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Original Article

Outcomes of primary pelvic floor repairs in women at different ages

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Abstract

Objectives: We aimed to explore 1-year clinical and imaging outcomes among different age groups of women undergoing pelvic organ prolapse (POP) surgeries. **Materials and Methods:** We retrospectively analyzed a cohort of women undergoing primary POP surgeries. All women received preoperative as well as 12-month postoperative assessments: clinical interview, pelvic exam, and introital four-dimensional ultrasound. Women should be independent in everyday living and low-risk on preoperative assessments to be eligible for surgeries. The primary outcome was composite POP outcomes comprising lump sensation, item 3 of the short version of the Pelvic Floor Distress Inventory, and points Ba, C, and Bp on POP Quantification classification system. The secondary outcomes were postoperative adverse occurrences, symptoms of stress urinary incontinence, overactive bladder, and voiding difficulty, as well as ultrasound findings. To control potential confounders in exploring the composite outcome, we adopted a linear regression to model the dependent measure. **Results:** There were 23, 90, 268, 100, and 41 women aged <51, 51–60, 61–70, 71–80, and >80 years, respectively. One-year composite outcome and postoperative adverse occurrences were comparable among five age groups. Women of all ages achieved significant improvements in subjective and objective outcomes after surgeries. **Conclusion:** Senior women who are independent in everyday living and low in surgical risk could acquire equivalent surgical benefits compared with younger women.

Keywords: *Elderly, Independence, Pelvic floor repair, Pelvic organ prolapse, Surgery*

Introduction

Pelvic organ prolapse (POP) is frequently seen in senior women [1,2], with nearly half of women aged 50 years or older affected [1]. Factors such as decreased voluntary pelvic floor muscle contractions with older age [3] might pose risks for POP. A risk of 12.6% is estimated that women with POP will undertake POP surgery by 80 years old [2,4]. The highest rates of POP surgeries have been reported in women of 70–79 years old [4].

With people aging worldwide, there is a growing need for a better knowledge of the associated risks with POP surgeries and management planning for senior women presenting with POP. The common conditions in elderly women such as genitourinary tissue atrophy and altered defecation might raise the risks of mesh erosion, voiding difficulty, or surgical failures after POP repairs [5]. Furthermore, when seeking POP treatments, senior women might have additional aging-related conditions, such as systemic diseases, functional impairment, cognitive deficit, or frailty. Impaired cognition is correlated with severe postoperative complications including delirium, longer hospital stay, and 6-month mortality [6]. Frailty is associated with a higher rate for serious complications including cardiac complications, pneumonia, reintubation, renal complications, thromboembolism, stroke, mortality, viscus injury, blood transfusion, reoperation, readmission, and nonhome discharge [2]. It is therefore essential to elucidate not only if aging tissue would affect the efficacy or safety of POP repairs but also if geriatric comorbidities could potentially cause major postoperative medical complications.

Current surgical trials on surgical outcomes in senior patients undergoing POP surgeries are underrepresented and diverging [2,7-12]. The primary objective of our study was to survey the surgical efficacy among differently aged women who have received primary POP repairs. The secondary objective involved postoperative adverse occurrences including hemorrhage, mesh-suture exposure, pain, urinary

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tract infection (UTI), overactive bladder (OAB) symptoms, difficult voiding, stress urinary incontinence (SUI), and ultrasound findings.

Materials and methods

This research retrospectively analyzed the data of women undergoing isolated POP surgeries for symptomatic ≥ stage II POP, based on the POP Quantification (POP-Q) classification system [13], from November 2007 to January 2014 at a single medical center. The exclusion criteria included prior POP surgeries, prior or concurrent anti-incontinence surgeries, and concomitant surgeries for uterine or adnexal neoplasm. Of 786 women having undergone primary POP surgeries, 164 women were absent for follow-up, leaving 622 women for the analysis. This study was conducted in accordance with the Declaration of Helsinki. Data were categorized according to age. Ethical approval was acquired from the Cathay General Hospital institutional review board of the participating hospital (CGH-P10953). The need for informed consent was waived owing to the study's retrospective design. The methods, definitions, and units in this study all comply with the recommendations of the International Continence Society [13] unless else specified.

