REVIEW ARTICLE

Factor Associated With Cervical Elongation in Women With Pelvic Organ Prolapse: A Systematic Review

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ABSTRACT

Women with severe symptoms of pelvic organ prolapse may be able to benefit from surgery. Cervical elongation events may occur during or after this surgical operation, potentially interfering with the healing process. This study explores the cervical elongation risk factors in women with pelvic organ prolapse. A comprehensive analysis was carried out utilizing the PubMed, Google Scholar, and ScienceDirect databases during 2016-2021, employing a combination of the following Medical Subject Headings phrases and appropriate keywords. The inclusion criteria that were used to choose the articles were investigated using a prospective cohort and case-control study written in English. Data from 140 women without pelvic organ prolapse and 1205 women with pelvic organ prolapse were included in this study. According to these data, cervical elongation is not a common symptom of pelvic organ prolapse in women. Nonetheless, compared to women without pelvic organ prolapse, women with pelvic organ prolapse have an association and are more likely to experience cervical elongation. Maternal characteristics such as parity, age, BMI, and menopausal status, as well as measurements like vaginal length, uterine weight, POPDI-6, POP-Q point C, POP-Q cervical length, and anatomical cervical length, are associated with the risk of cervical elongation in women with pelvic organ prolapse. The occurrence of pelvic organ prolapse and cervical elongation is influenced by several factors, including the severity of the prolapse and maternal features. This factor requires further consideration, particularly when it comes to the proper care of women who have pelvic organ prolapse.
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Keywords: Risk Factor, Cervical Elongation, Pelvic Organ Prolapse, Women's Health, Pelvic Floor Disorder

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INTRODUCTION

A common gynecological condition known as pelvic organ prolapse is defined by a weakening of the vaginal wall, which allows the pelvic organs to descend into the vagina. Prolapse of the pelvic organs is linked to a woman's long-term quality of life. The breakdown of the fascia, muscles, and ligaments supporting the pelvic organs causes prolapse, and medical professionals must recognize and treat women who experience this illness. (1) Options for treatment include surgery or more conservative methods, such as using a pelvic floor or pessary.(2) There are options for obliterative and reconstructive surgery to treat pelvic organ prolapse, which may involve uterine conservation (hysteropexy) or hysterectomy.(3) When conservative treatment has failed or is no longer effective, surgery is often reserved for individuals with bothersome prolapse symptoms who have at least stage 2 prolapse on inspection.(4) Women who have pelvic organ prolapse may be able to regain their expected quality of life with surgery.

Cervical elongation during surgery may exacerbate the fall of uterine prolapse. A corpus/cervical ratio of 1.5 was used to characterize cervical elongation. Cervical elongation and prolapse are made more likely by the increase of cervical mass, which can drag the cervix (5) Cervical elongation is a sign of pelvic organ prolapse (POP) recurrence following uterine sparing surgery and may reduce patient satisfaction in women with uterine prolapse. Additionally, it has been noted that cervical elongation impairs the effectiveness of salpingo-oophorectomy during vaginal hysterectomy. Furthermore, an extended surgical duration is linked to the existence of cervical elongation. Patient choice, a lower risk of mesh erosion, a shorter surgical time, and a decrease in postoperative discomfort and blood loss have all contributed to uterine conservation and hysteropexy; however, cervical elongation may limit these procedures (6) A reduced chance of obtaining salpingo-oophorectomy was linked to 7 cm cervical

elongation, external cervical/uterine prolapse, and anterior vaginal wall prolapse outside the hymen. (7)

Expert gynecological surgeons are aware that cervical elongation might make it difficult to enter the vaginal (from above) or blind (from below) cessation during vaginal or abdominal hysterectomy. Comparably, cervical length could influence the decision to offer a supracervical hysterectomy or uterine-sparing procedure in place of a full hysterectomy. (8) Cervical elongation should therefore be detected in women who are scheduled for surgery to correct pelvic organ prolapse. The risk factors for cervical elongation in females who have pelvic organ prolapse are reviewed systematically in this research.

