

Influence of Patient's Age on the Outcome of Vaginal and Laparoscopic Procedures in Urogynaecology

Einfluss des Patientenalters auf das Outcome vaginaler und laparoskopischer Eingriffe in der Urogynäkologie



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ABSTRACT

Introduction In the treatment of prolapse and incontinence, the choice of surgical procedure often depends not only on the clinical findings but also on the age of the patient. Uncertainty exists at present regarding the effect of patient age on treatment outcomes for both vaginal and laparoscopic procedures. The aim of this study is therefore to compare both the anatomical outcome after prolapse surgery and the functional outcome after incontinence surgery in the context of the treatment of stress urinary incontinence in older and younger patients.

Patients/Methods This is a retrospective single-centre study conducted at a university site. Over the study period, a total of 407 women underwent surgery, 278 of whom were < 70 and 129 ≥ 70 years of age. They were assigned to one of three treatment groups (prolapse surgery, incontinence surgery or a combination of both types of surgery) and were then subjected to statistical analysis after assessment of the anatomical and functional outcome after 3–6 months.

Results The most common form of prolapse among the 407 evaluated patients was in the anterior and middle compartment, with a higher degree of severity being diagnosed in the older patients. Grade 4 prolapse according to the Baden-Walker system was thus present in the anterior compartment in 15.6 vs. 28.8% ($p = 0.033$) and in the middle compartment in 5.7 vs. 23.7% ($p < 0.001$) of cases. Younger women underwent vaginal mesh implantation less frequently and laparoscopic sacropexy more frequently for this overall. The proportion of cases of combined prolapse and incontinence surgery was the same in both groups. Overall, high success rates were observed in both younger and older patients following prolapse and incontinence surgery. These rates were 93.5 vs. 84.8% ($p = 0.204$) after prolapse surgery and 92.8 vs. 84.2% ($p = 0.261$) after incontinence surgery. A significant disadvantage for the older patients was the persistence of stress urinary incontinence after prolapse surgery alone (19.6 vs. 50%, $p = 0.030$) and the rate of occult (de novo) stress urinary incontinence (7.4 vs. 20%, $p = 0.030$).

Conclusion Our data show that both pelvic organ prolapse and stress urinary incontinence can be treated with surgery with good results in women aged ≥ 70 years. It was thus possible to show for the first time in a large patient population that older women should not be denied appropriate surgery but can be offered the same range of surgical options as younger patients.

ZUSAMMENFASSUNG

Einleitung Bei der Behandlung von Deszensus und Inkontinenz hängt das gewählte Operationsverfahren häufig nicht nur vom klinischen Befund, sondern auch vom Alter der Patientin ab. Bislang besteht sowohl für vaginale als auch laparoskopische Eingriffe Unklarheit bezüglich des Therapieerfolgs in Abhängigkeit vom Patientenalter. Ziel dieser Arbeit ist es daher, sowohl den anatomischen Erfolg nach Deszensusoperationen als auch das funktionelle Outcome nach Inkontinenzoperationen im Rahmen der Behandlung von Belastungsinkontinenz bei älteren und jüngeren Patientinnen zu vergleichen.

Patientinnen/Methodik Es handelt sich um eine retrospektive monozentrische Studie aus einem universitären Zentrum. Im Untersuchungszeitraum wurden insgesamt 407 Patientinnen operativ behandelt, darunter 278 <70-Jährige und 129 ≥ 70 -Jährige. Diese wurden in 3 Behandlungsgruppen aufgeteilt (Deszensusoperation, Inkontinenzoperation oder eine Kombination beider Operationsmethoden) und nach Bewertung des anatomischen und funktionellen Outcomes nach 3–6 Monaten statistisch ausgewertet.

Ergebnisse Die häufigste Form des Deszensus bei den 407 ausgewerteten Patientinnen lag im Bereich des vorderen und mittleren Kompartiments, wobei bei den älteren Patientinnen ein höherer Schweregrad diagnostiziert wurde. So lag ein Deszensus Grad 4 nach Baden Walker im vorderen Kompartiment in 15,6 vs. 28,8% ($p = 0,033$) und im mittleren Kompartiment in 5,7 vs. 23,7% ($p < 0,001$) vor. Jüngere Frauen erhielten insgesamt seltener eine vaginale Netzeinlage, dafür häufiger eine laparoskopische Sakropexie. Der Anteil kombinierter Eingriffe aus Deszensus- und Inkontinenz-OP waren in beiden Gruppen gleich. Insgesamt zeigten sich sowohl bei den jüngeren als auch bei den älteren Patientinnen hohe Erfolgsraten nach Deszensus- sowie Inkontinenzoperationen. Diese lagen nach einer Deszensusoperation bei 93,5 vs. 84,8% ($p = 0,204$) und nach einer Inkontinenzoperation bei 92,8 vs. 84,2% ($p = 0,261$). Ein signifikanter Nachteil für die älteren Patientinnen bestand in der Persistenz einer Belastungsinkontinenz nach alleiniger Deszensusoperation (19,6 vs. 50% $p = 0,030$) sowie bei der Rate der larvierten (De-novo-)Belastungsinkontinenz (7,4 vs. 20% $p = 0,030$).