Eligibility for surgeries were being fully active and able to perform all predisease activities without restriction or assistance, as well as acceptable surgical risks (minimal risks for serious life-threatening events including stroke, heart attack, mortality, etc.) assessed by preoperative evaluations including urinalysis, hemogram, coagulation function, serum biochemistry, echocardiography, and chest X-ray. Women who need mobility aids were considered eligible. Women apparent with life-threatening medical issues such as congestive heart failure would be excluded from surgeries.

A single investigator (WCH) performed the POP surgeries. The choices of surgical procedures were decided after a detailed discussion between the patients and the operator, regarding the women's expectations and the location and extent of the vaginal defect. Generally, total vaginal hysterectomy performed for symptomatic ≥ stage II uterine prolapse, anterior colporrhaphy for symptomatic ≥ stage II cystocele, and posterior colporrhaphy for ≥ stage II rectocele. For stage IV cystocele, a mesh is placed if the patient consents to the procedure.

All women had received preoperative and 12-month postoperative assessments: a standardized clinical interview, pelvic examination, and introital [14] four-dimensional (4D) ultrasound.

The clinical interview focused on demographics, baseline information, pelvic floor symptoms like lump sensation, symptoms associated with storage, voiding, and postmicturition, postoperative adverse occurrences, and self-administered questionnaires. The presence of pain, UTI, and remarkable hemorrhage till 30 days after operation were considered postoperative adverse occurrences.

The impact of POP on the quality of life was investigated through self-administered questionnaires, including the short version of the Pelvic Floor Distress Inventory (PFDI) [15]. Patients ranked bother magnitude through a four-point rating scale, where 0 indicating not at all, 1 slightly, 2 moderately and 3 greatly. The answer to item 3 (Q3) of the PFID, i.e. "Usually have something falling out or a bulge that you can feel or see in your vaginal area?" was assessed separately as a subjective POP record. Postoperatively, the patients were inquired about surgery-related events such as bleeding or pain.

OAB symptoms were urgency, commonly accompanied by frequency and nocturia, without or with urgency urinary incontinence, in the absence of obvious pathology and UTI [13]. Voiding difficulty was positive when the women reported voiding symptoms such as slow stream, incomplete emptying, hesitancy, intermittency, strain to void [13], or postvoid residual >50 mL. SUI was defined as a complaint of involuntary loss of urine on physical exertion, coughing, or sneezing [13]. SUI severity was ranked through the four-level Sandvik scale [16], involving the 4-level frequency and 3-level amount of leakage. The frequency and leakage amount were, respectively, quantified by two inquiries: "How often do you experience urinary leakage?" (1: Less than once a month; 2: a few times per month; 3: a few times per week; and 4: daily and/or every night) and "How much urine do you leak each time?" (1: drips; 2: small splashes; and 3: more). Multiplication of points from two queries yields an index value ranging from 1 to 12. The index value was ranked into slight (values 1 and 2), moderate (values 3, 4, and 6), severe (values 8 and 9), and very severe (value 12) of severity.

Pelvic exam assessed women's pelvic supports through the POP-Q system during maximal straining in the dorsal lithotomy condition [13]. Mesh or suture exposure was confirmed as vaginal mesh or suture observed through separated vaginal epithelium [17]. Residual urine was estimated through ultrasound immediately after women emptied their bladder.

Introital 4D ultrasound was performed by a single investigator (WCH) using a PHILIPS® iU22 ultrasound system (Philips Medical Systems, Bothell, WA, USA) and a 3–9 MHz endovaginal volume transducer (85° acquisition angle at 2–3 Hz) when women were in supine and with hips flexed and abducted during states of resting, maximum straining, strong coughing, and voluntary squeezing [18].

A single investigator (WCH) analyzed recorded 4D ultrasound volume data utilizing the QLAB 6.0 (Philips Medical Systems) software programs. The plane of minimal hiatal dimensions (PMHD) was attained through placing a line drawing between the symphysis pubis's posterior margin and the puborectalis muscle's anterior edge at the anorectal angle on the midsagittal plane. Levator macrotrauma (LMT) [Figure 1] was confirmed as abnormal muscle insertion to the pubic bone in the PMHD and the slices 2.5 and 5.0 mm cranial on tomographic ultrasound imaging obtained during resting in incapable patients or squeezing in patients capable for squeezing. For doubtful cases, a distance of levator-urethra gap more than 2.5 cm was considered abnormal [19,20]. The genitohiatal area (GHA) were explored during resting [Figure 2], maximum straining, strong coughing, and voluntary squeezing at the PMHD in the

