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REVIEW

Cervical Elongation – The Search for a Definition

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ABSTRACT

Objectives: *To evaluate the definition of the entity "cervical elongation", as it effects our clinical work and surgical outcome.*

Methods: *A search of PubMed for publications since the year 2000 regarding "cervical elongation", in order to track the evolution in the understanding and assessing of the entity.*

Results: *Out of 27,317 publications, 25,285 were in English and, after filtering those for "humans" and "cervical elongation in women", we ended up with 16 relevant publications.*

Conclusions: *After reviewing the literature, we found that there was no consensus regarding either any aspect of "cervical elongation", or the proper way to measure the cervix, the threshold for definition or even the pathophysiology behind it.*

Keywords: cervical elongation.

INTRODUCTION

Today, gynecologists face a challenge when approaching a patient with what is defined as "cervical elongation". It has a major role in dealing with pelvic organ prolapse, and in fact, we know very little regarding this entity.

Surgical treatment of pelvic organ prolapse (POP) involving uterine preservation was shown to have no impact on the surgical outcome, shorten operative time and decrease blood loss (1). These reports led to increase popularity towards uterine sparing procedures in POP treatment, increasing the importance of cervical anatomy as a factor in the outcome (2, 3). During the preoperative exam, the surgeon must identify the presence of cervical elongation, as it affects the surgical procedure of choice and its outcome, taking the Manchester operation as an example – a procedure that involves shortening the cervix and attaching the stump to the uterosacral ligaments. The failure rates for this procedure varies between 0-50% (4-7), while when focusing on cases involving solely prolapse of the cervical elongation (point 'D' in the POP-Q is intact), the failure rate is 0% (8). Cervical elongation poses a challenge when deciding to spare the uterus as was seen by Lin *et al*, who showed higher failure rates at the time of sacrospinous hysteropexy (9). Walters *et al*, classified cervical elongation as a relative contraindication for uterine preservation and debated the necessity for additional cervical amputation in order to improve outcomes (10) and Rosen *et al* revealed 14% of

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cervical elongation following laparoscopic treatment of POP (11).

Even when following the route of vaginal hysterectomy, cervical elongation has been reported by Karp *et al* (12) to have a negative impact on the success of performing concomitant salpingo-oophorectomy as associated with an increase in the operative time during vaginal hysterectomy (13) secondary to difficulties reaching the anterior and posterior fornixes (14).

Albeit the understanding of the importance of cervical length on surgical outcomes, we were unable to find a consensus regarding the normal length of the cervix among non-pregnant women, the measuring technique and even the measuring tool – *i.e.*, vaginal exam, POP-q, ultrasound, MRI or pelvic CT.

By acknowledging the importance of identifying the presence of cervical elongation, the effect it has on the decision-making process and a lack of clear/uniform definitions, we have decided to search the literature. ❑

MATERIAL AND METHODS

In order to track the evolution in the understanding and assessing of the cervical elongation entity, we have searched PubMed for publications since the year 2000, with the following search tags: cervical elongation, cervical length and pelvic organ prolapse. ❑

RESULTS

We located 27,317 publications, of which 25,285 were in English. After filtering those for humans and cervical elongation in women, we ended up with 16 relevant publications.

Reviewing these publications, we found that there were several main pitfalls regarding cervical elongation. We tried to address each one separately, although they were all interlinked. We identified the pitfalls regarding measurement, definition and pathophysiology of cervical elongation and used them to itemize the review.

Measurement

In order to define cervical elongation, we must first define what is the normal cervical length. This is a challenge by itself due to scarcity of publications describing the cervical anatomy in non-pregnant women. In 1996, Mert *et al* (15) tried to define the normal size of the uterus and ovaries, *via* transvaginal ultrasound, in a cohort of 263 women. They defined the normal cervix length as 3 cm, but they did not elaborate on the specific ultrasound technique used for their measurements. Cervical anatomy includes a vaginal part and an abdominal part. As opposed to the obstetrics cervical length, which is described as the length of the cervical canal, the actual cervical length in non-pregnant women might not correlate to the cervical canal measurements, as described by multiple publications: Since then, several studies have been conducted in an effort to define the most accurate way to measure the cervix (13, 16, 17), which have shown that measurement by 2D/3D ultrasound, POP-Q and direct cervical length measurements were not accurate when comparing to the length of the cervix in a pathology specimen after hysterectomy. Others found a good correlation between the cervical canal and uterine body length (18). A recent study from 2020 (19) suggested a novel way to measure the cervix *via* pediatric 10-french Foley catheter. The authors measured the cervix of 56 women who were about to undergo hysterectomy for stage 2-4 symptomatic prolapse. The preoperative direct cervical length measurement was performed using a pediatric 10-French Foley catheter under general or spinal anesthesia. Inflating the balloon and pulling gently until the balloon reaches the internal os, then marking the catheter at the point of the external cervical os.