Schlussfolgerung Unsere Daten zeigen, dass sowohl der Deszensus genitalis als auch die Belastungsinkontinenz bei ≥ 70 -Jährigen mit guten Ergebnissen operativ versorgt werden können. Damit konnte an einer großen Patientenzahl erstmals gezeigt werden, dass den älteren Patientinnen eine adäquate Operation nicht vorenthalten werden sollte, sondern diesen das gleiche operative Spektrum angeboten werden kann wie den jüngeren Patientinnen.

Introduction

Functional pelvic floor disorders in the form of prolapse and urinary incontinence are common in the female population [1]. According to current data, the average lifetime risk of a woman developing urinary incontinence for which treatment is indicated is 13.6%, the peak age group being 71–72 years. The average risk of developing prolapse for which treatment is indicated is 12.6% with the age-specific risk increasing up to the age of 75 years [2].

In older people, besides considerably impairing quality of life, prolapse and urinary incontinence are often associated with a variety of medical, social and economic problems and constraints which can even have a detrimental effect on the mental state of those affected [3, 4].

In Germany, urinary incontinence represents the second most important reason for receiving nursing care at home, after loss of mobility; up to 50% of admissions to elderly care homes are as a direct or indirect result of incontinence, and approx. 25% of the working day of the care staff in these homes is taken up by dealing with incontinence [5–7]. Going forward, there is reason to believe that the trend will continue as a result of the anticipated continuing increase in life expectancy, since statistical data illustrate the global demographic trend towards longevity [5, 8]. The higher life expectancy of women leads to a shift in the gender balance in fa-

vour of women in old age and thus also to an increasing demand for treatment for urogynaecological conditions [9].

Although conservative treatment is often not sufficient for prolapse or incontinence, older patients are often denied access to surgical measures on age grounds alone and because of fears of the possible complications of surgery [10]. Besides this reluctance to select patients for surgery, uncertainty exists with regard to the anatomical and functional outcome of treatment to be expected in older compared with younger patients. This also applies in particular to the outcome to be expected with regard to bladder function after prolapse surgery. Not only is the number of previously published studies on this subject small, but the results are conflicting in some cases and there is insufficient comparability because of differences in methodology [11, 12].

For this reason, the aim of this study is to compare both the anatomical outcome after prolapse surgery and the functional outcome after incontinence surgery in the treatment of stress urinary incontinence in older and younger patients.

Material and Methods

This retrospective study involved recording the data of all urogynaecological patients who had undergone surgical treatment for symptomatic pelvic organ prolapse (POP-Q \geq II, B–W \geq 2), pure stress urinary incontinence or both conditions simultaneously in

the Department of Gynaecology of Saarland University. As a general rule, the stress urinary incontinence was diagnosed and further evaluated by means of urodynamic studies and the Bonney test. In the case of borderline findings, a pad test was also used. The single inclusion criterion for the study was surgical treatment performed for the aforementioned indications. Patients with mixed urinary incontinence were excluded. The patient data were collected consecutively.

Patient population

All data for the period from July 2012 to the end of December 2014 were evaluated. The study period was therefore 2½ years. With the end of acquisition period on 30.06.2015, the postoperative follow-up period, during which the surgical outcome was recorded and assessed, is between 3 and 6 months.

The age cutoff for distinguishing between younger and older patients was 70. Over the study period, a total of 407 women underwent surgery, 278 of whom were <70 and 129 ≥70 years of age.

Procedures performed

For patients suffering from a combination of symptomatic prolapse and concomitant stress urinary incontinence, we generally recommended a two-stage procedure. This involves first surgically repairing the prolapse and then reassessing the stress urinary incontinence and, if necessary, treating it by means of incontinence surgery. In selected cases, e.g. where the level of suffering was very high or if a patient requested it specifically, a one-stage procedure was also sometimes selected, i.e. the incontinence and prolapse surgery were combined.