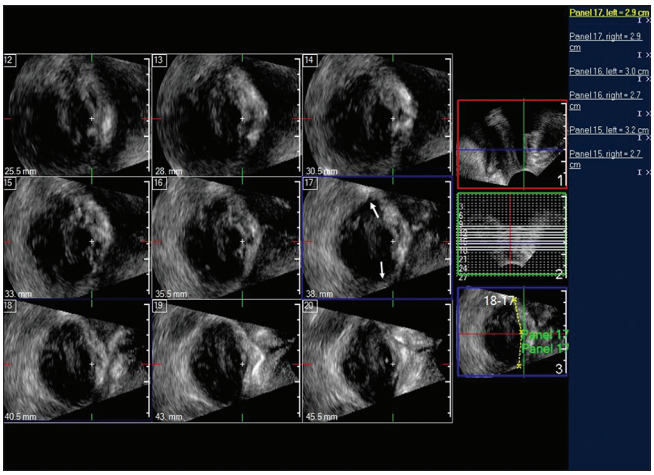

Figure 1: Tomographic ultrasound via introital approach showing a patient with anterior vaginal prolapse and bilateral levator macrotrauma (arrows). The panels 17, 16, and 15 represents the positions of the slices at the level of the plane of minimal dimensions, 2.5 mm above the plane of minimal dimensions, and 5.0 mm above the plane of minimal dimensions, respectively. The urethral level is marked with "+." Anorectum appears on the left side of the axial diagram. Symphysis pubis is on the right side in the axial view. The measurement (dotted line, the bottom axial image of the three images on the right) and numerical measurements (right upper corner) for the levator-urethral gap are displayed

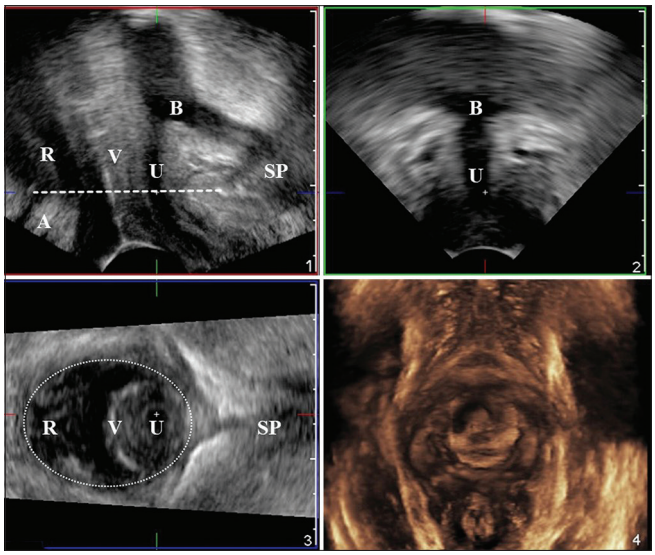

Figure 2: Four-dimensional introital ultrasonography demonstrating the measurements of genitohiatal area (area of the dotted circle in panel 3) at the plane of minimal hiatal dimensions (the dashed line in panel 1) on the axial diagram (panel 3). A: Anus, B: Bladder, R: Rectum, SP: Symphysis pubis, U: Urethra, V: Vagina, +: Urethral level

axial plane [18]. The capability of squeezing was confirmed when the women could demonstrate cranioventral bladder neck movement complying the demand of squeezing during ultrasound examination.

The primary outcome was summed the scores of composite outcomes for POP. The component of composite outcomes consisted of lump sensation, Q3 of PFDI-20, POP-Q Ba, POP-Q C, and POP-Bp. Lump sensation was recorded as absence (score 0) or presence (score 1). The Q3 of PFDI-20 of 0–1 was considered not or slightly bothered (score 0), and the others were considered significantly bothered (score 1). POP-Q points Ba, C, and Bp of stages 0– I was considered free of POP (score 0), while those of ≥ stages II were considered the presence of POP (score 1). Women were considered cured, improved, or persistent if summed scores of composite outcome were 0, 1–3, or 4–5, respectively. The secondary objective involved postoperative adverse occurrences including hemorrhage, mesh-suture exposure, pain, UTI, OAB symptoms, difficult voiding, SUI, and ultrasound findings.

