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Cervical Length Measurement During Mid-Pregnancy as a Predictor for Preterm Delivery

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ABSTRACT

Background: During the transition between the prenatal and intrapartum periods, the uterine cervix undergoes significant physiological, biochemical, and morphological changes. According to the WHO, preterm birth is defined as babies born alive before the 37 weeks.

Aim of the work: To assess the ability of the cervical length during this period of gestation to predict the occurrence of preterm delivery and hence the need for intervention.

Patients and methods: In this study, 200 pregnant women at 22–24 ws gestation were selected. 150 high-risk women for preterm delivery (as indicated by the history of previous preterm birth or repeated mid-trimesteric abortions) formed the study group and 50 low –risk women constituted the control group with no history of preterm delivery or repeated abortions. The cervical length in these 200 women was measured using transvaginal and transabdominal ultrasound.

Results: This study showed that history of previous preterm delivery or repeated abortions increased the incidence of preterm delivery 3 times. The cervical length was found to be lower in high-risk women either measured transvaginally or transabdominally, but it was more easily and more accurately measured using TVS. This study also demonstrated that women with shorter cervices delivered preterm more frequently. This was even more evident in women at high-risk. Thus cervical shortening was considered a risk factor for preterm delivery.

Conclusion: The findings of this study therefore suggest that screening of the patients at midpregnancy for cervical length can be a useful method for the prediction of preterm delivery. Thus, it may guide in the risk assessment for pregnant women and in the decision of administration of different measures for the prevention of preterm labour. Transvaginal ultrasonography proved to be more accurate and more useful serving this aim.

Keywords: *Cervical Length Measurement; Mid-Pregnancy; Preterm Delivery.*

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INTRODUCTION

During the transition between the prenatal and intrapartum periods, the uterine cervix undergoes significant physiological, biochemical, and morphological changes.

Preterm birth is defined by the World Health Organization as a baby born alive before the 37 weeks [1].

Preterm birth continues to be a serious public health issue across the world. To reduce prematurity and alleviate its effects on preterm newborns, evidence-based strategies are required, particularly in low-resource settings.

Preterm birth data in most countries is of poor quality, making exact evaluation impossible at the global, regional, and national levels; nevertheless, standardisation of definitions, measurement, and reporting would allow global comparisons of current data [2].

Preterm birth and low birth weight are linked to a higher risk of illness and death, putting a strain on health, education, and social services, as well as on families. Preterm delivery and low birth weight may result in considerable health-care costs once the child is discharged from the hospital for the first time. It can also impose a strain on special education and social services, as well as newborns' families and caregivers, as well as society as a whole. In addition to the expenses indicated in the research, preterm delivery and low birth weight might have significant long-term repercussions that must be examined from an economic approach [3].

All these considerations had led various authors to search for a method that can reliably predict the occurrence of preterm birth. Various methods have been investigated: oncofetal fibronectin in vaginal and cervical secretions, screening for abnormal genital tract colonization, the use of biochemical markers (serum collagenase, CRH, relaxin, AFP, IL-6, IL-8, phosphorylated IGFP-1, lactoferrin). Different cervical scores have been devised. Finally, the use of ultrasound has been suggested and studied extensively for this purpose.

In 1969, Anderson and Turnbull reported that, in primi-parous women, cervical dilatation and effacement were related to the time in gestation at which labour started. However, they also pointed out that dilatation of the internal os after the 28th week of gestation did not invariably predict either preterm birth or neonatal risk [4].

Techniques for measuring cervical length have been compared in non-pregnant women undergoing hysterectomy [(5)]. Unfortunately, Digital cervix examination is subjective and involves a lot of interobserver variability. In addition, just the part of the cervix below the front vaginal wall is examined. The length was frequently underestimated by more than 13 mm when measured digitally. Ultrasonographic measures, on the other hand, were well associated with those obtained using a ruler on the postoperative material [6].

Varma et al. (1986)[7], The average cervical length was determined to be between 35 and 40 mm in 30 low-risk pregnancies examined serially using transabdominal ultrasonography. Internal dilatation of up to 6 mm was considered typical.

Brown et al. (1986) [8] were the first to propose that transvaginal scanning was more likely to yield sufficient cervical pictures [9].