METHODS

Study design and search strategy

To investigate the risk factors for cervical elongation in women who have pelvic organ prolapse, a systematic review was carried out. As the name suggests, systematic reviews usually entail an extensive plan and search technique developed a priori to reduce bias by finding, evaluating, and summarizing all pertinent papers on a given issue.(9) The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) criteria were followed in the report's development.(9) Using a combination of the following Medical Subject Heading (MeSH) terms and pertinent keywords in a different order, a search was done through the PubMed, Google Scholar, and ScienceDirect databases on English-language studies conducted over five years, from 2016 to 2021: "risk factor," "cervical elongation," "cervical length," "pelvic organ prolapse," and "pelvic floor disease." Once the manuscripts were located, the references were examined to locate any further manuscripts that the electronic literature search had missed. AND, OR, and NOT searches employ Boolean operators.

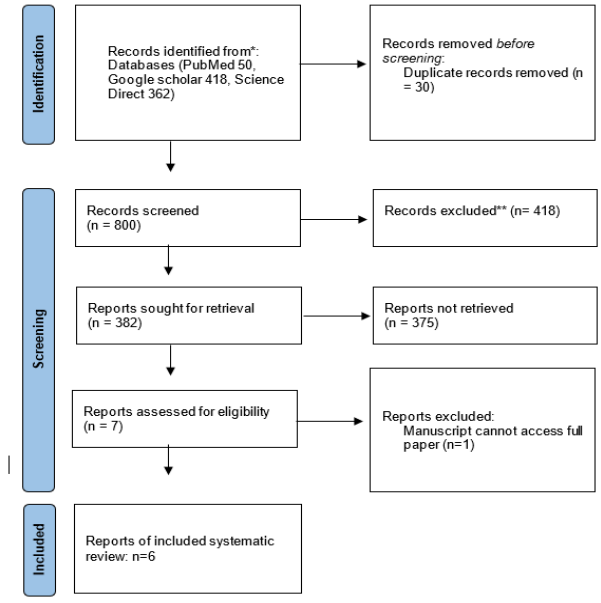

Figure 1: PRISMA Flow Diagram

Study selection and outcome measure

The inclusion criteria used to select articles were based on the relevance of the content to the purpose of the review, namely, prospective cohort studies discussing the cervical elongation risk factors in women with pelvic organ prolapse, published in 2011-2021, using English, and open access. The exclusion criteria in this study were studies not published in that year range, studies not a prospective cohort, namely case reports, letters to the editor, reviews, etc., articles that were not open access, incomplete cervical elongation examination methodology procedures, and did not use English.

Data extraction

Using common Microsoft Excel forms, five writers independently screened titles and/or abstracts of the included publications. To resolve differences in consensus, a third outside partner was consulted. Two members of the research team who worked independently completed the official evaluation of the article's quality using CASP for cohort studies. The purpose of the questions is to aid in the methodical review of a cohort study. Based on JAMA 'Users' Guides to the Medical Literature 1994 (modified from Guyatt GH, Sackett DL, and Cook DJ), the fundamental CASP checklists (randomized controlled trial & systematic review) were tested with medical professionals. The final CASP scores are divided into two categories: low overall quality and moderate overall quality. (10)

Data abstraction and synthesis

The results and conclusions of each study serve as the basis for the analysis, as recommended by a thorough evaluation of the literature. To find subthemes and themes, pertinent results are first retrieved, sorted, and reviewed. Each author contributed to the synthesis's outcomes. The incidence of cervical elongation in women with pelvic organ prolapse and risk variables associated with cervical elongation in pelvic organ prolapse comprise the two main sections of the data that follow. The authors, year, country, purpose, study type, sample period, and method are the structures that are analyzed in Table 2. Table 3 presents the authors, year, and cervical elongation in pelvic organ prolapse-related parameters.

RESULTS

The study's findings indicate that there is a dearth of literature on the connection between cervical elongation and pelvic organ prolapse. After screening the 800 articles that were examined, it was discovered that some of the articles met the exclusion criteria. Six articles remained for examination after seven were evaluated for eligibility, and one could not be accessed in full. Data on cervical elongation in females with pelvic organ prolapse are displayed in Table 1. Data from 140 women without pelvic organ prolapse and 1205 women with pelvic organ prolapse were included in this study.