Three treatment groups were defined in this study to assess the outcome: patients undergoing prolapse surgery, incontinence surgery or a combination of the two types of surgery. The data were compared between the two age groups, the younger (<70 years) and the older (≥70 years) patients.

Data entry and evaluation

In all cases, prolapse quantification was carried out in accordance with the Baden–Walker half-way system (B–W). Quantification in accordance with the Pelvic Organ Prolapse Quantification System (POP-Q) was also carried out by the Head of the Urogynaecology Section. It was the aim of this study to define treatment success after prolapse surgery as POP-Q ≤ I based on the criteria of the International Continence Society (ICS).

The data were taken from both the digitised outpatient and the inpatient documentation. Details of the applied procedures, the intraoperative course and potential complications were obtained from the operative report in the patient's chart. The patients' ASA score was documented in the anaesthetic record. We defined the length of stay in hospital as the time from postoperative day 1 up to and including the day of discharge.

The surgical outcome was derived from the findings of the postoperative examination performed during the inpatient stay before discharge. As part of this final examination, an ultrasound measurement of residual urine was also performed and specific questions were asked about continence. All patients were asked to attend the Urogynaecology Clinic for follow-up 3 months after

surgery, to enable any early recurrences or postoperative complications to be documented.

Any occurrence of occult stress urinary incontinence after prolapse surgery was also assessed and the outcome of pre-existing stress urinary incontinence determined within the context of postoperative follow-up.

The statistical analysis was performed using IBM SPSS Version 22. The t-test was used for continuous variables, provided that they were approximately normally distributed, and the Mann-Whitney U test when the data did not have an approximately normal distribution. Descriptive statistics were described in terms of mean and standard deviation for normally distributed data and median and interquartile range (IQR) for non-normally distributed data. Group differences in the case of categorical variables were evaluated using the χ^2 test. If the expected frequency here was <5 for at least one field, Fisher's exact test was used. The distribution of the categorical variables was described in terms of the absolute number and the percentage.

Results

Characteristics of the patient population

During the study period, 407 urogynaecological operations were evaluated in total, with 278 of the patients (68.3%) falling into the younger and 129 (31.7%) into the older (≥70 years) group. The mean age in both groups was 55.60 ± 8.94 and 75.41 ± 4.05 years respectively.

The ASA score was used as a proxy measure for pre-operative comorbidity. Overall, significantly more younger patients were classified as ASA I (11.2 vs. 0.8%; $p = 0.001$) or ASA II (77.3 vs. 60.9%; $p = 0.003$), and these patients were classified more rarely as ASA III (11.5 vs. 37.5%; $p < 0.001$). In addition, the data relating to the detailed obstetric and hormonal history were also collected (► **Table 1**).

Patients' previous surgical history

Overall, 14.7% of the younger and 26.4% of the older patients had had at least one operation for prolapse in the anterior compartment ($p = 0.026$). The most frequent previous procedure in both age groups was anterior colporrhaphy. The use of mesh in the anterior vaginal compartment was found more frequently in the history of the older patients (2.2 vs. 4.7%).

7.2% of the younger and 12.4% of the older patients ($p = 0.142$) reported at least one previous operation for prolapse in the middle compartment. With regard to differences in history of surgery in the posterior compartment, no statistical significance could be established despite a higher incidence in older compared with younger patients (15.5 vs. 8.3%).

On the other hand, only 7.2% of the younger and 6.2% of the older patients had undergone surgical treatment for stress urinary incontinence prior to the study ($p = 0.887$). At 48.8%, the percentage of patients with a history of hysterectomy was significantly higher in the older patient group than in the younger group (34.2% [$p = 0.002$]). The most frequent surgical approach in both groups was the vaginal approach (► **Table 2**).

► **Table 1** General patient data.

Age group	< 70 years		≥ 70 years		p-value
Parameter		[n]		[n]	
Age	55.60 ± 8.94	[278]	75.41 ± 4.05	[129]	
BMI	27.20 ± 4.72	[278]	26.97 ± 4.05	[129]	0.658 ^t
ASA score		[278]		[128]	
▪ I	31 (11.2)		1 (0.8)		0.001 ^c
▪ II	215 (77.3)		78 (60.9)		0.003 ^c
▪ III	32 (11.5)		48 (37.5)		<0.001 ^c
▪ IV	0 (0.0)		1 (0.8)		0.401 ^f
Number of births	2 [1–2]	[277]	2 [2–3]	[125]	0.032 ^m
Mode of delivery					
▪ Spontaneous	2 [1–2]	[277]	2 [2–3]	[125]	0.005 ^m
▪ Caesarean	0 [0–0]	[277]	0 [0–0]	[125]	0.006 ^m
▪ VE/forceps	0 [0–0]	[277]	0 [0–0]	[125]	0.098 ^m
BW ≥ 4000 g	0 [0–0]	[277]	0 [0–0]	[125]	0.628 ^m
BW ≥ 4500 g	0 [0–0]	[277]	0 [0–0]	[125]	0.717 ^m
Multipara (≥ 3)	68 (24.5)	[277]	46 (36.8)	[125]	0.029 ^c
Years PMP	6.74 ± 6.88	[196]	24.36 ± 6.57	[74]	<0.001 ^t
Current HRT	33 (16.1)	[205]	10 (8)	[125]	0.066 ^c