Categorical and continuous data were displayed as number (percentage) and median (quartile 1, quartile 3), respectively. The categorical data were analyzed with the Yates-corrected Chi-square test. The continuous data of all age groups were analyzed by the Wilcoxon Signed–Ranks test, whereas perioperative continuous data within individual age group were analyzed by the Mann–Whitney test. A linear regression was adopted to model the dependent parameter (age) to control potential confounders in exploring the composite outcome variables included in the model comprising parity, menopausal status, diabetes, comorbidities, POP-Q points Bp and Ba, hysterectomy, and meshes in women of different age groups. P <0.05 was regarded statistically significant. All analyses were conducted by the SPSS software for Windows (version 17.0, SPSS, Inc., Chicago, IL, USA).

Results

Six hundred and twenty-two women who had undergone POP repairs met the inclusion criteria. The cohort was divided into five groups, including women younger than 51 years old (Group 1, n = 23), 51–60 years old (Group 2, n = 90), 61–70 years old (Group 3, n = 268), 71–80 years old (Group 4, n = 200), and older than 80 years old (Group 5, n = 41).

Preoperatively, elder women tended to have more parity, menopause, diabetes, and medical morbidity. Women in different age groups were comparable in Q3 of PFDI and OAB. Significant differences existed in voiding difficulty, SUI, and SUI severity among different age groups. Older patients tended to have lower positions of POP-Q points Ba and Bp and received hysterectomy, and were less likely to have mesh. Although older women appeared less capable to squeeze on demand, women among different age groups were comparable in rates of LMT and dimensions of GHA [Table 1].

There was no postoperative coronary artery disease, stroke, thromboembolism, delirium, or 6-month mortality. We observe less surgical hemorrhage and shorter operation time in older women. Postoperatively, the composite outcomes were favorable and equivalent among age groups. Rates of OAB, difficult voiding, and SUI, and SUI severity were comparable among age groups. Postoperative adverse occurrences including hemorrhage, pain, UTI, and mesh-suture exposure were rare and similar among age groups. Residual urine amount was parallel among age groups. On ultrasound, the rates of LMT and dimensions of GHA were not significantly different among age groups. While older patients tended to be less capable of performing squeezing [Table 2], a significant reduction in LMT and increased squeezing capability were observed in older women [Supplementary Table 1].

Women in each age group obtained significant improvements in Q3 of PFDI, voiding difficulty, and POP-Q