Table I: Research quality assessment

Author, year	Did the study address a focused issue?	Was the cohort recruited acceptably?	Was the exposure accurately measured to minimize bias?	Was the outcome accurately measured to minimize bias?	Have the authors identified all-important confounding factors?	Have they taken account of the confounding factors in the design and/or analysis?	Was the follow-up of subjects long complete?	Were the follow-up subjects long enough?	How precise are the results?	Do you believe the result?	Can the results be applied to the local population	Do the results of this study fit with other available evidence	What are the implications of this study to practice?	Overall quality assessment
Sheng-Mou Hsiao, et al[13]	Y	Y	Y	Y	Y	Y	C	C	Y	Y	Y	Y	Y	M
Geoffrion et al[14]	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	M
Yi yin liu et al[15]	Y	Y	Y	Y	Y	Y	C	C	Y	Y	Y	Y	Y	M
Mitchell B. Berger, et al[8]	Y	Y	Y	Y	Y	Y	C	C	Y	Y	Y	Y	Y	M
Anke R. Mothes et al[16]	Y	Y	Y	Y	Y	Y	C	C	Y	Y	Y	Y	Y	M
Man Tan, et al[17]	Y	Y	Y	Y	Y	Y	C	C	Y	Y	Y	Y	Y	M

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Table II: The incidence of cervical elongation in women with pelvic organ prolapse

Authors	Year	Country	Aim	Study type	Sampling time and method	Incidence of cervical elongation
Sheng-Mou Hsiao, et al[13]	2018	Taiwan	Identify factors predicting cervical elongation in women with uterine prolapse.	Retrospective cohort	All women with uterine prolapse who underwent vaginal hysterectomy between January 1994 and October 2014. Data obtained through medical records.	Of the 295 women with uterine prolapse, 136 (46.1%) patients experienced cervical elongation with the classification according to Berger et al. ie, cervical length >3.38 cm and/or cervical-to-corpus length ratio >0.79).
Geoffrion et al[14]	2016	St. Paul's Hospital, Vancouver BC	Compare cervical length in surgical hysterectomy specimens from women with symptomatic POP with the length in specimens from women with other benign gynaecological conditions	Prospective, pilot, case-control study	Specimen data from patients undergoing hysterectomy were collected between 2013 and 2015. Specimens from women in whom the indication for hysterectomy was POP were compared with the specimens from women with other benign gynaecological conditions	Seventy-seven specimens were collected, 52 from women with POP and 25 from women without POP. Mean cervical length was estimated to be 0.75 cm (95% CI 0.10 to 1.40; P 0.025) longer in the POP group than in the non-POP group after adjusting for age, hysterectomy due to fibroids, and uterine length. The ratio of cervical length to total uterine length in women with POP was 0.10 higher (95% CI 0.03, 0.16; P 0.005) than in women without POP.
Yi yin liu et al[15]	2021	Kaohsiung Medical University Hospital	Investigate the risk factors for uterine cervical elongation among women with POP.	Single-center retrospective cohort study,	Women who underwent vaginal total hysterectomy for POP between 2014 and 2016 were collected. The cervical and total uterine lengths were measured by pathologists, while the ratio of cervical length to total uterine length were calculated.	The cervical elongation is defined as corpus/cervix ratio ≤ 1.5. A total of 133 patients were enrolled in this study. Among these patients, 43 women had cervical elongation and 90 women had normal length of uterine cervix.
Mitchell B. Berger, et al[8]	2012	University of Michigan	Test the hypotheses that the cervix is elongated in women with pelvic organ prolapse, and if so, how frequently and by how much.	Case control study	Cervix and uterine corpus lengths were measured on magnetic resonance images in a case-control study of 51 women with prolapse and 46 women with normal support determined by pelvic organ prolapse (POP) quantification (POP-Q) examination.	The cervix is 36.4% (8.6 mm) longer in women with prolapse than in women with normal pelvic support ($p < 0.001$). Approximately 40% of women with prolapse have cervical elongation.
Anke R. Mothes et al[16]	2016	University Hospital Germany	Define and classify cervical elongation, to compare uterine measurements after prolapse hysterectomy with a non-prolapse control group, and to associate stage of prolapse and degree of cervical elongation	Single-centre retrospective case-control study	Data were 332 women collected from patients with and without pelvic organ prolapse (POP) who underwent laparoscopically assisted vaginal hysterectomy. Post-hysterectomy uterine cervical elongation was examined using the corpus/cervix ratio (CCR), calculated from measurements taken on photographs. Cervical elongation was classified as physiological (grade 0, CCR>1.5) grade I (CCR>1 and≤1.5) grade II (CCR>0.5 and≤1), and grade III(CCR≤0.5).	Cervical elongation was detected in 288/295 (97.6%) patients in the prolapse group (grade I, 44/288 [15.2%]; grade II, 212 [73.6%]; grade III, 32 [11.1%]). Mean calculated cervical length was greater in the prolapse group than in the control group (4.41.1vs.3.1 + 0.8 cm; $p<0.001$). Mean CCR was greater among those with stage II/III than among those with stage IV prolapse (1.0±0.4vs. 0.8±0.2;$p<0.001$). Cervical elongation was found more often in the prolapse group compared to the control group ($p<0.001$).
Man Tan, et al[17]	2020	Peking University People's Hospital China	Examine the cervical length of patients with POP and assess the characteristics of the pelvic floor of Chinese women	prospective case study	379 POP patients were included from the Department of Obstetrics and Gynecology, Peking University People's Hospital from October 2015 to February 2019. Exclusion criteria were set as follows: (1) patients who underwent previously hysterectomy; or (2) patients who were prepared to accept uterine preservation surgery.	The anatomical cervical length was ≥4 cm in 70.2% of the cases. Moreover, there was a good correlation between POP-Q cervical length (PCL) and anatomical cervical length (ACL) (P=0.003). In 80.5% of cases, the difference between PCL and ACL was within 2 cm.