VE = vacuum extraction; BW = birth weight; PMP = post menopause; HRT = hormone replacement therapy

[n] = reference data count; expressed as: mean ± standard deviation, median [IQR] or number (%).

^t = t-test; ^m = Mann-Whitney U; ^c = χ^2 ; ^f = Fisher's exact test; p-values adjusted to "fdr".

Pre-operative prolapse findings

The most frequently diagnosed form of prolapse was in the anterior and middle compartment, the distribution of prolapse between the different compartments remaining the same regardless of age group.

The severity of anterior and middle compartment prolapse did differ significantly between the younger and older groups, however. The descent in the anterior compartment corresponded to Baden-Walker grade 4 in 15.6% of the younger and 28.8% of the older women ($p = 0.033$). Grade 4 prolapse in the middle compartment was found in 5.7% of the younger and 23.7% of the older women ($p < 0.001$) (► **Table 3**).

Depending on the examiner, an additional quantification of the prolapse was also carried out in accordance with POP-Q. This was available for analysis for 45.3% of the younger and 45.8% of the older patients. ► **Table 3** also provides a comparison of the different stages between the age groups.

Surgical procedures used

Younger patients presented more frequently with stress urinary incontinence for which treatment was indicated, whereas the older patients presented more frequently with prolapse for which treatment was indicated. As a result, 30.9% of the younger and just 8.5% of the older patients underwent incontinence surgery ($p < 0.001$). On the other hand, 60.1% of the <70-year-olds and as many as 85.3% of the ≥70-year-olds underwent prolapse surgery ($p < 0.001$).

With regard to the choice of procedure, the method used most frequently to treat stress urinary incontinence was suburethral sling implantation in both groups (76.7 and 90.9%).

Significant differences were identifiable between the two age groups in terms of the choice of prolapse surgery, however. Vaginal mesh implantation was less frequent among the younger than among the older patients (19.8 vs. 42.7%; $p < 0.001$), with anterior mesh being the most common form in both groups.

Laparoscopic sacropexy was performed significantly more frequently in the younger patients, on the other hand (40.1 vs. 24.5%; $p = 0.016$). The most common type of sacropexy performed was cervicosacropexy.

With regard to procedures performed with autologous tissue and also in respect of concurrent procedures carried out, no statistically significant difference could be identified between the two groups (► **Table 4**).

The percentage of patients who underwent a combined procedure was 90% in the <70-year-old and 6.2% in the ≥70-year-old age group. In both age groups, the most frequent combination was colporrhaphy with a form of suburethral sling, followed by laparoscopic sacropexy and Burch colposuspension as a single-stage procedure (► **Table 4**).

Peri-operative data

The average operative time was 91.06 ± 65.57 minutes for the younger patients and 96.64 ± 64.35 minutes for their older counterparts ($p = 0.643$). In the comparison of both groups, we found

► **Table 2** Surgical history.