Definition

As of today, we were unable to find a consensus of how to accurately measure the cervix in a non-pregnant woman or a well-accepted definition for what is named "cervical elongation". This entity was first described in 1996, by Bump (20), who depicted it as the prolapse of point 'C' in the POP-Q system, while point 'D' was preserved in a high position. There was not a definitive definition for the C to D discrepancy to define “elongation”.

In their study conducted in 2010, Ibeanu *et al* (21) tried to characterize the cervical elongation clinically. They chose the arbitral value of 8 cm as the minimal distance between points C and D in order to diagnose cervical elongation. The reason for this value is their desire to ensure "significant cervical elongation to see any possible histological differences". They discuss this and express that they think it is "a good initial estimation."

Their findings were contradicted by a study conducted by Berger (22), in 2012, on a MRI study population of 97 subjects, which came to the conclusion that the location of point C alone, and not the distance between points C and D, was the strongest predictor of the cervical length and elongation. He also suggested and used two different definitions for cervical elongation: the first one, "a cervical length of >33.8 mm" and the second one, "a ratio of >0.79 between cervix to the corpus uteri".

Yet, no consensus was reached. In 2014, in an attempt to examine the relation between the POP-Q examination, cervical length measured by transvaginal ultrasound and length measured by direct anatomic measurement in 151 women, Dancz *et al* (17) concluded that cervical elongation should be diagnosed when the anatomic length was 5 cm and more, giving us a fifth different definition.

It does not stop there, as in 2016, Mothes *et al* (23) performed a retrospective analysis of uterine and cervical length after prolapse hysterectomy in comparison to a non-prolapse control group and offered a grading system for cervical elongation based on corpus to cervix ratio of >1.5, >1 and <1.5, >0.5 and <1, <0.5 as grades 0, 1, 2 and 3, respectively.

In the same year, Geoffrion *et al* (24) conducted a study of prolapse induced cervical elongation of 50 hysterectomy specimens and defined elongation as an increase of cervical length of more than or equal to twice the preoperative measurement.

And thus, there is still no agreed definition. This is, however, not that surprising, giving that there is still no real understanding of the pathophysiology of the elongation process. A summary of the different definitions is given in Table 1.

Pathophysiology

When Ibeanu *et al* tried to characterize cervical elongation clinically (21), they found that cervical elongation was consistently associated with good posterior vaginal apical support and a well-supported cul-de-sac, but they also stated that the exact mechanism remained elusive. In their study,

TABLE 1. A summary of the different definitions of cervical elongation

Article	Year	Definition	N	Mean age (years)	Mean BMI (kg/m^2)	Parity	Cervical elongation properties
Bump *et al* (20)	1996	A prolapse of point 'C' in the POP-Q system, while point 'D' is preserved in high position	240	N/A	N/A	N/A	N/A
Ibeanu *et al* (21)	2010	A minimal distance of 8 cm between point 'C' and 'D' in the POP-Q system	42	47.7 (± 9.6)	30.9 (± 6.9)	1.71	parity↑
Berger *et al* (22)	2012	MRI measurements -	97	54 (± 10.6)	27 (± 6.3)	2.6	more advanced POP-Q stages
		Definition I - cervical length of >33.8 mm					
		Definition II - cervix/corpus uteri >0.79					
Dancz *et al* (17)	2014	Cervical anatomic length of 5 cm or more	149	55.7 (± 9.7)	29.9 (± 4.7)	3	older, postmenopausal
Mothes *et al* (23)	2016	A grading system based on corpus uteri/cervix ratio- Grade 0 - >1.5, Grade 1 - >1 and <1.5 Grade 2 - >0.5 and <1, Grade 3 - <0.5	295	63.9 (± 10.2)	29.42 (± 11.72)	N/A	prolapse↑
Geoffrion *et al* (24)	2016	An increase of cervical length of more than or equal to twice the preoperative measurement	77	58.5 (± 12.1)	N/A	N/A	prolapse↑
Alay *et al* (19)	2020	Cervical length measured by foley of 47.5 mm and higher	43	63.4 (± 8.1)	27.9 (± 2.9)	3.6	advanced posterior prolapse

