main group was higher than in women of subgroup 1 of the comparison. In addition, there were complications of the operation in middle-aged women, which influenced the outcome of the study. Surgical treatment was performed on women who were not satisfied with the results of PFMT. Thus, for middle-aged women it is rational to use the methods of PFMT with MUS. The least rational method of SUI correction is the method of containment, which is 31 % less than MUS. However, among women of all ages, middle-aged women received the highest score.

The most rational method of treatment of elderly women with SUI was identified MUS as a method that has a positive effect on life quality. There were no complications associated with the operation in the main group. Although, according to the literature, it is older women who have more intra- and postoperative complications [12]. TMTD were less successful in women of this age group, which is due to the limited ability to exercise (in our case – 3 %); exercises were performed without an instructor. Let’s found the use of containment as the least rational in this age group (36 % less than the MUS).

Analysis of life quality of women before and after SUI correction was given key importance. Thus, on the basis of a questionnaire using UDI-6/IIQ-7, indicators of the condition of the lower urinary tract of women, differentiated by age, and the impact on life quality before and after treatment were obtained, which was used to compile a hierarchy of treatments.

The results of the life quality impact assessment were distributed as follows. The averages UDI-6/IIQ-7 in the main group of surgical treatment before the MUS were 24.0/23.8, and 1.5–2 years after the MUS were 7.2/8.2, respectively; draws attention to the significant uniform improvement both in terms of urogynecological complaints (3.3 times) and in terms of life quality (2.9 times).

In 1 subgroup of comparison (PFMT group), the averages of UDI-6/IIQ-7 were 18.1/22.2 before training, and 17.4/12.7 – 3–6 months after the transfer of the proposed methods of PFMT. Noteworthy is the slight improvement in urogynecological complaints (17.4 after PFMT against 18.1 in PFMT - by 3.9 %), but noted a moderate improvement in quality of life (by 42.8 %), which may indicate a change in attitudes to their complaints and independent improvement of life quality. None of the women used all the proposed methods of PFMT; none of the women used at least one of the proposed methods of PFMT completely.

Because 2 subgroup of comparison (containment group) was selected from women in which surgical treatment was unsuccessful and which did not use or used only partially PFMT, the averages urogynecological complaints/life quality in women who used pads every day were 31.9/34.9.

When ranking by age, changes in the life quality of women who resembled SUI correction in different ways looked like this.

Young women who underwent surgical treatment - women of the main group– noted a significant improvement in life quality, UDI-6/IIQ-7 before and after surgical treatment were 24.0/23.8 and 7.2/8.2, respectively. In women of the same age who underwent PFMT – women of the 1 subgroup of comparison – the indicators of UDI-6/IIQ-7 before and during the use of PFMT were 16.7/13.1 and 14.6/7.1. Women who used absorbent pads - women of the 2 subgroup of comparison - used pads only occasionally and UDI-6/IIQ-7 was 14.6/7.1, respectively.

Middle-aged women belonging to the main group and having the highest number of operated – 54.5 % – showed the best comparative results in this type of treatment – UDI-6/IIQ-7 before and after treatment were 33.3/38.1 and 6.8/8.3, respectively. Women of the same age did not report an improvement in urological complaints, but noted an improvement in life quality when using PFMT, there were 20.8/40.5 and 22.9/23.8, respectively. Women who did not undergo surgical treatment used pads every day and their urological complaints/life quality averages were 31.9/34.9.

Elderly women belonging to the main group rated their condition before surgery at 14.6/9.4, after treatment – at 8.3/7.9 points of the questionnaires UDI-6/IIQ-7, respectively, which indicates moderate improvement in urological complaints (by 43 %), and slight improvement in quality of life (by 17 %). This may indicate that older women have been adapted to urogynecological complaints and have not perceived complaints of urinary loss as strongly affecting their lifestyle.

**Study limitations.** The study was not performed in case of complicated SUI.

**Prospects and directions of research development.** Further research in improving the treatment of women with SUI should be considered to continue to improve treatment methods and their comprehensive evaluation with the inclusion of a larger number of relevant criteria.

## 5. Conclusions

1. A formal differentiated approach is developed to the management of women of different ages with SUI, aimed at improving their life quality.

2. The approach is based on the consistent determination of the priorities of treatment criteria that meet the standards of evaluation of treatment methods, and the determination of the hierarchy of treatment methods. The choice of parameters for prioritizing treatment methods in relation to life quality took into account the recommendations of the UDI-6/IIQ-7 questionnaires.

3. The most rational method of treatment of women with SUI of the studied methods is the surgical method of treatment by MUS; its isolated use is sufficient to improve the life quality of young and elderly women. For middle-aged women, it is rational to use PFMT methods with MUS. The use of containment (absorbent pads) is the least rational method of treating women with SUI for women of all ages, including the elderly.

## Conflict of interest

The authors declare that they have no conflicts of interest.

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