Age group	< 70 years [n = 278]	≥ 70 years [n = 129]	p-value
Previous surgery for incontinence			
▪ Suburethral slings	14 (5)	3 (2.4)	
▪ Burch colposuspension*	6 (2.2)	3 (2.3)	
▪ MMK**	0 (0.0)	2 (1.6)	
▪ At least one previous operation	20 (7.2)	8 (6.2)	0.887 ^c
▪ ≥ 2 previous operations	0 (0.0)	2 (1.6)	0.142 ^f
Previous surgery for prolapse			
In the anterior compartment			
▪ With mesh	6 (2.2)	6 (4.7)	
▪ Without mesh	32 (11.5)	26 (20.2)	
▪ Both	3 (1.1)	2 (1.6)	
▪ At least one previous operation	41 (14.7)	34 (26.4)	0.026^c
▪ ≥ 2 previous operations	6 (2.2)	4 (3.1)	0.829 ^f
In the middle compartment			
▪ With mesh	11 (4.0)	6 (4.7)	
▪ Without mesh	8 (2.9)	10 (7.8)	
▪ Both	1 (0.4)	0 (0.0)	
▪ At least one previous operation	20 (7.2)	16 (12.4)	0.142 ^c
▪ ≥ 2 previous operations	2 (0.7)	0 (0.0)	1 ^f
In the posterior compartment			
▪ With mesh	5 (1.8)	4 (3.1)	
▪ Without mesh	17 (6.1)	14 (10.9)	
▪ Both	1 (0.4)	2 (1.6)	
▪ At least one previous operation	23 (8.3)	20 (15.5)	0.104 ^c
▪ ≥ 2 previous operations	2 (0.7)	4 (3.1)	0.141 ^f
History of hysterectomy			
▪ Vaginal	59 (21.2)	38 (29.5)	
▪ Abdominal	22 (7.9)	23 (17.8)	
▪ LASH	9 (3.2%)	2 (1.6%)	
▪ TLH	5 (1.8)	0 (0.0)	
▪ Total	95 (34.2)	63 (48.8)	0.002^c

* open and laparoscopic colposuspension; ** Marshall-Marchetti-Krantz; LASH = laparoscopic supracervical hysterectomy; TLH = total laparoscopic hysterectomy; n = reference data count; expressed as number and (%).

^c = χ^2 ; ^f = Fisher's exact test; p-values adjusted for "fdr".

the operative time respectively, 109.32 ± 59.75 and 101.24 ± 60.93 minutes ($p = 0.643$) for prolapse and 39.84 ± 35.09 and 33.09 ± 21.05 minutes for incontinence.

The postoperative reduction in the Hb level was 1.13 ± 0.77 g/dl in the younger and 1.24 ± 0.89 g/dl in the older group ($p = 0.343$). There was therefore no significant difference either in the length of surgery or the reduction in the Hb level.

The length of stay in hospital did differ between the two age groups, however. The median was 5 [3.50–7.00] days for the younger and 6 [2.25–8.75] days for the older patients ($p < 0.001$) (► **Table 5**).

Success after prolapse surgery

In this study, success after prolapse surgery was defined as $POP-Q \leq I$. Only those cases in which pre- and postoperative POP-Q findings were recorded were used for the analysis. This applied to 77 patients in the younger and 46 in the older age group, the success rate being 93.5% in the < 70-year-old and 84.8% in the ≥ 70-year-old patients ($p = 0.204$). Separate assessment of prolapse surgery alone and in combination with incontinence surgery also failed to reveal any significant difference between the two age groups. The success rate in younger vs. older patients was 93.8 and 84.1% respectively after prolapse surgery alone

► **Table 3** Pre-operative findings for prolapse.

Parameter	Total	n				
According to Baden–Walker						
			1	2	3	4
Anterior compartment						
▪ Age < 70	[192]	160 (83.3)	32 (16.7)	59 (30.7)	39 (20.3)	30 (15.6)
▪ Age ≥ 70	[118]	101 (85.6)	12 (10.2)	26 (22.0)	29 (24.6)	34 (28.8)
▪ p-value			0.264 ^c	0.264 ^c	0.638 ^c	0.033 ^c
Middle compartment						
▪ Age < 70	[192]	153 (79.7)	35 (18.2)	63 (32.8)	44 (22.9)	11 (5.7)
▪ Age ≥ 70	[118]	93 (78.8)	12 (10.2)	28 (23.7)	25 (21.2)	28 (23.7)
▪ p-value			0.230 ^c	0.256 ^c	0.959 ^c	<0.001 ^c
Posterior compartment						
▪ Age < 70	[192]	109 (56.8)	52 (27.1)	34 (17.7)	16 (8.3)	7 (3.6)
▪ Age ≥ 70	[118]	68 (57.6)	29 (24.6)	20 (16.9)	10 (8.5)	9 (7.6)
▪ p-value			0.920 ^c	1 ^c	1 ^c	0.328 ^c
In accordance with POP-Q stage after ICU						
			I	II	III	IV
▪ Age < 70	[87]	87 (100)	1 (1.1)	30 (34.5)	51 (58.6)	5 (5.7)
▪ Age ≥ 70	[54]	54 (100)	11 (1.9)	7 (13.0)	35 (64.8)	10 (18.5)
▪ p-value			1 ^f	0.033 ^c	0.703 ^c	0.095 ^c

n = number and (%); ^c = χ^2 ; ^f = Fisher's exact test; p-values adjusted for "fdr".