Table III: Risk factors related to cervical elongation in pelvic organ prolapse

Author	Year	Factors related
Sheng-Mou Hsiao, et al[13]	2018	Lower parity, advanced uterine prolapse are predictors of cervical elongation, uterine prolapse stage 3 or more
Yi Yin Liu[18]	2021	Age > 65 years old, total vaginal length ≥ 9.5 cm, uterine weight < 51 gm and Pelvic Organ Prolapse Distress Inventory 6 (POP-DI-6) ≥ 12
Mitchel Berger et al[8]	2012	POP-Q point C, body mass index and menopausal status
Man Tan et al[17]	2020	lACL-PCL, the consistency of C-D and the cervical length
Anke Mothes et al[16]	2016	Prolapse stages

Cervical elongation is not a common symptom of pelvic organ prolapse in women, according to statistics. In contrast to women without pelvic organ prolapse, women with pelvic organ prolapse were linked to cervical elongation. According to five studies, the grade of the prolapse and the characteristics of the mother, such as parity, age, BMI, and menopausal status, as well as measurements like vaginal length, uterine weight, POPDI-6, POP-Q point C, and ACL-PCL, are associated with the risk of cervical elongation (8,11–15). Table 2 provides information regarding the prevalence of cervical elongation. Table 3 provides information regarding the risk of pelvic organ prolapse and cervical elongation.

DISCUSSION[av1.1][av1.2]

According to these data, cervical elongation is not a common symptom of pelvic organ prolapse in women. Nonetheless, compared to women without pelvic organ prolapse, women with pelvic organ prolapse have an association and are more likely to experience cervical elongation. Maternal characteristics such as parity, age, BMI, and menopausal status, as well as measurements like vaginal length, uterine weight, POPDI-6, POP-Q point C, POP-Q cervical length, and anatomical cervical length, are associated with the risk of cervical elongation in women with pelvic organ prolapse.

Parity

The review results showed that parity was associated with cervical elongation in patients with POP. This may be related to Collagen I. Collagen type I is critical for cervical strength, with collagen levels increasing with age but decreasing with parity in nonpregnant women(16). Parity contributes significantly to the etiology of POP by generating levator ani avulsion and muscle neuropathy (17). In women who are relatively young and have lower parity, uterine prolapse occurs, which is characterized by the elongation of the uterine cervix. (18). Parity is connected with poor tissue mechanics and a lack of collagen alignment. Such behavior is likely to lead to the development of pelvic organ prolapse (19).