Murakawa et al. (1993) [10] the cervical length of 32 women who were at risk of preterm labour was investigated. None of the women who had a cervical length more than 30 mm gave birth prematurely. When the cervix was smaller than 30 mm, 65 percent of the babies were born prematurely. All women with a cervical length of less than 20 mm gave birth prematurely [11].

Three large studies by Zorzoli (1994) [12], Heath (1998)[13], and Taipale (1998)[14], studies use of transvaginal ultrasonography to evaluate cervical length to predict premature birth was investigated.

This study aims to determine the correlation between cervical length in mid-pregnancy and its use as a predictor for preterm delivery and the possible cutoff values.

PATIENTS AND METHODS

Type of Study:
This study is a prospective case controlled study.
This study was conducted at Sheikh Zayed Specialized hospital, Obstetrics and Gynaecology department. This was in the period from April 2019 till October 2020.
The study was conducted on an outpatient basis. It enrolled 200 women which were divided into two groups, as follows:
Group A (The study group):
Was involving 150 patients at midpregnancy (22 – 24 weeks). They fulfilled the following inclusion criteria:
Age: 20 – 35 years.
Parity: para 1 up to para 4.
22 – 24 weeks gestational age. Accurate dating was mandatory as confirmed by sure date of Last Menstrual Period (LMP).
History of previous preterm delivery or repeated abortions.
No medical disorders.
Singleton pregnancy.
Exclusion criteria were:
Smokers.
Congenital anomalies of uterus and cervix (Ultrasonography).
Multiple pregnancy.
Placental abnormalities.
Past history of cervical operations or cerclage.
Presence of cervical abnormalities.
Group B (The control group):
Included 50 women considered as low-risk for preterm delivery. These women fulfilled the above inclusion criteria for the study group, but they had NO history of preterm delivery or repeated abortions. One abortion was not an exclusion criterion. Primigravidae were excluded.
Methodology:
Every woman in both groups was subjected to:
Thorough history taking: stressing on the following points:
Personal data including name, age, occupation, address, phone numbers, length of marriage, and husband name and occupation.
Obstetric history: obstetric code, information about prior pregnancies (date, outcome, mode of delivery, gestational age at delivery, and any associated complications).
History of past medical or surgical disorders.
Full analysis of the current pregnancy ensuring the accuracy of LMP and the presence of symptoms suggestive of any complication.
Physical examination:
Pulse, Blood pressure, lower limb edema, other salient features of medical disorders.
Obstetric examination (fundal level, fundal grip, umbilical grip, pelvic grips, fetal heart sound auscultation).
Basic laboratory investigations:
Blood group and RH.
Complete blood picture.
Urine analysis.
Fasting blood sugar and 2hours post prandial blood sugar.
Hepatitis B and C.
Ultrasound examination, both transabdominal and transvaginal with measurement of the cervical length:
Fetal biometry (BPD, FL, AC), estimated gestational age, placenta (site and maturity), liquor (amount and turbidity).
Cervical length by transabdominal ultrasound.
Cervical length by transvaginal ultrasound.

Follow-up till delivery: patients were followed up till delivery and the gestational age at which labour occurred was recorded. Spontaneous preterm birth was defined as the onset of labour before 37 completed weeks.

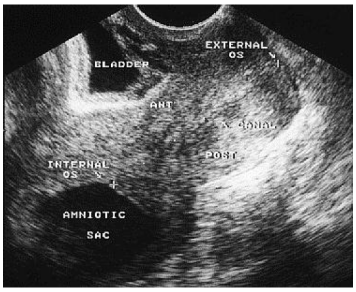

Fig. 1: Transvaginal ultrasound scan showing landmarks found for cervical length measurement with an optimized plane for scanning.

Fig. 2: Transvaginal ultrasound scan showing a short cervix measuring 28.1mm in length. This case delivered preterm.

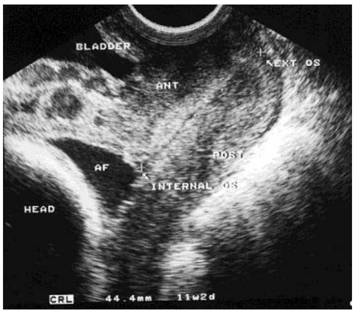

Fig. 3: Transvaginal ultrasound scan showing a relatively long cervix measuring 44.4mm in length. This case delivered at term.