($p = 0.204$) and 92.3 and 100% respectively after combined surgery ($p = 1$).

Success after incontinence surgery

The success rate after incontinence surgery, defined as complete cure of incontinence and restoration of voiding without residual urine (residual urine < 50 ml), was 92.8% among < 70-year-old and 84.2% among ≥ 70-year-old patients ($p = 0.261$). The assessment was carried out as part of the discharge examination on the basis of a cough stress test with natural bladder filling and ultrasound measurement of postvoid residual urine. The same investigations were repeated as part of the follow-up examination. Separate assessment of incontinence surgery alone and in combination with prolapse surgery failed to reveal any significant difference between the two age groups. The success rates for younger vs. older patients were thus 94.2 and 100% respectively after incontinence surgery alone ($p = 1$) and 88 and 62.5% respectively after combined surgery ($p = 0.204$).

Urinary incontinence after prolapse surgery alone

In order to assess bladder function after prolapse surgery, the data of all 167 < 70-year-old and 110 ≥ 70-year-old patients who had undergone prolapse surgery alone were analysed. This revealed pre-existing stress urinary incontinence in 27.5% of the younger and 27.3% of the older patients. After prolapse surgery, the pre-existing stress urinary incontinence was cured in 80.4% of the younger and 50% of the older patients ($p = 0.030$). In other words,

the persistence of stress urinary incontinence was 19.6% in the younger and 50% in the older patient group (► **Table 6**).

The occurrence of occult (de novo) stress urinary incontinence was identified considerably more frequently in older than in younger patients (7.4 vs. 20%, $p = 0.03$) (► **Table 6**).

Discussion

This study examined the effect of patient age on the outcome of vaginal and laparoscopic procedures in urogynaecology, taking a closer look at the fact that, as a rule, older women have been and continue to be denied the opportunity of urogynaecological surgery. In addition, the influence of prolapse surgery on bladder function was studied and compared between younger and older patients.

These investigations show that the caution exercised in the past in selecting older patients for such operations needs to be reconsidered because these patients are clearly just as likely as their younger counterparts to benefit greatly. Furthermore, the results obtained in a large patient population within the scope of this study also indicate that the separation of prolapse and incontinence surgery into a two-stage procedure remains a sensible approach as a rule – a single-stage procedure appears at best to be an alternative treatment option for the elderly patient.

The choice of 70 years as the age cutoff for distinguishing between younger and older patients is based on the definition of geriatric patients applied in Germany, which uses an age cutoff

► **Table 4** The surgical procedures used.

Surgical procedures	< 70	≥ 70	p-value
All procedures	n = 278	n = 129	
Incontinence surgery	86 (30.9)*	11 (8.5)*	< 0.001 ^c
▪ Suburethral slings	79 (91.9)	11 (100)	
▪ LSC colposuspension	7 (8.1)	0 (0.0)	
Prolapse surgery	167 (60.1)*	110 (85.3)*	< 0.001 ^c
Vaginal meshes	33 (19.8)	47 (42.7)	< 0.001 ^c
▪ Anterior mesh	17 (51.5)	23 (48.9)	
▪ Posterior mesh	6 (18.2)	5 (10.6)	
▪ Total mesh	10 (30.3)	19 (40.4)	
LSC sacropexy	67 (40.1)	27 (24.5)	0.016 ^c
▪ LSC colposacropexy	16 (23.9)	11 (40.7)	
▪ LSC cervicosacropexy	43 (64.2)	13 (48.1)	
▪ LSC hysterovacropexy	8 (11.9)	3 (11.1)	
Repair with autologous tissue	67 (40.1)	36 (32.7)	0.354 ^c
▪ Colporrhaphy	31 (46.3)	18 (49.9)	
▪ Amreich-R. ± colporrhaphy	14 (20.9)	13 (36.1)	
▪ McCall ± colporrhaphy	22 (32.8)	5 (13.9)	
Combined prolapse and incontinence surgery	25 (9.0)*	8 (6.2)*	0.509 ^c
▪ LSC sacropexy + colposuspension	4 (16.0)	3 (37.5)	
▪ Colporrhaphy + suburethral sling	9 (36.0)	5 (62.5)	
▪ McCall + colposuspension	3 (12.0)	0 (0.0)	
▪ LSC lateral repair + colposuspension	7 (28.0)	0 (0.0)	
▪ Other	2 (8.0)	0 (0.0)	
Concurrent procedures	140 (50.4)	60 (46.5)	0.523 ^c

n = number; expressed as n = number and (%); percentages relate to the next higher category in each case

* percentage relates to the entire age group; ** percentage relates to prolapse surgery

TVT = tension free vaginal tape; TVT-O = transobturator TVT; LSC = laparoscopic; p-value adjusted for “fdr”.