Table 1: Baseline information

	<51 years old (*n*=23)	51–60 years old (*n*=90)	61–70 years old (*n*=268)	71–80 years old (*n*=200)	>80 years old (*n*=41)	*P*
Age (years old)	47 (41–49)	57 (56–59)	66 (63–68)	76 (73–78)	83 (82–84)	<0.001
BMI (kg/m^2)	22.5 (20.1–24.8)	23.6 (22.3–26.0)	24.2 (22.4–27.0)	24.6 (22.3–26.8)	24.1 (21.8–26.0)	0.415
Parity	2 (2–2)	3 (2–3)	3 (2–3)	4 (3–5)	5 (3–5)	<0.001
Menopause	3 (13.0)	73 (81.1)	268 (100.0)	200 (100.0)	41 (100.0)	<0.001
Diabetes	1 (4.3)	5 (5.6)	29 (10.8)	42 (21)	8 (19.5)	0.001
Comorbidities*	5 (21.7)	58 (64.4)	122 (45.5)	127 (63.5)	29 (70.7)	<0.001
Item 3 of PFDI	2 (0–3.5)	3 (2–4)	3 (2–4)	3 (2–4)	3 (3–4)	0.684
OAB	5 (21.7)	23 (25.6)	67 (25.0)	58 (29.0)	6 (14.6)	0.401
Voiding difficulty	10 (43.5)	30 (33.3)	142 (53.0)	109 (54.5)	17 (41.5)	0.007
SUI	17 (73.9)	25 (27.8)	46 (17.2)	36 (18.0)	12 (29.3)	<0.001
SUI severity†	1 (0–1)	0 (0–1)	0 (0–0)	0 (0–0)	0 (0–0)	0.003
POP-Q						
Ba	0.0 (−1.0–0.0)	0.0 (0.0–1.0)	0.5 (0.0–1.5)	1.0 (0.0–2.0)	1.5 (0.0–3.0)	0.003
C	−0.5 (−4.5–0.0)	0.0 (−3.0–2.0)	0.0 (−2.0–1.5)	0.0 (−1.0–2.0)	0.5 (−1.0–2.5)	0.162
Bp	−2.5 (−3.0–−1.5)	−2.0 (−2.5–0.0)	−1.0 (−2.0–0.0)	−1.0 (−2.0–0.5)	−1.0 (−2.0–0.0)	0.001
POP surgeries						
Hysterectomy	8 (34.8)	44 (48.9)	177 (66.0)	121 (60.5)	33 (80.5)	<0.001
Mesh	10 (43.5)	27 (30.0)	65 (24.3)	59 (29.5)	16 (39.0)	0.119
Ultrasound						
LMT	7 (30.4)	32 (35.6)	94 (35.1)	54 (27.0)	16 (39.0)	0.311
Rest						
GHA (cm^2)	21.5 (18.7–24.3)	24.0 (20.6–25.8)	25.0 (19.2–28.2)	23.1 (21.4–36.2)	22.8 (21.8–28.8)	0.914
Straining						
GHA (cm^2)	16.7 (15.3–19.7)	28.8 (23.5–31.1)	25.8 (23.6–30.4)	27.5 (20.2–34.3)	25.7 (23.7–30.7)	0.594
Coughing						
GHA (cm^2)	14.5 (13.2–16.7)	24.0 (21.3–29.6)	27.3 (23.9–31.2)	27.4 (20.5–31.9)	26.1 (23.2–32.1)	0.469
Squeezing						
Capability	12 (52.2)	32 (35.6)	41 (15.3)	30 (15.0)	5 (12.2)	<0.001
GHA (cm^2)	10.5 (9.3–14.6)	17.7 (12.1–23.5)	17.4 (14.5–19.0)	17.3 (15.6–24.1)	19.3 (17.8–23.6)	0.532

*Comorbidities comprising cerebrovascular diseases, cardiovascular diseases, and pulmonary diseases, †SUI severity was ranked with the four-level Sandvik scale [16]. The data is expressed with median (quartile 1, quartile 3) or number (percentage) and compared with the Kruskal–Wallis test or the Yates-corrected Chi-square test, as appropriate. GHA: Genitohiatal area, LMT: Levator macrotrauma, OAB: Overactive bladder symptoms, PFDI: Pelvic floor distress inventory – short form 20, POP: Pelvic organ prolapse, POP-Q: Pelvic Organ Prolapse Quantification system, SUI: Stress urinary incontinence

points Ba, C, and Bp after surgeries. Rates of LMT were significantly reduced in age Groups 2–5 after surgeries. OAB symptoms and squeezing capability were significantly improved in age groups 2–4 after surgeries. Only women in age group 1 had significantly reduced SUI rates after surgeries. GHAs did not change after surgeries among all age groups. The *P* values are provided in supplementary Table 1.

Discussion

This study illustrated that POP repairs are similarly effective and safe in younger and senior women who are independent in daily living and low in operative risks. Either pre- or post-operatively although senior women were less capable of voluntary pelvic floor muscle contraction, the rates of LMT and GHA were not significantly different among different age groups.

POP surgeries are elective and primarily aim to improve the patients' overall quality of life by mitigating the symptoms bother from POP [8]. Hence, efficacy and safety were crucial requirements, particularly for elderly women. This study demonstrated equivalently favorable surgical efficacy and morbidities such as visceral injury, pelvic floor function worsening, and major postoperative medical complications surrounding POP repairs among different age groups. Our findings are consistent with current literature [21]. A research specifically exploring laparoscopic sacrohysteropexy or sacrocolpopexy also reported similar incidences of complications and long-term outcomes in women of different ages [21].

For women at any age following POP surgery, the overall rates of composite 30-day severe postoperative complications, such as mortality, vascular morbidity, respiratory morbidity, renal morbidity, wound morbidity, systemic infectious morbidity, blood transfusion, and return to the operating room, has been reported as 3.1% [8]. The composite 30-day severe postoperative complications occurred significantly differently between women <80 years old and those ≥80 years old (3.0% versus 4.3%) [8]. The most important preoperative predictors of postoperative major morbidity in older women undergoing POP surgeries include functional disability, poor nutritional status, cognitive impairment, depression, mobility impairment, and social vulnerability [2,22].