Fig. 4: Transvaginal ultrasound scan showing a markedly shortened cervix with funneling.

Statistical analysis

The statistical programme for social sciences, version 20.0, was used to analyse the data (SPSS Inc., Chicago, Illinois, USA). The mean and standard deviation were used to convey quantitative data (SD). Frequency and percentage were used to convey qualitative data. As a result, the following p-value was declared significant: P-values of less than 0.05 were deemed significant, P-values of less than 0.001 were regarded very significant, and P-values of more than 0.05 were considered inconsequential.

RESULTS

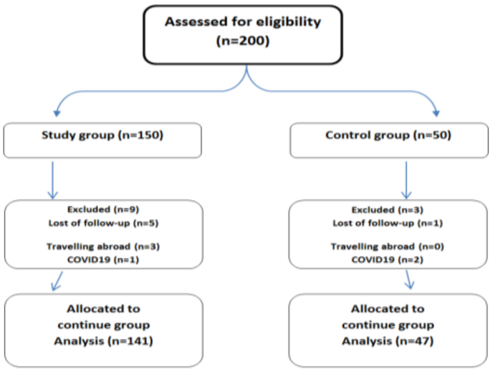

Fig. 5: Flow chart

Baseline characteristics	Study group (n=141)	Control group (n=47)	t-test	p-value
Age (years)				
Range	20-35	20-35	t=1.668	0.126
Mean±SD	27.64±4.44	26.18±3.95		
Parity(n)				
Range	0-4	0-4	z=1.562	0.265
Median (IQR)	2 (2)	2 (1)		
G.A. (weeks)				
Range	30-39	31-40	t=0.219	0.753
Mean±SD	36.60±2.56	38.92±1.56		
BMI [wt/(ht)^2]				
Range	19-30	20-32	t=0.181	0.813
Mean±SD	26.37±2.64	26.96±1.61		

t-Independent Sample t-test; z-Mann-Whitney test; x2: Chi-square test

p-value>0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

Table 1: Comparison between study group and control group according to baseline characteristics (n=188).

This table shows no statistically significant difference between groups according to baseline characteristics. No woman received prophylactic tocolysis in this study, before the time of ultrasound examination. The mean gestational age for preterm delivery was 37.60±2.56, in both the study and control groups.

Transvaginal cervical length	Study group (n=141)	Control group (n=47)	t-test	p-value
Range(mm)	25-49	37-48	5.968	<0.001**
Mean±SD (mm)	37.76±6.99	44.24±3.35		

t-Independent Sample t-test; **p-value <0.001 HS

Table 2: Comparison between study group and control group according to transvaginal cervical length (n=188).

This table shows that a highly significant decrease mean in study group compared to control group according to transvaginal cervical length, with p-value <0.001 HS.

Transabdominal cervical length	Study group (n=141)	Control group (n=47)	t-test	p-value
Range (mm)	28-45	36-44	6.400	<0.001**
Mean±SD(mm)	38.34±5.07	41.01±2.36		

t-Independent Sample t-test; **p-value <0.001 HS

Table 3: Comparison between study group and control group according to transabdominal cervical length (n=188).

This table shows that a highly significant decrease mean in study group compared to control group according to transabdominal cervical length, with p-value <0.001 HS.

Outcome	Study group (n=141)	Control group (n=47)	Chi-square test	p-value
Preterm delivery (number,%)	48 (34.0%)	6 (12.8%)	4.766	0.016*
Term delivery (number,%)	93 (66.0%)	41 (87.2%)		

x2: Chi-square test; *p-value <0.05 S

Table 4: Comparison between study group and control group according to outcome preterm delivery and term delivery (n=188).

This table shows the observed frequencies of the different outcomes (preterm vs. term delivery) in both study and control groups. Out of the 141 study women 48 delivered preterm (34%). Out of the 47 control women 6 delivered preterm (12.8%). This difference was stastically significant.

Cervical length measured transvaginally	Study group preterm (n=48)	Study group term (n=93)	t-test	p-value
Mean±SD (mm)	31.24±5.64	43.16±4.42	6.940	<0.001**

t-Independent Sample t-test; **p-value <0.001 HS

Table 5: Comparison between preterm and term according to cervical length measured transvaginally in the study group (n=141).