Statistical test methods: ^c = χ^2 ; p-values adjusted for “fdr”.

of 70 years in addition to the presence of other criteria to make the distinction [13].

What is unusual about the data presented here is the extraordinarily high proportion of older patients in the study population. Unlike most other of the other studies [14, 15] on this subject, the percentage of ≥ 70-year-olds in this study is 31.7%. Because these older patients, despite often having poorer general health, were offered the same range of treatments as their younger counterparts, the statements that can be made about the older patient group on the basis of these data are particularly valid. The range of comorbidities existing prior to treatment was similar to that in other studies, both in terms of the ASA classification and with regard to the pre-operative local findings. In other words, within the study population, older patients were classified more frequently as ASA III and had significantly more severe prolapse in the anterior and middle compartment than their younger counterparts [15–19].

Regarding the surgical procedure used, older patients with prolapse also underwent reconstructive procedures (maintaining coital function), both for primary and recurrent prolapse. This

means that, unlike in other studies [15, 19], obliterative procedures such as colpocleisis were avoided as a rule in favour of functional reconstruction. In terms of the choice of mesh-based reconstructive procedure, however, vaginal mesh implantation was performed more frequently in the older patients and laparoscopic sacropexy in their younger counterparts. The reason for this was that the use of vaginal mesh implants tends to be indicated in more severe forms of prolapse and recurrences, which occur more frequently in the ≥ 70-year-old age group. In addition, vaginal mesh implantation can be carried out under spinal anaesthesia, thereby avoiding general anaesthesia in very old patients (► **Tables 3 and 4**).

The procedure most used for treating stress urinary incontinence was the suburethral sling for all patients, with a retropubic, transobturator or adjustable sling being indicated on the basis of clinical criteria alone, not age. Because of the much longer duration of the operation and the need for general anaesthesia, laparoscopic colposuspension was offered only to younger patients, however (► **Table 4**).

► **Table 5** Peri-operative patient data.

Age group	< 70 years		≥ 70 years		p-value
Parameter		[n]		[n]	
Length of surgery (min)					
▪ All operations	91.06 ± 65.57	[278]	96.64 ± 64.35	[129]	0.643 ^t
▪ Prolapse surgery	109.32 ± 59.75	[167]	101.24 ± 60.93	[110]	0.643 ^t
▪ IC surgery	39.84 ± 35.09	[86]	33.09 ± 21.05	[11]	0.634 ^t
▪ Prolapse and IC surgery	140 [67.5–219.5]	[25]	60.50 [40.8–233.8]	[8]	0.643 ^m
Hb reduction (g/dl)	1.13 ± 0.77	[247]	1.24 ± 0.89	[125]	0.343 ^t
Length of stay (d)	5 [3.5–7.0]	[278]	6 [2.3–8.8]	[129]	< 0.001 ^m

[n] = reference data count; min = minutes; IC = incontinence

Expressed as mean ± standard deviation, median and [IQR]

^t = t-test; ^m = Mann-Whitney U; p-values adjusted for “fdr”.

► **Table 6** Postoperative outcome.

Age group	< 70 years		≥ 70 years		p-value
Parameter		[n]		[n]	
Success after IC surgery	103 (92.8)	[111]	16 (84.2)	[19]	0.261 ^f
▪ IC surgery	81 (94.2)	[86]	11 (100)	[11]	1 ^f
▪ Concurrent POP/IC surgery	22 (88.0)	[25]	5 (62.5)	[8]	0.204 ^f
Success after POP surgery	72 (93.5)	[77]	39 (84.8)	[46]	0.204 ^c
▪ POP surgery	60 (93.8)	[64]	37 (84.1)	[44]	0.204 ^f
▪ Concurrent POP/IC surgery	12 (92.3)	[13]	2 (100)	[2]	1 ^f
Development of SIC after POP surgery		[167]		[110]	
▪ Pre-existing SIC cured	37 (80.4)	[46]	15 (50)	[30]	0.030 ^c
▪ Persistence of pre-existing SIC	9 (19.6)	[46]	15 (50)	[30]	0.030 ^c
▪ De novo SIC	9 (7.4)	[121]	16 (20)	[80]	0.030 ^c

[n] = reference data count; POP = pelvic organ prolapse; IC = incontinence; SIC = stress urinary incontinence

Expressed as number (%)

Success is defined: after POP surgery in accordance with POP-Q ≤ I/Baden–Walker ≤ grade 1; success after SIC surgery restoration of continence.