Age

Age is related to cervical elongation. Women aged over 65 are an independent risk factor for cervical elongation in women with POP (13). Pelvic organ prolapse (POP) is a prolapse of one or more of the anterior or posterior vaginal walls, uterus (cervix), or vaginal vault (after hysterectomy). It is a common clinical condition prevalent in 40% of women aged over 45 and in 50% of parous women (20). In nulliparous and cesarean-delivered women, the prevalence of symptomatic prolapse was relatively similar and below 5% across ages 40-64 years. In contrast, in women after vaginal delivery, there was an accelerating increase in the prevalence of symptomatic genital prolapse up to 65 years of age. The estimated probability from the regression model increased 4-fold, from 3.8% at 40 years to 13.4% at 64 years of age. The observed induction period associated with 1 vaginal delivery seemed to be at least 20 years among women giving birth in their early 20s. At age 64 years, the estimated probability of symptomatic prolapse was 12 times higher after vaginal delivery compared with cesarean delivery. Age is a risk factor for POP (21).

BMI

BMI is associated with the risk of cervical elongation in patients with POP. Although the average body mass index is similar in women with cervical elongation and those with normal cervical lengths, higher BMI is associated with a lower likelihood of cervical elongation due to altered hormonal and/or metabolic milieu, differential effects of increased intraabdominal pressure on the pelvic floor and support structures, or a combination (22). Other research found that women with a BMI > 25 kg/m2 have greater cervical length compared to women with a normal weight (23). The differences between these studies show that there are no definite research results that when a patient is obese, they will experience cervical elongation, although overweight and obese women are more likely to have pelvic organ prolapse compared with women with a body mass index in the normal range (24). Other research found that the pooled result of meta-analysis depicts that body mass index (BMI) doesn't have a statistically significant association with pelvic organ prolapse (25).

Menopausal status

A study compared the cervix of women with and without prolapse. In women with prolapse, cervical elongation showed higher concentrations of estrogen and

progesterone receptors (26) In middle age, the presence of these hormones can have an effect, especially during menopause, especially if there is a change in body mass index (27). The main cause of uterine prolapse in older women is the weakening of the muscles and tissues of the pelvic floor, which is largely influenced by age and the presence of hormonal factors that are involved in the process (28)

Anatomical dimensions of the vagina and uterus

Vaginal length, and uterine weight, are associated with the risk of cervical elongation in women with pelvic organ prolapse. Total vaginal length ≥ 9.5 and uterine weight < 51 gm related to cervical elongation. The vaginal length was 24% longer in women with prolapse as previously reported (29). In our study, women with TVL over 9.5 cm were more common in the group of cervical elongation. A previous observational cross-sectional study reported that TVL seems to confound the relationship between cervical station and prolapse symptoms (30).

POP diagnostic indicators

POPDI-6, POP-Q point C, POP-Q cervical length, and anatomical cervical length are associated with the risk of cervical elongation in women with pelvic organ prolapse. Cervical elongation was diagnosed and assessed using the PFDI-20, ICIQ-SF, OABSS, FSFI questionnaire, and POP-Q system both before and after surgery. POP-Q can diagnose cervical elongation in POP patients with a 68% accuracy rate, strong specificity (79%), but low sensitivity (58%) (31). Cervical elongation was measured using two locations. Point C is A point on either the leading edge of the vaginal cuff (hysterectomy scar) or the most distant (i.e., most dependent) edge of the cervix. Point D is the posterior fornix in a woman who still has a cervix. To distinguish suspensory failure from the uterosacral–cardinal ligament "complex" of cervical elongation, point D was included as a measurement point. Cervical elongation, which may be symmetrical or eccentric, is indicated when the Point C location is noticeably more positive than the Point D location. When there is no cervix, point D is not included. (32) When using the Valsalva maneuver and a 15 mm difference in the pubic-uterine fundus distance at rest, it can be helpful to distinguish between uterine prolapse (UP) and cervical elongation (CE) without uterine prolapse (UP) on ultrasonography(33)

Limitation

Investigating the molecular and clinical baselines of women who acquire cervical elongation requires collaborative investigations incorporating morphological, pathophysiological, and clinical perspectives.(12) Because there aren't many studies examining risk factors for cervical elongation in women with pelvic organ prolapse, this manuscript's limitation is its inability to thoroughly examine factors linked to cervical elongation with a large amount of data.

CONCLUSIONS

The occurrence of pelvic organ prolapse and cervical elongation is influenced by several factors, including the prolapse's severity and maternal features. This factor requires further consideration, particularly when it comes to the proper care of women who have prolapsed pelvic organs.

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