In the study group, cervical length assessed transvaginally was considerably smaller in women who delivered preterm compared to those who delivered at term, as seen in this table.

Cervical length measured transvaginally	Control group preterm (n=6)	Control group term (n=41)	t-test	p-value
Mean±SD (mm)	38.95±2.17	46.31±2.93	2.386	0.017*

t-Independent Sample t-test; *p-value <0.05 HS

Table 6: Comparison between preterm and term according to cervical length measured transvaginally in the control group (n=47).

The cervical length assessed transvaginally in the control group was considerably smaller in women who delivered preterm compared to those who delivered at term, as seen in this table.

Cervical length measured transvaginally	Preterm (n=54)	Term (n=134)	t-test	p-value
Mean±SD (mm)	32.39±5.93	44.42±4.17	6.011	<0.001**

t-Independent Sample t-test; **p-value <0.001 HS

Table 7: Comparison between preterm and term according to cervical length measured transvaginally in the all patients (n=188).

The cervical length measured transvaginally was substantially smaller in women who delivered preterm compared to those who delivered at term, as seen in this table.

Cervical length measured transabdominally	Study group preterm (n=48)	Study group term (n=93)	t-test	p-value
Mean±SD (mm)	34.25±4.58	42.30±3.77	4.772	<0.001**

t-Independent Sample t-test; **p-value <0.001 HS

Table 8: Comparison between preterm and term according to cervical length measured transabdominally in the study group (n=141).

The cervical length assessed transabdominally in the study group was substantially smaller in women who delivered preterm than in women who delivered at term, as seen in this table.

Cervical length measured transabdominally	Preterm (n=54)	Term (n=134)	t-test	p-value
Mean±SD (mm)	34.87±4.53	42.70±3.29	7.388	<0.001**

t-Independent Sample t-test; **p-value <0.001 HS

Table 9: Comparison between preterm and term according to cervical length measured transabdominally in the all women (n=188).

The cervical length measured transabdominally in women who delivered preterm was much smaller than in those who delivered at term, as seen in this table.

Cervical lengths measured transvaginally	Preterm (n=48)	Term (n=93)	x2	p-value
<25mm (number,%)	25 (17.7%)	0 (0.0%)	78.719	<0.001**
25-40mm (number,%)	20 (14.2%)	25 (17.7%)		
>40mm(number,%)	3 (2.1%)	68 (48.2%)		

x2: Chi-square test; **p-value <0.001 HS

Table 10: Comparison between preterm and term according to cervical length measured transvaginally in the study group (n=141).

The table describes the different outcomes in study cases with different cervical lengths measured transvaginally. This shows that with less than <25mm no cases delivered at term, while 25 women delivered preterm. Between 25-40mm 20 women delivered preterm and 25 delivered at term. More than >40mm, 3 woman only delivered preterm and 68 women delivered at term.

Cervical lengths measured transvaginally	Preterm (n=6)	Term (n=41)	x2	p-value
<25mm (number,%)	0 (0.0%)	0 (0.0%)	12.002	0.003*
25-40mm (number,%)	4 (8.5%)	4 (8.5%)		
>40mm (number,%)	2 (4.3%)	37 (78.7%)		

x2: Chi-square test; *p-value <0.05 S

Table 11: Comparison between preterm and term according to cervical length measured transvaginally in the control group (n=47).

The table describes the different outcomes in control cases with different cervical lengths measured transvaginally. This shows no woman had cervical length less than <25mm. Between 25-40mm, 4 women delivered preterm and 4 delivered at term. More than >40mm, 2 woman only delivered preterm and 37 women delivered at term.

Cervical lengths measured transvaginally	Preterm (n=54)	Term (n=134)	x2	p-value
<25mm (number,%)	25 (13.3%)	0 (0.0%)	100.545	<0.001**
25-40mm (number,%)	24 (12.8%)	29 (15.4%)		
>40mm (number,%)	5 (2.7%)	105 (55.9%)		

x2: Chi-square test; *p-value <0.05 S

Table 12: Comparison between preterm and term according to cervical length measured transvaginally in the all women (n=188).