Concern regarding frailty is raising when considering POP repair for senior women [2]. Various methods to determine frailty usually include assessments for the degree

Table 2: 12-month postoperative outcomes

	<51 years old (*n*=23)	51–60 years old (*n*=90)	61–70 years old (*n*=268)	71–80 years old (*n*=200)	>80 years old (*n*=41)	*P*
Blood loss (mL)	50 (5–150)	20 (10–20)	10 (10–20)	20 (10–20)	15 (10–20)	0.001
OP time (min)	67 (60–110)	75 (53–102)	63 (53–77)	73 (54–81)	65 (50–81)	0.014
Composite outcome						
Cure	23 (100)	84 (93.3)	240 (89.6)	189 (94.5)	41 (100)	0.133*
Improved	0	6 (6.7)	23 (8.6)	6 (3.0)	0	
Persistent	0	0	5 (1.8)	5 (2.5)	0	
Lump sensation	0	0	6 (2.2)	2 (1.0)	2 (4.9)	0.218
Item 3 of PFDI	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0.703
OAB	2 (8.7)	3 (3.3)	8 (3.7)	14 (7.0)	1 (2.4)	0.201
Voiding difficulty	0	3 (3.3)	3 (1.1)	3 (1.5)	1 (2.4)	0.615
SUI	2 (8.7)	14 (15.6)	36 (13.4)	25 (12.5)	5 (12.2)	0.913
SUI severity†	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	0.216
Pain	1 (4.3)	2 (2.2)	3 (1.1)	1 (0.5)	1 (2.4)	0.436
UTI	1 (4.3)	2 (2.2)	1 (0.4)	4 (2)	1 (2.4)	0.329
Hemorrhage	1 (4.3)	0	3 (1.1)	1 (0.5)	0	0.263
Mesh/suture exposure	2 (8.7)	7 (7.8)	15 (5.6)	3 (1.5)	2 (4.9)	0.098
POP-Q						
Ba	−3.0 (−3.0–−3.0)	−3.0 (−3.0–−3.0)	−3.0 (−3.0–−3.0)	−3.0 (−3.0–−3.0)	−3.0 (−3.0–−3.0)	0.272
C	−7.5 (−8.0–−6.0)	−7.5 (−8.0–−7.0)	−7.5 (−7.5–−7.5)	−7.5 (−7.5–−7.0)	−7.5 (−7.5–−7.0)	0.158
Bp	−3.0 (−3.0–−3.0)	−3.0 (−3.0–−3.0)	−3.0 (−3.0–−3.0)	−3.0 (−3.0–−3.0)	−3.0 (−3.0–−3.0)	0.818
Ultrasound						
LMT	4 (17.4)	13 (14.4)	37 (13.8)	25 (12.5)	3 (7.3)	0.757
Residual (mL)	10.3 (6.3–14.9)	11.8 (8.5–17.5)	21.1 (3.0–29.0)	13.8 (6.6–29.5)	7.7 (2.8–26.8)	0.856
Rest						
GHA (cm^2)	22.5 (18.9–23.8)	21.7 (20.3–25.1)	22.9 (19.6–26.9)	24.1 (18.5–26.8)	26.0 (22.7–27.3)	0.273
Straining						
GHA (cm^2)	22.4 (18.9–26.5)	25.8 (20.6–28.8)	25.6 (21.7–29.3)	24.6 (19.6–27.5)	23.2 (20.4–26.1)	0.163
Coughing						
GHA (cm^2)	21.3 (18.6–25.8)	20.8 (17.9–24.6)	22.7 (18.7–26.7)	22.0 (18.8–26.3)	24.8 (21.7–27.0)	0.278
Squeezing						
Capability	11 (47.8)	48 (53.3)	80 (29.9)	58 (29.0)	13 (31.7)	<0.001
GHA (cm^2)	18.5 (14.5–22.1)	17.1 (13.7–19.4)	17.6 (14.6–22.2)	17.6 (15.3–21.5)	17.8 (16.6–19.7)	0.569