^c = χ^2 ; ^f = Fisher's exact test; p-values adjusted for “fdr”.

Regardless of the age group, analysis of the pre-operative data shows that, as expected, there is no difference between the two groups in terms of the length of surgery and the postoperative reduction in Hb levels. This is also confirmed by other authors in this way [16, 18–20].

The length of stay in hospital was admittedly longer for the older than for the younger patients. This was not for medical or surgery-related reasons in most cases, however, but was due to the logistical situation at home. Because of the different comorbidities and definitions of age in the published data, the literature on this subject is somewhat heterogeneous. For example, some authors have also reported longer stays in hospital for older patients [14, 19, 21], and others not [18].

The main focus of this study is postoperative outcomes, however. It was thus possible to show that, in specialist Urogynaecology Departments with a high level of expertise, ≥ 70-year-old pa-

tients can be offered the same surgical procedures as their younger counterparts and a similar success rate can be expected, in the short and medium term at least. Despite the greater severity of pre-operative prolapse generally found in ≥ 70-year-old patients, the postoperative outcome achieved was as good as in younger patients. Other authors have reached a similar conclusion in some cases, although in much smaller patient populations. For example, the success rate following prolapse surgery in one study, at 84.4%, was similar to that in this study with the same definition of success as POP-Q stage ≤ stage I, or slightly higher (93%) with a less strict definition of success as POP-Q stage ≤ stage II [20, 22, 23].

Other recent studies on outcome and patient safety following prolapse and incontinence surgery have, like our study, been able to show that a similarly good outcome can be achieved in very old patients to that in younger patients. Of particular significance in

this respect are the studies which have selected a very high age cutoff of 80 years for the comparison [24,25].

Similar results were observed for incontinence surgery. Despite a strict definition of success as complete restoration of urinary continence and voiding without residual urine, a good success rate was observed in both groups with no statistically significant difference based on age. Taking into account other studies, this quite clearly indicates that the clinical practice applied in many cases should be reconsidered and that older patients should not be denied access to appropriate surgery [11,26].

It is generally unclear in the literature whether, in patients with existing prolapse with concomitant incontinence, normal bladder function is more likely to be restored by a single- or two-stage surgical approach. It therefore seems that neither approach will always be the right one and for all patients. What does seem clear on the basis of these data, however, is that patient age has a direct influence on bladder function after prolapse surgery. Of course, the poorer incontinence rate after prolapse surgery frequently cited in discussions on the subject might in principle also be caused by the higher rate of revision surgery in the older patient group.

In the case of a differentiated approach, the results for pre-existing and de novo stress urinary incontinence must be considered separately.

With regard to pre-existing stress urinary incontinence, the available data show that incontinence resolved as a result of prolapse treatment in the majority of cases involving young and as many as half of the cases involving older patients. Consideration should therefore be given to a combined procedure.

According to Dwyer (2012), 10 women would have to receive TVT concurrently with prolapse surgery in order to prevent just one patient from needing follow-up surgery for this 2–4 years after the prolapse surgery [27].

The incidence of de novo stress urinary incontinence was also considerably higher among the older patients. The data of Lo et al. (2015) point to a similar result: The risk of de novo stress urinary incontinence after prolapse surgery was 2.86 times higher in women > 66 years of age than in their younger counterparts [28].

A certain bias is possible in the interpretation of the data because the procedures performed are, of course, generally of an elective nature. It must therefore be assumed that a selection bias existed in the elderly patient group based on their general state of health, because seriously ill patients do not generally attend Urogynaecology Clinics. Nevertheless, our results show clearly that postoperative success can also be achieved in older patients. Provided that they were healthy enough, surgery should not be ruled out due to high age alone. In the case of prolapse, these patients should also not be offered obliterative surgery automatically either.

In summary, it can be said that the data presented here make an important contribution to answering the question of urogynaecological surgery outcome in elderly patients. Going forward, the evaluation needs to be confirmed on a prospective basis. Until these results are available, however, there are good reasons on the basis of our data to suggest that both prolapse and stress urinary incontinence can be treated surgically in ≥ 70 -year-old women with good results and that these patients should be offered the

same range of surgical options as their younger counterparts. In principle, a combined surgical procedure cannot be recommended generally, although it should be considered for older patients on a case-by-case basis.

Conflict of Interest

The authors declare that they have no conflict of interest.

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