The table describes the different outcomes in all cases with different cervical lengths measured transvaginally. This shows that with less than <25mm no cases delivered at term, while 25 women delivered preterm. Between 25-40mm 24 women delivered preterm and 29 delivered at term. More than >40mm, 5 women only delivered preterm and 105 women delivered at term.

Cervical length transvaginally	Sensitivity%	Specificity%	PPV%	NPV%
25mm (number,%)	100	84	56	100
30mm (number,%)	91	93	80	99
40mm (number,%)	67	101	99	77

Table 13: Sensitivity, specificity, (+)ve predictive value and (-)ve predictive value of measuring cervical length transvaginally in study group.

This table shows the testing of 3 cut-off values for the cervical length measured transvaginally in the study group, as regarding their ability to predict preterm labour. The highest sensitivity (100%) was seen at 25mm. While 40mm showed the highest specificity it showed a marked reduction in sensitivity. The highest positive predictive value was seen at 40mm and the highest negative predictive value was seen at 30mm. The cut-off value of 30mm showed intermediate values for all criteria.

Cervical length transvaginally	Sensitivity%	Specificity%	PPV%	NPV%
25mm	100	86	0	100
30mm	90	92	0	100
40mm	53	100	70	94

Table 14: Sensitivity, specificity, (+)ve predictive value and (-)ve predictive value of measuring cervical length transvaginally in control group.

This table shows the testing of 3 cut-off values for the cervical length measured transvaginally in the control group, as regarding their ability to predict preterm labour. The 25mm and 30mm values could not be assessed as no patients had values less than these figures.

Cervical length transvaginally	Sensitivity%	Specificity%	PPV%	NPV%
25mm	100	85	46	100
30mm	89	90	66	98
40mm	63	98	92	82

Table 15: Sensitivity, specificity, (+)ve predictive value and (-)ve predictive value of measuring cervical length transvaginally in all cases.

This table shows the testing of 3 cut-off values for the cervical length measured transvaginally in both groups, as regarding their ability to predict preterm labour. The highest sensitivity (100%) was seen at 25mm. While 40mm showed the highest specificity it showed a marked reduction in sensitivity. The highest positive predictive value was seen at 40mm and the highest negative predictive value was seen at 25mm. The cut-off value of 25mm showed intermediate values for all criteria

DISCUSSION

This study included the examination of 200 pregnant women at 22 – 24 ws gestation. 150 women were considered to be at high risk for preterm delivery as indicated by the history of previous preterm birth or repeated abortions. 50 women constituted the control group. They were similar to the study group but they had NO history of preterm delivery or repeated abortions.

These 200 women were examined using transvaginal and transabdominal ultrasound for cervical length and assessment of the pregnancy status. The aim was to assess the ability of the cervical length during this period of gestation to predict the occurrence of preterm delivery and hence the need for intervention.

Study of the clinical data gathered from the patient's history focused mainly on the age, occupation, residency, phone numbers for follow up, length of marriage. Study also focused on details of previous pregnancies (date, outcome, mode of delivery, gestational age at delivery, and any associated complications), history of past medical or surgical disorders, with full analysis of the current pregnancy ensuring the accuracy of LMP and the presence of symptoms suggestive of any complication.

The aim of this was to detect any risk factors that could affect the outcome of this pregnancy or that would increase the risk for preterm delivery. Normalcy of the current pregnancy was also ensured by physical examination and ultrasound assessment. Gestational age at which labour occurred was recorded by contacting patients. Spontaneous preterm birth was defined as the onset of labour before 37 completed weeks.

As regarding the age, this study limited the age to 20 – 35 years. This was to exclude the effect of extreme of ages on the outcome of pregnancy as identified by Manju Lata and Verma., 2016. The mean age was 27.64 ± 4.44 years in the study group and 26.18 ± 3.95 years in the control group.

Both groups were from the same race and ethnicity de Oliveira et al. (2018) [15] and almost the same living and social conditions (Kramer et al., 2000) [16] as the study was done in the same clinic. No history of smoking (Stock and Bauld, 2020) [17] or abuse of banned substances was detected [18]. This was to exclude the effects of these variables on the risk of preterm delivery as stated by these authors.