*Linear regression is adopted to adjust for menopausal status, parity, diabetes, comorbidities, POP-Q points Ba and Bp, hysterectomy, and meshes, †SUI severity was scored with the four-level Sandvik scale [16]. The data is expressed with median (quartile 1, quartile 3) or number (percentage) and compared with the Kruskal–Wallis test or the Yates-corrected Chi-square test, as appropriate. GHA: Genitohiatal area, LMT: Levator macrotrauma, OAB: Overactive bladder symptoms, OP: Operation, PFDI: Pelvic floor distress inventory – short form 20, POP: Pelvic organ prolapse, POP-Q: Pelvic organ prolapse quantification system, SUI: Stress urinary incontinence, UTI: Urinary tract infection

of independence, mobility, and cognitive function [2]. Frailty could lose interaction from extreme age [2]. Hence, experts may recommend more conservative and safer surgeries for women of extreme age regardless of their medical situation or frailty level [2]. The rare occurrence of postoperative complications in our study is possibly contributed by our practice principle for POP repairs. We operated only on women who were generally well enough to manifest daily living independence and acceptable surgical risk. Women at extreme ages were more likely to receive more conservative treatments after preoperative counseling.

Despite for nonsignificant rates of LMT and dimensions of GHA in differently aged women and less squeezing capability in older women, either preoperatively or postoperatively, this study notices a significant reduction in LMT and increased squeezing capability in older women after surgeries. Decreased voluntary muscle contractions with older age are likely attributed to the drastic decline of muscle mass with aging [3,23]. POP repairs might bring pelvic floor structures closer that reduces levator-urethra gap (a factor to define LMT) and enhances voluntary squeezing capability.

The strength of this study includes performing primary POP repair in a cohort including extremely old ages. Nevertheless, our study may be limited by the selection bias due to the retrospective nature. Bias may arise from uneven group sizes. We sought to explore surgical outcomes in very elderly patients, who in fact rarely seek medical attention or undergo surgery. Although operations and ultrasound were conducted by the same investigator, potential bias from variations in surgical and ultrasound techniques could be diminished through a senior practitioner performing standardized operations and ultrasound protocols at different times.

Conclusion

This study did not find significant differences in the surgical outcomes of POP repairs among differently-aged

patients who are independent in everyday living and low in operative risk. Our results may provide useful insight into selecting senior women for POP repair. With the bettering knowledge of personal health care, more seniors can maintain healthy conditions. It is anticipated that physically well senior patients can attain benefits through POP repairs.

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Data availability statement

The datasets generated during and/or analyzed during the current study are not publicly available due to the content of the original institutional review board application but are available from the corresponding author on reasonable request.

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Conflicts of interest

There are no conflicts of interest.

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Supplementary material

Supplementary Table 1: *P* values of perioperative comparisons in all age groups

	<51 years old (*n*=23)	51–60 years old (*n*=90)	61–70 years old (*n*=268)	71–80 years old (*n*=200)	>80 years old (*n*=41)
Item 3 of PFDI	0.037	<0.001	<0.001	<0.001	<0.001
OAB	0.412	<0.001	<0.001	<0.001	0.114
Voiding difficulty	0.001	<0.001	<0.001	<0.001	<0.001
SUI	<0.001	0.070	0.280	0.164	0.102
POP-Q					
Ba	<0.001	<0.001	<0.001	<0.001	<0.001
C	<0.001	<0.001	<0.001	<0.001	<0.001
Bp	0.010	<0.001	<0.001	<0.001	<0.001
Ultrasound					
LMT	0.489	0.002	<0.001	<0.001	0.002
Rest					
GHA (cm^2)	0.727	0.360	0.614	0.307	0.588
Straining					
GHA (cm^2)	0.600	0.098	0.602	0.237	0.750
Coughing					
GHA (cm^2)	0.222	0.070	0.087	0.094	0.941
Squeezing					
Capability	1.000	0.024	<0.001	0.001	0.062
GHA (cm^2)	0.182	0.802	0.567	0.916	0.714

The data is compared with the Mann–Whitney test or the Yates-corrected Chi-square test, as appropriate. GHA: Genitohiatal area, LMT: Levator macrotrauma, OAB: Overactive bladder symptoms, PFDI: Pelvic floor distress inventory – short form 20, POP-Q: Pelvic organ prolapse quantification system, SUI: Stress urinary incontinence