they examined the levels of collagen, elastin, smooth muscle, and nerve tissue distribution between the non-prolapsed cervices and elongated cervices but found no differences. It was a conflicting finding due to the sex steroid receptors that were found to be significantly lower in prolapsed postmenopausal women (25). They suggested the possibility of a localized effect rather than a systemic derangement of changes in sex hormones due to the finding of a higher proportion of estrogen and progesterone receptors in the presence of cervical elongation (rather that what was found in case of prolapse) and pointed to a potential different mechanism of disease than the more commonly reported failure of the uterosacral support mechanism.

The different mechanism theory received emphasis when Berger's MRI study (22) reported that only 30% of cervical elongation was explained by cervical descent. Also, Mothes (23) found a 97.6% correlation, again pointing out that different definitions for cervical elongation were used in each study. Berger also showed that younger premenopausal women with uterine descent were more likely to have a longer cervix than older women with better apical support. Berger offers two theories of his own regarding the pathophysiology – 1) Women with prolapse have inherently longer cervices; and 2) Descent of the developing prolapse causes elongation of the cervix through downward traction – stating that he cannot discriminate between these two possibilities.

Hyakutake (26) also suggested the downward traction as a mechanism, when in a case series of eight sacrospinous hysteropexy, five (62.5%) subjects developed cervical elongation during a five-year follow up, suggesting unbalanced forces as the cause. Mothes was also favoring this theory in his study carried out in 2016 (23). It is important to point out that Geoffrion *et al* (24, 27), in their one-year follow up of bilateral sacrospinous vault fixation *via* synthetic mesh, offer a theory of a local hypertrophic reaction to the mesh a cause for the 63% cases of cervical elongation development. ❑

DISCUSSION

Since Bump mentioned the entity of cervical elongation in 1996, there is much incoherency regarding all related aspects.

We begin to realize that cervical elongation is not an uninfluential entity to be ignored. It affects the way we approach surgical management of pelvic organ prolapse, and even hysterectomies for other causes are affected by its presence. We also noted that a suspicion has been risen whether certain procedures may even cause cervical elongation. Going backwards, when trying to understand what really causes the elongation of the cervix, by looking at the pathophysiology, we find that there is no real understanding as to why this is happening. There are several theories with no solid proof for any of them.

Researchers who have tried to clarify the understanding of a specific etiology have been faced with another challenge – how to define cervical elongation. Numerous criteria were suggested for the definition of this entity, some using the cervical length, others using its ratio to the uterus and most of them having a variety of different cut-offs for this definition.

And again, another challenge has risen when trying to compare each diagnosis proposition. How do we even measure the cervix accurately? By looking at the literature, we found that, although there were specific criteria as to how to measure the cervix in a pregnant woman, none existed for a non-pregnant one. Several ways were evaluated as to how it was best to measure the cervix – 2D/3D ultrasound, POP-Q, direct cervical length measurements and even MRI. A summary of those proposals can be seen in Table1. None was proven as an accurate measurement when compared to the cervical length after hysterectomy; and even with this comparison to pathology as reference, there is a lack of unanimous agreement, stating that formaldehyde may cause the shrinkage of the cervix. A novel approach was offered to measure the cervix *via* catheter, but despite being found to have a good correlation to the pathology specimen this method was used on the operating table and under anesthesia – a method not compatible to the clinic setting, so as MRI as Ibeanu *et al* suggested. We therefore find ourselves in a loop – how do we know if the measurement is accurate enough and if so, what is the threshold for elongation, and whether can we then try to understand the pathophysiology behind it all? ❑

CONCLUSION

In our opinion, we need to get back to basics and start speaking the same language in order

to better understand the entity of cervical elongation and its effects. We must first define the proper and most accurate way to measure the cervix (and our control population). From there, the road to compare different diagnostic criteria and thus diving into the understanding of the pathophysiology is paved. Finally, here is a take home message: 1) There is a need for a standardized terminology; 2) Cervical elongation is an entity that is poorly understood; and 3) We must start with the basics and define the proper way to measure the cervix. ❑

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