In our study it was found that women who delivered preterm had shorter cervices than those who delivered at term and this difference was statistically significant (mean was 32.39±5.93mm vs44.42±4.17mm when measured transvaginally and 34.87±4.53mm vs. 42.70±3.29mm when measured transabdominally).

Out of 141 in the study group 48 females delivered preterm , and out of 47 in the control group only 6 females delivered preterm.

When the cervix is abnormally short, it is more likely to dilate, allowing the foetus and pregnant lady to be exposed.

In the study of Jafari-Dehkordi et al. (2015) [19] the mean of uterine cervical length in trimester 2 was 38.28 ± 5.13, which is not far from the mean detected in this study.

Also in the study of Moroz, L. A., & Simhan, H. N. (2012) [20] It reveals that a change in sonographic CL is associated with an increased risk of SPTB among women with a sonographically short cervix, regardless of embryonic fibronectin test status or other relevant risk factors for SPTB. For every 1 mm of cervical shortening between ultrasounds, the risk of SPTB increases by 3% in women with a short cervix. The relationship is maintained when the average daily change in CL is utilised to account for the interval between sonograms. The rate of SPTB was lower in women with CL 25 mm and maintained or increasing CL between visits than in women with decreasing CL. Women having a CL greater than 25 mm do not have this link.

Also this is in agreement with the study of Thangaraj et al. (2018)[21] Cervical length less than 3cm measured between 20-24 weeks of pregnancy is linked to preterm deliveries and favours vaginal birth, whereas cervical length greater than 4cm is linked to postdated pregnancy and higher caesarean section rates.

Again in the study of Tanvir et al. (2014) [22] In the research population, the average cervical length was 33.16 mm. At mid-trimester, 16 women had cervical lengths of < 25 mm, with 13 (40.62 %) opting for spontaneous premature birth. As the length of the cervix shrank, the chance of preterm birth rose. The P value is < 0.001, which indicates that the result is statistically significant. There was a substantial difference between multigravida at risk of preterm birth (62.5%) and primigravida (37.5%) at risk of preterm birth.

Also the study of Crane and Hutchens (2008) [23] Transvaginal ultrasonography assessments of cervical length in asymptomatic high-risk women have been proven to predict spontaneous preterm birth. When the cervical length cut-off was less than 25 mm and the gestational age was less than 35 weeks, preterm birth was most common. These findings held true in a sample of women who had previously given birth preterm. More study into the utility of transvaginal ultrasonography in certain subtypes of spontaneous preterm delivery is needed (preterm premature rupture of membranes versus spontaneous onset of labour with intact membranes), Women who have had progesterone therapy beyond 24 weeks of pregnancy in women with a history of spontaneous preterm delivery, and women who have had uterine abnormalities detected, including those who have had a uterine anomaly surgically resected, may be required, women who have had progesterone therapy beyond 24 weeks of pregnancy in women with a history of spontaneous preterm delivery, and women who have had progesterone therapy beyond 24 weeks of pregnancy in women with a history of spontaneous preterm delivery

Begum and Behera (2014) [24] discovered that when the cervical length was less than 3cm at 14-24 weeks, the majority of women (63.15 %) gave birth prematurely.

Also in the study of Bina et al. (2020) [25] Between 16 and 24 weeks of pregnancy, 35 prenatal women had cervical length of 25 mm determined by transvaginal sonography, 07 had preterm birth, and 108 had term delivery.

Also, between 16 and 24 weeks, a cervical length of less than 25 mm has been found to be the most dependable threshold for an increased risk of Preterm labour in the study of Grimes-Dennis and Berghella(2007) [26].

Also in the study of Visintine et al. (2008) [27] A cervical length of 25 mm determined by transvaginal ultrasonography between 14 and 24 weeks was found to be predictive with spontaneous preterm delivery.

In contrast to this study, the cutoff value for cervical length in predicting preterm labour in the study of was 30 mm Kwasan et al. [28]

This contrast maybe due to the small sample size used in the study.

CONCLUSION

The outcomes of this study imply that screening patients for cervical length during mid-pregnancy can be an effective strategy for predicting preterm birth. As a result, it may aid in the risk assessment of pregnant women and the choice to administer various interventions to avoid premature labour. In this case, transvaginal ultrasonography proved to be more accurate and beneficial.

Conflict of interest : none

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